Under the High Patronage of His Majesty King Mohammed VI

Kingdom of Morocco
Hassan II Academy of
Science and Technology

NATIONAL ACADEMIES Sciences Engineering Medicine

Second U.S.-Africa Frontiers of Science, Engineering, and Medicine Symposium

January 16 –18, 2024 - Rabat - Morocco

Mohammed V Mausoleum

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Hassan II Academy of Science and Technology
Km 4 Ave Mohammed VI

Rabat, Morocco

Monday, January 15

7:30 PM *Networking Reception at the Sofitel Jardin Des Roses Hotel*

Tuesday, January 16

8:30 AM Registration

9:00 AM ***Opening Ceremony (Chaired by Chancellor Prof. Mostapha Bousmina)***

Prof. Omar Fassi Fehri, Permanent Secretary, Hassan II Academy of Science and Technology
Dr. Marcia McNutt, President, National Academy of Sciences
Prof. Abdellatif Miraoui, Minister, Higher Education and Scientific Research
H.E. Puneet Talwar, U.S. Ambassador to Morocco
Dr. Patricia Gruber, Science Advisor to the Secretary of State

10:00 AM *Coffee Break and Group Photo*

Scientific Sessions

10:30 AM **Session I: Green Technologies for Climate Adaptation**

Dr. Asmeret Asefaw Berhe, Department of Energy, United States
Dr. Samir Rachidi, Institut de Recherche en Énergie Solaire et en Énergies Nouvelles, Morocco
Dr. Ryan Lively, Georgia Institute of Technology, United States
Dr. Henrietta Langmi University of Pretoria, South Africa

12:00 PM Session I: Panel Discussion

12:45 PM Lunch

2:15 PM **Session II: Sensing Technologies**

Dr. Kenneth Mubea, Digital Earth Africa, Kenya
Dr. Alfredo Delgado, Leica Geosystems, United States
Dr. Haeyoung Noh, Stanford University, United States
Dr. Sanaa Ghouzali, International University in Rabat, Morocco

3:45 PM Session II: Panel Discussion

4:30 PM Flash Talks

5:00 PM Poster Session

6:00 PM Adjourn

Wednesday, January 17

9:00 AM Funding Opportunities for Collaboration

Dr. Bindu Nair, Department of Defense, United States
Dr. David Robinson, Bill and Melinda Gates Foundation, United States
Mr. Daniel Placht, NASEM, United States

10:00 AM Break

Scientific Sessions

10:20 AM **Session III: Human-Technology Interaction**

Dr. Girmaw Abebe Tadesse, Microsoft, Kenya
Dr. Sanmi Koyejo, Stanford University, United States
Dr. Adji Bousso Dieng, Princeton University, United States
Dr. Anicia Peters, National Commission on Research, Science and Technology, Namibia

11:50 AM Session III: Panel Discussion

12:30 PM Lunch

2:00 PM **Session IV: Vaccine Manufacturing**

Dr. Caryn Fenner, Afrigen Biologics, South Africa
Dr. Marie Angelique Sene, Institut Pasteur, Senegal
Dr. Mohamad-Gabriel Alameh, Children's Hospital of Pennsylvania, United States
Dr. Tatenda Shopera, Pfizer Inc, United States

3:30 PM Session IV: Panel Discussion

4:15 PM Flash Talks

4:45 PM Poster Session

6:00 PM Adjourn

Thursday, January 18

9:00 AM Funding Opportunities for Collaboration

Mr. Mohamed Abdel-Kader, USAID, United States
Dr. Conrad Tucker, CMU-Africa, Rwanda
Dr. Aisha Walcott-Bryant, Google Research Africa, Kenya

10:00 AM Break

Scientific Sessions

10:20 AM **Session V: One Health**

Dr. Irene Naigaga, Makerere University, Uganda
Dr. Hellen Amuguni, Tufts University, United States
Dr. Meghana Gadgil, UC San Francisco, United States
Dr. Thumbi Mwangi University of Nairobi, Kenya

11:50 AM Session V: Panel Discussion

12:30 PM ***Closing Remarks***

Dr. Nadine Aubry, International Secretary, National Academy of Engineering
Prof. Driss Ouazar, Resident Member, Hassan II Academy of Science and Technology

12:45 PM *Lunch*

2:00 PM Adjourn

Afternoon *Cultural Activities*

Institutional Leadership

Marcia McNutt

President

National Academy of Sciences

Washington, District of Columbia, United States

Marcia McNutt is a geophysicist and president of the National Academy of Sciences. From 2013 to 2016, she served as editor-in-chief of the Science journals. Prior to joining Science, she was director of the U.S. Geological Survey (USGS) from 2009 to 2013. During her tenure, the USGS responded to a number of major disasters, including earthquakes in Haiti, Chile, and Japan, and the Deepwater Horizon oil spill. McNutt led a team of government scientists and engineers at BP headquarters in Houston who helped contain the oil and cap the well. She directed the flow rate technical group that estimated the rate of oil discharge during the spill's active phase. For her contributions, she was awarded the U.S. Coast Guard's Meritorious Service Medal.

Before joining the USGS, McNutt served as president and chief executive officer of the Monterey Bay Aquarium Research Institute (MBARI), in Moss Landing, California. During her time at MBARI, the institution became a leader in developing biological and chemical sensors for remote ocean deployment, installed the first deep-sea cabled observatory in U.S. waters, and advanced the integration of artificial intelligence into autonomous underwater vehicles for complex undersea missions.

From 2000 to 2002, McNutt served as president of the American Geophysical Union (AGU). She was chair of the Board of Governors for Joint Oceanographic Institutions, responsible for operating the International Ocean Drilling Program's vessel JOIDES Resolution and associated research programs.

McNutt began her academic career at the Massachusetts Institute of Technology (MIT), where she was the E.A. Griswold Professor of Geophysics and directed the Joint Program in Oceanography/Applied Ocean Science & Engineering, jointly offered by MIT and the Woods Hole Oceanographic Institution. Her research area is the dynamics of the upper mantle and lithosphere on geologic time scales, work that has taken her to distant continents and oceans for field observations. She is a veteran of more than a dozen deep-sea expeditions, on most of which she was chief or co-chief scientist.

McNutt received a B.A. in physics from Colorado College and her Ph.D. in Earth sciences at the Scripps Institution of Oceanography. She holds honorary doctoral degrees from the Colorado College, the University of Minnesota, Monmouth University, the Colorado School of Mines, University of Miami, Uppsala University, Michigan State University, Worcester Polytechnic Institute, George Washington University, Boston University, Texas A&M University, Indiana University Bloomington, and the National Academy of Sciences of Ukraine. McNutt is a member of the National Academy of Engineering, the American Philosophical Society and the American Academy of Arts and Sciences, a Foreign Member of the Royal Society, UK, the Russian Academy of Sciences, and the Chinese Academy of Sciences, and a Foreign Fellow of the Indian National Science Academy. She is a fellow of AGU, the Geological Society of America, the American Association for the Advancement of Science, and the International Association of Geodesy. In 1988, she was awarded AGU's Macelwane Medal for research accomplishments by a young scientist, and she received the Maurice Ewing Medal in 2007 for her contributions to deep-sea exploration.

Omar Fassi-Fehri

Permanent Secretary

Hassan II Academy of Science and Technology

Rabat, Morocco

Omar Fassi-Fehri, the Permanent Secretary of the Hassan II Academy of Science and Technology (nominated since July 2004 by His Majesty the King Mohammed VI). From 2002 to 2004 he was Minister Delegate in charge of Scientific Research. From 1998 to 2002 he served as Secretary of State in charge of Scientific Research.

He began his academic career at the Faculty of Sciences (Rabat, Morocco) as Professor of Mechanics, he directed since 1981 the Mechanics and Materials Laboratory of the Faculty of Sciences (Rabat). He was Member of the Jury of aggregation in Physics (1988-1992) and President of the Jury of aggregation in Mechanical engineering from 1989 to 1991. He served as Director of the National Higher School for Technical Education (Ecole Normale Supérieure de l'Enseignement Technique, Rabat, from 1991 to 1998).

Prof. Fassi-Fehri received a Master degree from the University of Paris (France) and his Ph.D. in Mechanics from the University of Metz (France). His research area is High Energy, Cosmology, Materials, Mechanical Engineering, Rheology. In addition, he is the author and co-author of several individual and collective works including scientific articles in his field of specialization, published in international indexed journals, and specialized communications in major international conferences.

Prof. Fassi-Fehri is a Member of the Higher Council of Education, Training and Scientific Research, a Member of the National Coordination Commission for Higher Education (Morocco), and a Foreign Fellow of the Academy of Science and Technologies of Senegal (since 2002). He is also Member of several boards in Morocco including National Center for Scientific and Technical Research Board, National Agency for Evaluation and Quality Assurance of Higher Education and Scientific Research Board and Euro-Mediterranean University of Fès Board.

He contributed in different societal instances: he was President of the Organizing Committee of the 1st, 2nd and 3rd International Congresses of Mechanics in Morocco; Founder and Honorary President of the Moroccan Society of Mechanical Sciences (since 1998); organizing member of the Assizes on Training in Applied Sciences and Techniques.

He was awarded Knight of the Order of the Throne of the Kingdom of Morocco and Officer of the Order of the Academic Palms (France).

Nadine Aubry

George and Virginia Bugliarello International Secretary

National Academy of Engineering

Washington, District of Columbia, United States

Nadine Aubry is a professor of the School of Engineering and the past Provost at Tufts University, and the George and Virginia Bugliarello International Secretary of the National Academy of Engineering (NAE). She has made numerous contributions to the field of fluid dynamics, particularly the reduced modeling of turbulence and other flows and novel solutions to microfluidics. Dr. Aubry was elected as a member of the National Academy of Engineering (NAE), the American Academy of Arts and Sciences (AAA&S), the American Academy of Mechanics (AAM) and the National Academy of Inventors (NAI) and as an international member of the UK Royal Academy of Engineering (RAEng), and as a Fellow of the American Association for the Advancement of Science (AAAS), the American Institute of Aeronautics and Astronautics (AIAA), the American Physical Society (APS) and the American Society of Mechanical Engineers (ASME). She was awarded the AIAA Fluid Dynamics Award, the ASME Fluids Engineering Award and the G.I. Taylor Medal of the Society of Engineering Science (SES), and served as Chair of the Division of Fluid Dynamics (DFD) of APS, President of the International Union of Theoretical and Applied Mechanics (IUTAM) and Chair of the National Academies' U.S. National Committee for Theoretical and Applied Mechanics (USNC/TAM). Prior to joining Tufts, she held various academic positions including as University Distinguished Professor and Dean of the College of Engineering at Northeastern University and as the Raymond J. Lane Distinguished Professor, University Professor and Head of the Department of Mechanical Engineering at Carnegie Mellon University. She grew up and was educated in France, and moved to the United States in 1984 where she was awarded a Ph.D. from the Sibley School of Mechanical and Aerospace Engineering at Cornell University.

Mostapha Bousmina

Chancellor

Hassan II Academy of Science and Technology

Rabat, Morocco

Email:m.bousmina@ueuromed.org

Professor Bousmina's background is in Physics, Physical Chemistry and Nanoscience. He got his Engineering diploma from École des Hauts Polymères of Strasbourg, France and MSc. from Louis Pasteur University-France. He then got a Ph.D. from Louis-Pasteur University-France in collaboration with the University of Illinois in Chicago, USA and then a Post-Doc at École Polytechnique of Montreal, Canada. He is presently the Chancellor of the Hassan II Academy of Science and Technology, Morocco, President of the Euromed University of Fes, Morocco, President of ASRIC (African Science, Research & Innovation Council) of the African Union. He is Member of WAAS (World Academy of Art and Science), of TWAS (The World Academy of Sciences), of AAS (African Academy of Sciences), Member at large of Polymer Processing Society (PPS), Co-Editor of the Journal of Polymer Engineering, Associate Editor for the Journal of Nanoscience and Nanotechnology, Regional Editor of Recent Patents in Nanotechnology and Member of the Editorial Board of J. of Polymer Processing. He was President of NASAC (Network of African Science Academies), Senior Canada Research Chair on Polymer Physics and Nanomaterials at Laval University, Canada, Co-Founder and Director General of MASciR (Moroccan Advanced Science, Innovation and Research Foundation). President of Quebec Society of Polymers, Director of Canada SPE (Society of Plastic Engineers), Vice-President of the Canadian Society of Rheology, Member of the Canada Team for Aerospace, Member of the Executive Board of IAP (InterAcademy Partnership), Member the board of Trustees of PSL University (Paris Sciences et Lettres, France) and of Shenkar University in Israel. His contributions in science & Engineering are in rheology of multiphase systems and in nanoscience and nanotechnology, with more than 220 publications, 9 patents and an H-index of 56 in Scopus and 62 in Google Scholar. He was Ranked in 2021 and in 2023 among the top 2% of scientific researchers in the world by Stanford Group. He got the Cross of the Order of Civil Merit of Spain in 2022, the Grand Prize on Innovation in Scientific Research from the Ministry of Higher Education, Morocco in 2009, the STEACIE fellowship from NSERC (Natural Science and Engineering Research Council of Canada) in 2004, Canada's Top Twenty Researchers Prize from CIAR (Canada Institute for Advanced Science) in 2002, the International Morand Lambla Award from the Polymer Processing Society in 2000, the Innovation Award from the Ministry of Industry, Canada in 1999 and the Louis-Pasteur Award, France in 1994.

John Boright

Executive Director of International Affairs

National Academy of Sciences

Washington, District of Columbia,United States

John P. Boright is the executive director of the Office of International Affairs of the US National Academies of Sciences, Engineering, and Medicine. International activities of the National Academies are very diverse, and include cooperation with national, regional, and global groups of counterparts from all regions of the world. 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 at all these levels.

Dr. Boright has served in several governmental positions. From 1994-1995, he served as deputy to the associate director for National Security and International Affairs at the Office of Science and Technology Policy in the Executive Office of the President. During the period from 1989-1994 he served as Deputy Assistant Secretary for Science and Technology Affairs at the Department of State overseeing U.S. science and technology agreements with other countries, international space policy and program matters, and the science officer system at U.S. Embassies. During the period 1987-1989 John served as director of the Division of International Programs, at the National Science Foundation, where he developed international cooperative arrangements and U.S. access to science and engineering in other countries, particularly with Japan, other Asian countries, and Eastern Europe. Prior to 1987 he served for 10 years at the Department of State, including a four year tour (1982-86) as Counselor for Scientific and Technological Affairs at the U.S. Embassy in Paris. John's earlier professional experience includes work at the Goddard Space Flight Center, the U.S. Arms Control and Disarmament Agency, and the U.S. Mission to the IAEA in Vienna, Austria.

John served from 1995 – 2002 as board member and chair for the Science and Technology Center/Ukraine. He also served from 1995 to 2001 as chair of the OECD Global Science Forum. He has received numerous awards for outstanding service. He is a member of Phi Beta Kappa and received a B.A. (high honors) and PhD in physics from Cornell University. His PhD, received in 1970, was on research at Brookhaven National Laboratory, measuring backward charge exchange scattering (proton + pi-minus to neutron + pi-zero).

Driss Ouazar

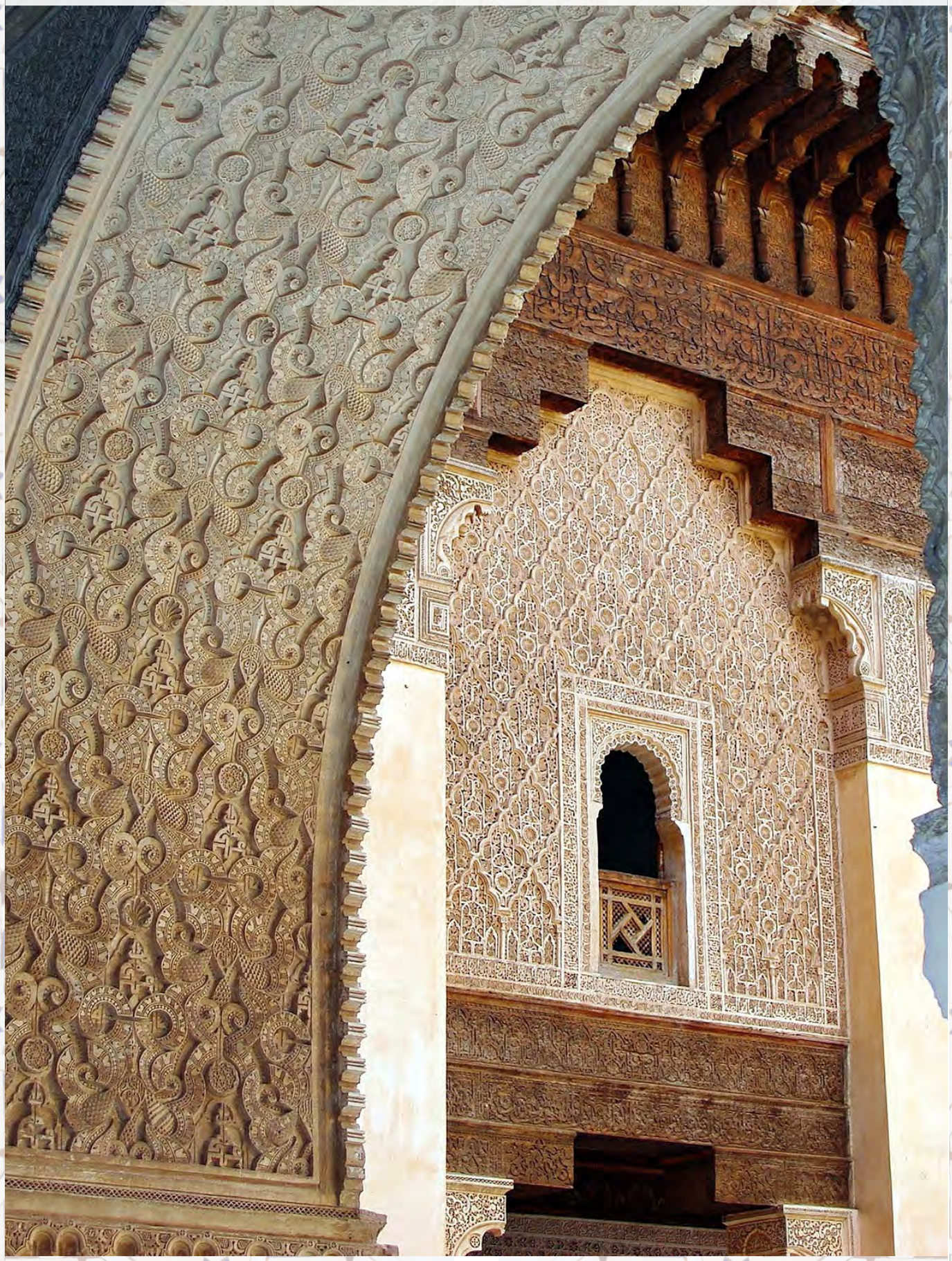
Professor of Computational Civil Engineering and Water Resources

Mohamed V University, Ecole Mohammadia d'Ingénieurs

Rabat, Morocco

Driss Ouazar is Professor of Computational Civil Engineering and Water Resources. (Mohammed V University, Ecole Mohammadia d'Ingénieurs, Rabat). He is a Resident Member of Hassan II Academy of Science and Technology since its creation in 2006, He is the National Representative of the International Association of Hydrological Sciences (IAHS), member of High Water and Climate Council, Founder of Adaptation Metrics and Techniques Cluster Water, Agriculture and Cities, Former President of UM6P University and Former Director of School of Engineering (Mines Rabat), Former member of Scientific Committee of COP22 and Scientific Board of the National Research Council of Morocco, Former Member of the Higher Council of Education, Training and Scientific Research and the Scientific Research Commission (Morocco). He is the Scientific committee of AAA (Adaptation Agriculture Africa- Moroccan Initiative). He was African Scientific Research and Innovation Council (ASRIC) Vice Chair and represents ASRIC as a co-Founder of the International Platform of Adaptation Metrics hosted by Africa Agriculture Adaptation (AAA) and currently the chair of IPAM Water. He was Jury Chair of 2019 African Union Kwame Nkrumah Awards for Scientific Excellence (AUKNASE), the African Union, Addis Ababa. He is also the Director of the College (Science and Technology for Environment, Earth and Sea), Associate Editor and Executive Director of Frontiers in Science and Engineering International Journal of the AH2ST.

Oversight Committee



John G. Hildebrand (Chair)

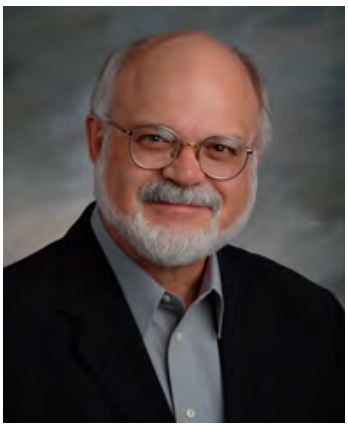
Foreign Secretary, U.S. National Academy of Sciences

Regents Professor, Department of Neuroscience

University of Arizona

Tucson, Arizona, United States

Email: jhildebrand@nas.edu



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.

Dereje Agonafer

Presidential Distinguished Professor

University of Texas at Arlington

Arlington, Texas, United States

Email: agonafer@uta.edu

Dereje Agonafer is a Presidential Distinguished Professor in MAE at UT Arlington. He heads two centers and his current primary research areas are in energy efficiency of data centers and electronic packaging. Before joining academia, he worked at IBM in Computer Aided Thermal Modeling. Since joining academia in 1999, he has graduated over 250 graduate students including 31 PhDs and is currently advising 15 PhDs. Some of his awards include: 2021 Lifetime Achievement Award by the SEMI-THERM Educational Foundation Thermal Hall of Fame; 2014 ITHERM Achievement Award; 2014 NSBE Golden Torch Award honoree; and 1998 Distinguished Alum – UC Boulder. He is a Fellow of AAAS, ASME, and NAI. In 2019, he was elected to the National Academy of Engineering where he currently chairs two committees. In March 2020, he was presented the Howard University Alumni Award for Distinguished Postgraduate Achievement in the field of Engineering at the 153rd Charter Day Dinner. Professor Agonafer and his wife Carolyn have two children; a son, Dr. Damena Agonafer who is Associate Professor of Mechanical Engineering at University of Maryland College Park, and a daughter, Dr. Senayet Agonafer, a Regional Chief Radiologist at Lennox Hill Radiology in New York City.

Serap Aksoy

Professor of Epidemiology

Department of Epidemiology of Microbial Diseases

Yale School of Public Health

New Haven, Connecticut, United States

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Aksoy has been a Professor of Epidemiology since 2002 at Department of Epidemiology of Microbial Diseases, Yale School of Public Health. She is a world leader in insect-borne disease epidemiology. She investigates African trypanosomiasis, a devastating and highly neglected zoonotic fatal disease of humans and livestock in Africa. She has integrated modern molecular and genomic techniques into tsetse research. She is recognized for her groundbreaking accomplishments in advancing knowledge on determinants of vector-borne and zoonotic disease transmission which have collectively provided innovative approaches that can be applied for control of these diseases. She was an elected Council Member, American Society of Tropical Medicine and Hygiene (ASTMH), 2013-2018; Editor in Chief, PLOS Neglected Tropical Diseases, 2009-2020 and Head, International Glossina Genome Consortium, 2004- 2014. She has received the Research Innovation and Leadership Award, Connecticut Technology Council of Women, 2015; Medical Entomology Breakthrough Award, ASTMH, 2016, and is Member of Connecticut Academy of Science and Engineering, 2019 and Member of National Academy of Sciences, USA, 2021. Aksoy collaborates extensively with East African scientists to build regional research and control capacity for vector-borne infectious diseases. Throughout her professional career, she has been an advocate of and innovator in Global Health and served as a dedicated mentor to students and scientists around the world to prepare the next generation of leaders, particularly in resource poor settings and in disease endemic countries in Africa.

Teketel Yohannes Anshebo

Executive Director

Ethiopian Academy of Sciences

Addis Ababa, Ethiopia

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Prof. Teketel received his PhD in Physical Chemistry in 1997 from Addis Ababa University (AAU), Addis Ababa, Ethiopia. From 1984 to 2000 he served at the Department of Chemistry, at the then Bahir Dar Teachers College of the AAU and since August 2000 at the Chemistry Department of the AAU. His main research area includes studies of conducting polymer electrochemistry, spectroelectrochemistry, photovoltaic and photoelectrochemistry. He has published over 70 scientific articles. In this endeavor he has been collaborating with prominent scientists in the University of Linkoping, Sweden, the University of Linz, Austria, the University of Osaka, Japan, the University of Antwerp, Belgium, the Abdus Salam International Center for Theoretical Physics, Trieste, Italy, Institute of Chemistry, Chinese Academy of Science, Beijing, China, ISMN-CNR, Bologna, Italy, and co-authored with leading scientists in his research areas.

The leadership quality of Prof. Teketel is demonstrated by his service at Bahir Dar Teachers College, Ethiopia, as the Chairman of the Department of Chemistry; Director, Chair and Coordinator of the Materials Science Program at College of Natural Sciences (AAU); Associate Dean for Graduate Programs the College of Natural Sciences (AAU); Director for Research at AAU; Acting Vice President for Research and Technology Transfer (AAU), and Vice President for Academic Affairs at Addis Ababa Science and Technology University (AASTU). Currently he is serving as an Executive Director of the Ethiopian Academy of Sciences.

Mohamed Essaaidi

Chief of Party, Interactive Digital Center Morocco

Professor, Mohammed V University

Rabat, Morocco

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Mohamed Essaaidi is General Manager of Moroccan School of Engineering Sciences Group (Since Jan. 2023), Chief of Party of Interactive Digital Center Morocco (since Nov. 2020) and a Professor and past Dean of ENSIAS School of Computer Science of Mohammed V University, Rabat, Morocco (since 2011), past Director of International Cooperation at the Ministry of General Affairs & Governance, Morocco (2019), and past faculty member (Professor & Assistant Professor) at the Faculty of Science of Abdelmalek Essaadi University, Tetuan, Morocco (1993-2011). He is IEEE Global Cities Alliance, MEA Chairman (2021-2022), IEEE Humanitarian Activities Committee (HAC) Assessment Committee Member (2021-2022), IEEE EAB Teaching Excellence Editorial Hub, Member (2021-2022), and IEEE Public SafetyTechnology, Education Chair (2022). He is also the founder and past Chairman of the IEEE Morocco Section (2005-2016), co-founder and chair of IEEE Morocco APS/MTT-S joint Chapter (2005-2010), IEEE Communications / Computer Society Chapter (2006-2008) and IEEE Education Society Morocco Chapter chair from 2007 to 2009. He has been a member of the Committee of Global Accreditation activities of IEEE Education Activities Board (2017-2018). He has also been the Director of the Morocco Office of Arab Science and Technology Foundation, ASTF (2006-2009) and the Coordinator of ASTF RD&I Network of Electro-Technology (2006 – 2008). He has authored and co-authored 10 books and more than 200 papers in international refereed journals and conferences in the field of Electrical and Computer engineering and its diverse applications. He has been Guest Editor of several international journals. He is also an active member of the editorial boards of several international journals in the same fields mentioned above.

Furthermore, Prof. Essaaidi is the founder and the General Chair / co-chair of several IEEE technically sponsored international conferences such as Information and Communication Technologies International Symposium (2005, 2007), NATO Advanced Research Workshop on Information Security Assurance (2005), International Conference of Multimedia Computing and Systems series (2009-2016). He also co-organized and co-chaired IEEE Smart Cities Summit in May 2020, the US National Academies 5th Arab American Science, Engineering and Medicine Frontiers Symposium in November 2017, Rabat, Morocco and US NSF sponsored workshop on Smart Cities in January 2016 in Rabat, Morocco. He has also served in the Organizing committees and TPC and presented keynote talks at many other international conferences worldwide. Prof. Essaaidi holds 10 patents in the field ICT. Some of these patents received several international innovation awards. He was also a member of the IEEE 802.16 Sponsor Ballot Pool of IEEE Standard Association that defined the technical specifications for WiMAX, and of that of IEEE P2784 - Smart City Planning and Technology Guide Work Group (2020-2021) that cover several aspects related to Smart Cities. He has supervised several Masters and PhDs theses and has been the principal investigator and the project manager for several research projects in the framework of national and international programs dealing with several research issues related to cybersecurity and privacy. Moreover, in the framework of his position as the director of International Cooperation in the Ministry of General Affairs and Governance (Morocco), he was involved in the coordination of the World Bank Group Morocco Country Partnership Framework (2019-2024) and OECD Morocco Country Program (2019-2021) among other international cooperation programs.

Evgeni Gousev

Chairman, tinyML Foundation

Senior Director, Qualcomm AI Research

Los Altos, California, United States

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Evgeni Gousev is a Senior Director of Qualcomm AI Research. He serves as the Chairman of the Board of Directors of tinyML Foundation (www.tinyML.org), a non-profit organization of 20000 professionals in 40 countries including more than three thousands in Africa. The Foundation is focused on supporting and nurturing the fast-growing branch of ultra-low power machine learning technologies and approaches dealing with machine intelligence at the very edge. Evgeni earned a PhD degree in solid-state physics and MSc in Applied Physics. After graduation, he joined Rutgers University first as a Postdoctoral Fellow and then as a Research Assistant Professor. While at Rutgers, he performed fundamental research in the area of advanced gate dielectric for CMOS devices, which, a decade later, became industry wide standards. In 1997, he was a Visiting Professor with the Center for Nanodevices and Systems, Hiroshima University, Japan. Shortly after, he joined IBM, where he led projects in the field of advanced silicon technologies in the Semiconductor Research and Development Center in East Fishkill and T.J. Watson Research Center in Yorktown Heights, NY. He has co-edited 26 books and published more than 166 papers (with over 11k citations and h-index of 50: Google Scholar). He is a holder of more than 100 issued and filed patents. Dr. Gousev is a member of several professional boards, committees, panels, and societies. In 2020, Evgeni was inducted into the “Hall of Fame” of SEMI MEMS and Sensors Industry Group. Dr. Gousev also serves on the Board of Trustees of American Institute of Physics Foundation, AIP Foundation.

Mahouton Norbert Hounkonnou

Full Professor of Mathematics & Physics

University of Abomey-Calavi

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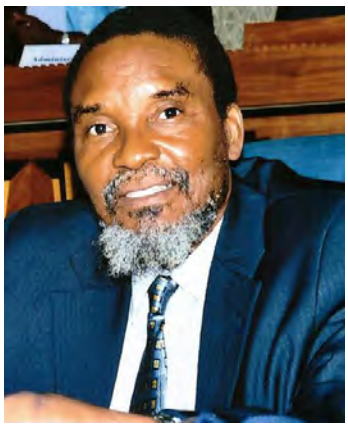

Dr. Sc in 1992 from Catholic University of Louvain in Belgium, Mahouton Norbert Hounkonnou is a full Professor of Mathematics and Physics at the University of Abomey-Calavi, Benin Republic. His works deal with noncommutative and nonlinear mathematics, and complex systems. He authors and reviews books. Further, he serves as member and associate editor of editorial boards for renowned journals and books in mathematics and mathematical physics, including the Editorial Boards of Mathematics in Mind, Springer, Fields Cognitive Science Network, the Peer Community In (PCI) Neuroscience, International Journal of Geometric Methods in Modern Physics, etc. He published over 200 main research papers in outstanding ISI-ranked peer reviewed journals and international conference proceedings in the fields of mathematics, mathematical physics and complexity. He is a visiting professor at African, Asian, European and North American Universities. Professor Hounkonnou supervised 36 PhD and 39 M. Sc. students from various countries and continents. He was awarded several international prestigious Prizes such as the Prize of the Third World Academy of Sciences (TWAS) in 1996, the Tokyo University of Science President Award in 2015, the 2016 World Academy of Sciences C. N. R. Rao Prize for Scientific Research ''for his incisive work on noncommutative and nonlinear mathematics and his contributions to world-class mathematics education '', the American Institute of Physics in 2023, Tate Medal for leadership in building and maintaining an enduring transnational African mathematical physics research and education community, in particular the COPROMAPH conferences and schools, and Academy level international networks, and the 2023 Yang Hui Award for his seminal contributions to the deformed quantum algebras. He was a member of UNESCO Scientific Board for International Basic Sciences Programme (IBSP), NANUM 2014 Award Committee Member of the International Congress of Mathematicians (ICM 2014) as reviewer for region Africa, and member of the InterAcademy Partnership working group on Harnessing Science, Engineering and Medicine to Address Africa's Challenges, etc. He was TWAS research Professor in Zambia, the chair of the African Academy of Sciences Commission on Pan-African Sciences Olympiad (2014), chair of the African Academy of Sciences Membership Advisory Committee (MAC) in Mathematical Sciences (2013 – present). Professor Hounkonnou is the co-chair of the Network of African, European and Mediterranean Academies for Science Education (AEMASE III), the President of the Network of African Science Academies (NASAC), former President of the Benin National Academy of Sciences, Arts and Letters (2015-2020). His membership extends to InterAcademy Partnership Advisory Committee and Science Education Programme (IAP SEP), the International Association of Mathematical Physics, American Mathematical Society, London Mathematical Society, Society for Industrial and Applied Mathematics (SIAM), Academy of Science of South Africa (ASSAf), Hassan II Academy of Science and Technology, Morocco, African Academy of Sciences (AAS), The World Academy of Sciences (TWAS), Scientific Council of the Centre International de Mathématiques Pures et Appliquées (CIMPA), Scientific Committee of the International Centre for Advanced Training and Research in Physics (CIFRA, Magurele-Bucharest, Romania), as well as other learned societies. He is Doctor Honoris Causa of the University Toulouse III Paul Sabatier, France, and representative for Africa of the International Mathematical Union (IMU) Commission for Developing Countries (CDC). He is a Knight of the Benin National Order.

Cato Laurencin

University Professor

Albert and Wilda Van Dusen Distinguished Professor of Orthopaedic Surgery

Professor of Chemical and Biomolecular Engineering

Professor of Materials Science and Engineering

Professor of Biomedical Engineering

University of Connecticut

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Cato T. Laurencin, MD, PhD is the University Professor and Albert and Wilda Van Dusen Distinguished Endowed Professor of Orthopaedic Surgery, Professor of Chemical and BIomolecular Engineering, Professor of Materials Science and Engineering, and Professor of Biomedical Engineering at the University of Connecticut. He is the CEO of The Cato T. Laurencin Institute for Regenerative Engineering at UConn.

He earned his BSE in Chemical Engineering from Princeton, his MD, Magna Cum Laude, from the Harvard Medical School, and his PhD in Biochemical Engineering/Biotechnology from MIT. Dr. Laurencin is the pioneer of the field of Regenerative Engineering. In receiving the Spingarn Medal he was named the world's foremost engineer-physician-scientist. In recognition of his breakthrough achievements, the American Institute of Chemical Engineers created the Cato T. Laurencin Regenerative Engineering Founder's Award.

Dr. Laurencin is an elected member of the National Academy of Sciences, the National Academy of Engineering, the National Academy of Medicine, and a fellow of the National Academy of Inventors, the American Academy of Arts and Sciences, and the American Association for the Advancement of Science. He is the first individual to receive both the oldest/highest award of the National Academy of Engineering (the Simon Ramo Founder's Award) and one of the oldest/highest awards of the National Academy of Medicine (the Walsh McDermott Medal). The American Association for the Advancement of Science awarded Dr. Laurencin the Philip Hauge Abelson Prize given 'for signal contributions to the advancement of science in the United States.

Dr. Laurencin is the recipient of the National Medal of Technology and Innovation, America's highest honor for technological achievement, awarded by President Barack Obama at the White House. He was named the 2023 Inventor of the Year by the intellectual Property Owners Educational Foundation. In Africa, Dr. Laurencin is an elected fellow of the Benin National Academy of Sciences and Arts, an elected fellow of the Senegal Academy of Science and Technology, and an elected fellow of the African Academy of Sciences. He received the UNESCO Equatorial Guinea International Prize for Research in the Life Sciences (the Africa Prize), for his work in Regenerative Engineering.

Jane Catherine Ngila

Executive Director, African Foundation for Women & Youth in Education & STI

Vice President, International Organization for Chemical Sciences

in Development–Emerging Economies

Fmr. Ag. Executive Director, The African Academy of Sciences

Nairobi, Kenya

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Prof Jane Catherine Ngila is currently the Executive Director of the African Foundation for Women and Youth in Education, Science, Technology and Innovation (AFoWYESTI) (Jan 2023-todate), whose vision is to promote access to quality education, alleviate poverty and offer mentorship programmes for women and youth in STEM. Prof Ngila is a Visiting Professor at University of Johannesburg. She is the Vice President of the Organization for Chemical Sciences in Development as the Economies (IOCD), in charge of Emerging International.

Prof Ngila is the immediate former Acting Executive Director of The African Academy of Sciences (AAS) where she was the chief executive officer; former Deputy Vice Chancellor of Riara University for Academic and Student Affairs (DVC-AA); former Deputy Director of the Institute of Oil and Gas (MIOG) under Kenya Pipeline Company, in charge of Training, Academic Programmes and Linkages. She was the Head of Applied Chemistry at University of Johannesburg; worked at the University of KwaZulu Natal, University of Botswana and Kenyatta University.

Prof Ngila is a Fellow of the World Academy of Sciences; Fellow of the Africa Academy of Sciences (AAS); Member of Academy of Science of South Africa (ASSAf); Member of the AAS Mentorship programme; Co-Chair for the 2021 Commonwealth Science Conference 22-26 Feb; Mentor for Mastercard Foundation Mentees; Member of various Chemical Societies (ACS, RSC, SACI) and Professional organizations.

Prof Ngila has won various Awards; 2021 L'Oréal-UNESCO For International Women in Science Awards for excellence in Water Research; 2017 African Union Kwame Nkrumah East Africa Regional Women Scientific Awards (January 2017); 2016 South Africa (SA) Distinguished Women in Science (WISA) Awards. She has received various Grants from South Africa National Research Foundation (NRF), Water Research Commission, and Council for Scientific for Industrial Research, among other grants.

Prof Ngila's research work is in Analytical/ Environmental Chemistry which focuses on water quality/pollution monitoring; modeling methods of water treatment based on nanotechnology; development of analytical methodologies for detecting chemical substances in water. She has mentored over 100 Postgraduate students including 36 MSc, 34 PhDs, 18 Postdoctoral Fellows, 22 Honours and published over 500 publications comprised of over 260 journal articles, 15 book chapters, 18 conference proceedings, 60 Keynote/Invited Lectures and 165 Conference abstracts. She is rated by South Africa NRF with a Google Scholar h-Index of 42; Researchgate h-Index 37; Scopus h-Index 35, etc.

Driss Ouazar

Professor of Computational Civil Engineering and Water Resources

Mohamed V University, Ecole Mohammadia d'Ingénieurs

Rabat, Morocco

Email: ouazard@gmail.com

Driss Ouazar is Professor of Computational Civil Engineering and Water Resources. (Mohamed V University, Ecole Mohammadia d'Ingénieurs, Rabat). He is a Resident Member of Hassan II Academy of Science and Technology since its creation in 2006, He is the National Representative of the International Association of Hydrological Sciences (IAHS), member of High Water and Climate Council, Founder of Adaptation Metrics and Techniques Cluster Water, Agriculture and Cities, Former President of UM6P University and Former Director of School of Engineering (Mines Rabat), Former member of Scientific Committee of COP22 and Scientific Board of the National Research Council of Morocco, Former Member of the Higher Council of Education, Training and Scientific Research and the Scientific Research Commission (Morocco). He is the Scientific committee of AAA (Adaptation Agriculture Africa- Moroccan Initiative). He was African Scientific Research and Innovation Council (ASRIC) Vice Chair and represents ASRIC as a co-Founder of the International Platform of Adaptation Metrics hosted by Africa Agriculture Adaptation (AAA) and currently the chair of IPAM Water. He was Jury Chair of 2019 African Union Kwame Nkrumah Awards for Scientific Excellence (AUKNASE), the African Union, Addis Ababa. He is also the Director of the College (Science and Technology for Environment, Earth and Sea), Associate Editor and Executive Director of Frontiers in Science and Engineering International Journal of the AH2ST.

Anne Petersen

Research Professor, University of Michigan

Founder/President, Global Philanthropy Alliance

Chair, Policy and Global Affairs Divisional Committee, NASEM

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Anne Petersen is a Research Professor (Adjunct), University of Michigan, in two units, and is the Founder/ President of Global Philanthropy Alliance, a foundation making grants in Africa. Petersen held administrative and faculty roles at several research universities. She was Senior VP Programs, WK Kellogg Foundation and US President-nominated/Senate-confirmed National Science Foundation Deputy Director/COO. She co-founded one scientific society and was President of several others. She chaired the NASEM Policy & Global Affairs Divisional Committee for two terms and chairs the NASEM EnCoRe Committee, and is key faculty for two fellowship programs in Africa, among other US/global voluntary boards/committees. Petersen has authored 15 books and over 350 articles, currently emphasizing global science policy and philanthropy, with continuing emphases on adolescence/youth development and evaluation/research methods. Her honors include election to National Academy of Medicine (NASEM) and Fellow in several scientific societies. She has also won several awards. Petersen received her education from the University of Chicago including a BA in mathematics, MSc in statistics, and PhD in measurement, evaluation, and statistical analysis.

David K. Robinson

Deputy Director, Vaccine Development

The Bill & Melinda Gates Foundation

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As Deputy Director, CMC Vaccines Development, David and his team work with internal and external partners to develop manufacturing technologies and execute CMC strategies to advance the foundation's goal to save lives and reduce healthcare inequities. Specifically for COVID, David was co-chair of the COVAX Vaccine Manufacturing SWAT team and was a member of the Vaccine Manufacturing Task Force Leadership Team. David received his Bachelor's degree from the University of California, Berkeley, and his Doctorate from the Massachusetts Institute of Technology, both in chemical engineering. David did his post-doctoral studies at the ETH in Zurich. David previously spent 25 years at Merck & Co, Inc (MSD), holding VP positions as head of Bioprocess R&D, Biologics Project Leadership and CMC Regulatory, and is a member of the National Academy of Engineering (USA).

Patrick Tippoo

Chief Science and Innovation Officer - Biovac

Executive Director – African Vaccine Manufacturing Initiative (AVMI)

Board Chair – Emerging BioPharmaceutical Manufacturers' Network

Special Advisor – DCVMN Board

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Mr Patrick Tippoo is the Chief Science and Innovation Officer at Biovac, responsible for vaccine product development. He is a founding member and the Executive Director of the African Vaccine Manufacturing Initiative (AVMI), advocating for the establishment of vaccine development and manufacturing capacity in Africa. He served as Vice President of the Developing Country Vaccine Manufacturers Network (DCVMN) from 2019-2022 and is now a special advisor to the DCVMN board. Patrick is Chair of the Emerging Biopharmaceuticals Manufacturing Network (EBPMN) board and also leads the Vaccine Manufacturing Enterprise Working Group within the AU Covid-19 Commission.

Organizing Committee

Abdelaziz Berrado (Committee Co-Chair)

Deputy Director of Research and Cooperation

Professor of Industrial Engineering

Ecole Mohammadia d'Ingénieurs (EMI)

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Abdelaziz Berrado, is a Professor of Industrial Engineering and Deputy Director of Research and Cooperation at the EMI School of Engineering at Mohammed V University in Rabat. Prior to his current position, he was a faculty member of engineering at Al Akhawayn University in Ifrane. He holds a PhD in decision systems and industrial engineering from Arizona State University.

Dr. Berrado researches advanced analytical methods and frameworks for knowledge generation and decision support in organizations. He focuses on data analytics for addressing societal challenges and also for operations and supply chain modeling, planning, improvement and control with applications in healthcare, education and other industries. He has led several funded applied research projects with local and international impact and published research papers in renowned journals. In addition to academic work, he interacts closely with the industry. Previously, he was a senior engineer and data analytics lead at Intel. He is a fellow of IEOM society and a member of INFORMS and IEEE.

Leonard Pease (Committee Co-Chair)

Senior Engineer and Group Leader

Pacific Northwest National Laboratory

Richland, Washington, United States

Email: fluids@pnnl.gov

Professor Pease, a senior engineer and group leader at the Pacific Northwest National Laboratory (PNNL), has held academic appointments in internal medicine, chemical engineering, and Asian studies. He earned a Ph.D. from Princeton University in chemical and materials engineering and completed a postdoctoral position at the National Institute of Standards and Technology (NIST) as a National Research Council postdoctoral research associate. At PNNL, he leads, manages, and advises high priority and high visibility research, development, and deployment efforts. He has earned several awards for technical excellence at PNNL and is currently advancing research initiatives in hybrid renewable energy systems, cleaning up produced water for alternative uses, and mineral extraction to support a green economy. 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 100 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-8th Arab-American Frontiers of Engineering, Science and Medicine Symposia.

Slimane Bah

Professor, Computer Science Department

L'École Mohammadia d'Ingénieurs (EMI)

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Dr. Slimane Bah is a full professor at the computer science department of Mohammadia Engineering School (Ecole Mohammadia d'Ingenieurs) affiliated University Mohammed V in Rabat (Morocco). Previously, he served as adjunct professor at the department of computer science of the university of Moncton. He holds a Ph.D. in computer networks from the Electrical and Computer Engineering Department of Concordia University (Montreal - Canada). He also holds an M.Sc. in computer networks from university of Montreal (Université de Montréal) and an engineering degree in computer science - Networking, from l'Ecole Nationale Superieure d'Informatique et d'Analyse des Systems (ENSIAS - Morocco). His research interests include end-user services, self-organizing and challenging networks, services and protocols engineering and sensor-based systems. He is also a technical committee member for several international conferences and journals (SITA, NETYS, AFRICATEK, MEDCT, elseivier Journal...)

Tarik Benmarhnia

Associate Professor, Scripps Institution of Oceanography

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Tarik Benmarhnia is an environmental epidemiologist and climate scientist at the University of California San Diego's Scripps institution of Oceanography as an associate professor where he leads the climate change epidemiology lab. He was a postdoc at McGill University with the Institute for Health and Social Policy. He finished his PhD jointly from The University of Montreal and Paris Sud and finished two Master's degrees, one in Environmental Health Sciences Engineering from the French School of Higher Education in Public Health and another in Pharmacy and Ecotoxicology from Montpellier University in France. He completed his BA in Environmental Sciences from Montpellier University.

His research interests include the impact of extreme weather events on human health in the context of climate change and advancing the notion of vulnerability and its implications for public policy. He also develops methodological approaches in order to evaluate the health impacts and environmental justice implications of various policies. He conducts several projects in Latin America, Sub-Saharan Africa or South Asia focusing on various climate-sensitive issues such as vector-borne diseases, food security, access to vaccination or human mobility. He published about 200 scientific papers and is an associate editor for journals including Environmental Health Perspectives and Plos Climate. He is also regularly featured in various publications such as Vice, CNN, New York Times, Wired, National Geographic and more.

Salome Bukachi

Associate Professor, Department of Anthropology, Gender, and African Studies

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Prof. Salome Bukachi holds a PhD in Anthropology from the University of Nairobi's Institute of Anthropology, Gender and African Studies, specializing in Medical Anthropology. Author of over 45 publications and supervisor of over 50 graduate students. She is one of the Members of Africa One Health Network Steering Committee, a Board member of the International Association of Ecology and Health, Member of the One Health High Level Expert Panel, Former Member of the Global Advisory Panel (GAP) for the REACH Programme – Improving Water Security for the Poor, Ad-hoc Committee member for the TDR and WaSH/WHO to support activities to control water-related infectious diseases with a special focus on vector-borne diseases. Salome has also served as Temporary Adviser to the WHO on Gender and intersectionality on infectious diseases of poverty, been a Member of the Working Group for the development of a guidance framework on testing and deploying the Sterile Insect Technique against mosquito-borne diseases under the IAEA/WHO/ UNICEF/ UNDP/WORLD BANK/WHO Special Programme for Research & Training in Tropical Diseases (TDR). She is currently a member of the Anthropological Association of Kenya, American Anthropological Association, Society of Medical Anthropologists and the International Water Resource Association. She has won several research grants and fellowships from organizations/Institutions such as the Government of Kenya, EU, IDRC, BMGF, WHO/TDR, Universities of Oxford & Cambridge, Netherlands Fellowship Program. She is an alumni fellow (2021) in the inaugural Fellowship Programme in the Social Science in Humanitarian Action Platform and an alumni fellow (2019) of the African Oxford Initiative. Prof. Bukachi serves in the Editorial and Review boards of many PUBMED cited journals. Salome has mentored many African Anthropologists and has created a niche for herself in the emerging field of Anthropology of infectious diseases and nutritional anthropology.

Deji Coker

Executive Advisor

Booz Allen Hamilton

Washington, DC, United States

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Dr. Ayodeji Coker is an Executive Advisor at Booz Allen Hamilton where he provides AI and Autonomy subject matter expertise, thought leadership, and strategic vision to the GDS NMC Account. Prior to this role he served as the Office of Naval Research (ONR) Portfolio Manager for Autonomy. As a Portfolio Manager he led ONR's corporate strategy in Autonomy; managed the corresponding investment portfolio; and provided focus on transition, operationalization, and fielding for autonomy and autonomous unmanned systems.

Dr. Coker has also served as a Science Director for Artificial Intelligence, Autonomy, and Unmanned Systems at the Office of Naval Research Global (ONRG) London office. In this capacity he built a program spanning Complex Adaptive Systems and Distributed and Collaborative Autonomy with particular emphasis in Swarm intelligence. His primary responsibilities were to scout and fund cutting-edge research and facilitate collaboration and partnership opportunities between scientists in Europe and U.S. Naval Science & Technology Research Enterprise and academic institutions. He was also responsible for coordinating ONRG S&T activities in Sweden, Italy, and Sub-Saharan Africa.

While in Europe, Dr. Coker also led a grand challenge initiative in partnership with the UK's Alan Turing Institute to develop 'AI Scientists': AI systems capable of making Nobel quality scientific discoveries highly autonomously at a level comparable, and possibly superior to the best human scientists by 2050. Prior to joining ONR and ONRG, Dr. Coker worked at the Naval Information Warfare Center Pacific (NIWC) (formerly Space and Naval Warfare Systems Center Pacific (SPAWAR)) as a Scientist, Project Manager, and Contract Officer Technical Representative (COTR) supporting DARPA's Defense Sciences Office. He also initiated and led various R&D projects centered on distributed and collaborative autonomy, and C2 data synchronization in environments characterized by Disconnected, Intermittent, and Low-Bandwidth (DIL) conditions.

Dr. Coker received his Bachelor of Science degree in Physics from the University at Albany, New York, his Master of Science degree in Electrical Engineering (optical communications) from Northwestern University, and his doctorate in Computer Engineering from Texas A&M University. His Doctoral work focused on the performance and reliability of Nano-electronic Memories.

Amal El Ghazaly

Assistant Professor, Department of Electrical and Computer Engineering

Cornell University

Ithaca, New York, United States

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Amal El-Ghazaly is an assistant professor in the department of electrical and computer engineering at Cornell University. Her work combines magnetism and ferroelectricity to create tunable, versatile electronic systems for telecommunications, sensing and actuation. Since joining Cornell, she has been recognized with the NSF CAREER Award for research, the Michael Tien Sustained Excellence and Innovation in Engineering Education Award for teaching, and the Zellman Warhaft Faculty Commitment to Diversity Award as well as the Faculty Champion Award for Junior Faculty both for service. Prior to joining Cornell in 2019, she was a postdoctoral research fellow at the University of California Berkeley, where she was awarded the University of California President's Postdoctoral Fellowship in 2017. Her postdoctoral research explored new possibilities for ultrafast all-electrical switching of magnetic nanodots for faster and more energy-efficient computer memories. She earned a Ph.D. in electrical engineering from Stanford University, where she was funded by both NSF and NDSEG graduate research fellowships as well as the Stanford DARE fellowship until her graduation in 2016. Her Ph.D. research focused on radio frequency devices using magnetic and magnetoelectric thin-film composites for tunable wireless communications. She received her B.S. and M.S. degrees in electrical and computer engineering from Carnegie Mellon University in 2011. She has studied and interned not only in the US, but also abroad in Japan, Egypt, and Nigeria over the course of her undergraduate and graduate degrees. Throughout her career, she has been, and continues to be, deeply passionate about empowering minorities through higher education and stimulating technology development and science and engineering education across the world.

Omowunmi Mary Longe

Associat Professor, Department of Electrical and Electronic Engineering Science

Chair of Smart Power and Energy Systems Research Group

University of Johannesburg

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Dr. Omowunmi Mary Longe is presently a Senior Lecturer in the department of Electrical and Electronic Engineering Science, University of Johannesburg, South Africa. She is also the Chair of Smart Power and Energy Systems Research Group in the department. She received her Doctor of Engineering (D.Eng) in 2017 from the University of Johannesburg in Electrical and Electronic Engineering Science. Her M.Eng and B.Eng degrees were obtained in Electrical and Electronics Engineering in 2011 and 2001 respectively from the Federal University of Technology, Akure, Ondo State, Nigeria.

She is a Senior Member of the Institute of Electrical and Electronics Engineers (SMIEEE), and Senior Member of the South African Institute of Electrical Engineers (SMSAIEE). She is the pioneering IEEE PES WiP Lead for South Africa and Southern Africa (2019-2021) and the pre-inaugural Vice-Chair of the Association of Professional Women Engineers of Nigeria, Ondo State chapter, Nigeria (2012). She is also a member of other notable professional organizations such as the Society of Women Engineers (SWE), Organization for Women in Science for the Developing World (OWSD), Nigeria Society of Engineers (NSE), and the Association of Professional Women Engineers of Nigeria (APWEN). Dr. O. M. Longe is also registered with the Engineering Council of South Africa (ECSA) and the Council for the Regulation of Engineering in Nigeria (COREN). She was the global Vice Chair of IEEE PES Women in Power executive committee (2022), member of IEEE PES Long Range Planning committee (2022), Chair, Education Committee, IEEE Smart Village – Africa Working Group (2022), and Secretary, Education Committee, IEEE Smart Village – Africa Working Group (2020-2021). She also founded the first IEEE Smart Village student branch in the world at the University of Johannesburg in May 2021. She is also a 2023/2024 mentor in the Global Women's Network for the Energy Transition (GWNET). She has served as co-chair and member of Technical Programme Committees for local and international IEEE conferences.

She has published more than forty papers in referred journals and conference proceedings. She is also a reviewer for ISI-listed journals and referred professional conferences. Her research interests include Renewable Energy Technologies, Microgrid designs, Electromobility, Mitigation of Energy Poverty, Demand Side Management, Distributed Energy Generation and Storage, Smart Energy Management, Gender and Energy Poverty Nexus, and Food-Energy-Water Nexus 4.0.

Emmanuel Margolin

Specialist Scientist

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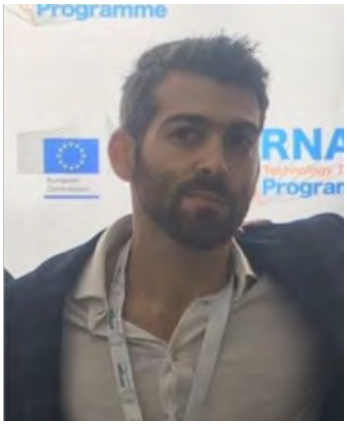

Emmanuel Margolin is a South African virologist with broad interests in vaccinology and infectious diseases. He completed his PhD in Virology at the University of Cape Town (2018), before continuing his research as a postdoctoral fellow in the Viral Vaccine Development Group and Biopharming Research Unit. His main focus during this time was to re-engineer glycosylation and glycosylation-dependent folding pathways in plants to support low-cost production of glycoprotein-based vaccines. In addition to his postdoctoral research he was also employed as a staff scientist in the Viral Vaccine Development Group (University of Cape Town) where he worked as part of a team to develop novel heterologous prime-boost vaccines against HIV. During his tenure in academia he also spent time at the John Innes Centre (Norwhich, UK) and Oxford University (Oxford, UK) for training. He transitioned to industry in 2022 where he was employed by Nant South Africa to drive the conception and implementation of a proprietary vaccine project. He is currently employed by Afrigen Biologics, as a specialist scientist, where he works as part of the mRNA vaccine technology transfer hub. Outside of work he enjoys learning to play the electric guitar, going to gym and surfing when the weather allows.

Abhishek Roy

Senior Staff Scientist

National Renewable Energy Laboratory

Englewood, Colorado, United States

Dr. Abhishek Roy is a scientist, innovator & science policy advocate with deep expertise in applying polymer and separation science fundamentals to address society's critical and pressing sustainability-driven challenges. He had spent over 18 years in academic and industrial separation science research (Dow) in water purification, fuel cell membranes, petrochemical separations, and carbon capture. Currently he is a strategic hire at NREL to shape a separation science program for industrial decarbonization, water purification and recovering critical minerals from unconventional sources. Before joining NREL, he was the technical lead for chemical decarbonization effort at Dow and drove several programs around carbon capture and chemical process separation. He is one of the co-inventor of next generation carbon molecular sieve membranes for reducing energy consumption of chemical separation processes.

He spent close to 10 years in the water purification industry (Dow Water Process Solutions) where he contributed towards inventing and commercializing a significant portion of today's commercial reverse osmosis membranes. He was awarded one of the highest recognitions from the Society of Chemical Industries (Gordon E Moore Medal, 2016) and the presidential Dow sustainability innovator award for developing a new generation of membranes that lowered the energy consumption of brackish water desalination by 30 %. He is a co-inventor of more than 150 global patents and applications and has published 40 peer-reviewed articles, including a cover page in Science and a special feature in PNAS. He was recognized by the National Academy of Science, Medicine, and Engineering as one of the top 18 outstanding young professionals and inducted into the New Voices program (2018) to drive meaningful dialogues on how science, engineering, and medicine are shaping the global future. He is currently on the Board of Directors for the North American Membrane Society.

Jamie Spangler

Assistant Professor, Biomedical Engineering

Johns Hopkins University

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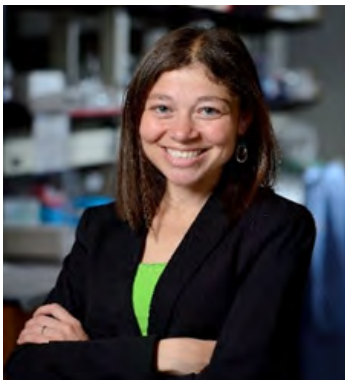
Email: jamie.spangler@jhu.edu



Dr. Jamie Spangler earned a Bachelor of Science degree in Biomedical Engineering at Johns Hopkins University and went on to earn a Ph.D. in Biological Engineering at MIT. After completing a postdoctoral fellowship at Stanford University School of Medicine, Dr. Spangler launched her independent research group at Johns Hopkins University in July 2017, jointly between the departments of Biomedical Engineering and Chemical & Biomolecular Engineering. Her lab, located in the Translational Tissue Engineering Center at the School of Medicine, applies structural and mechanistic insights to re-engineer existing proteins and design new proteins that therapeutically modulate the immune response. In particular, her group is interested in engineering immune molecules such as cytokines, growth factors, and antibodies for targeted treatment of diseases such as cancer and autoimmune disorders.

Aisha Walcott-Bryant

Senior Staff Research Scientist and Head of Google Research Kenya

Google

Nairobi, Kenya

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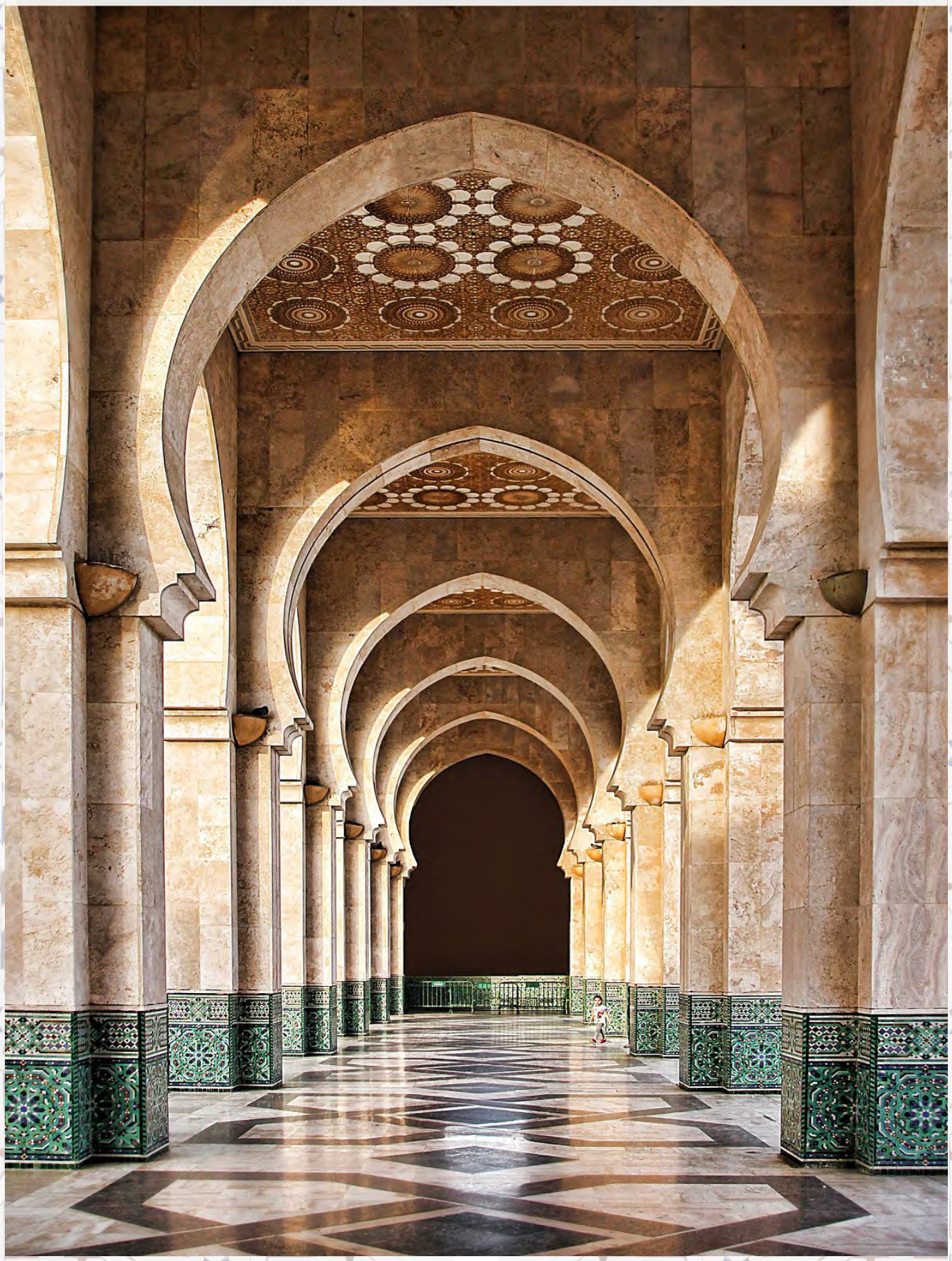
Dr. Aisha Walcott is a Senior Staff Research Scientist and head of Google Research Kenya. She has over a decade of experience working in Africa and leading teams to develop innovative technologies that leverage AI and computing to address some of Africa's most pressing challenges. Her current work focuses on the challenges of Africa's food systems and exploring ways in which advances in AI tools can make an impact on food security through building resilience in food systems.

Prior to her time at Google, she was a Senior Technical Staff Member at IBM Research Africa, and led projects in developing AI tools for global health, water management and access, as well as transportation. Currently, she serves on the board for the African Institute for Mathematical Sciences (AIMS) doctoral research program in data science, and is a Workshops co-chair for the International Conference on Learning and Representations 2023 (ICLR'23) - to be held in Rwanda May 2023. Dr. Walcott earned her PhD in the Electrical Engineering and Computer Science Department at MIT with a focus on robotics.

Plenary Sessions



Green Technologies for Climate Adaptation
Co-Chair: Omowunmi Mary Longe, University of Johannesburg, South Africa
Co-Chair: Abhishek Roy, National Renewable Energy Laboratory, United States

Science foundations for the U.S. Energy Transition
Asmeret Asefaw Berhe, Department of Energy, United States

Pioneering Progress: IRESEN's Journey in Morocco's Clean Tech Revolution & Vision for a Low-Carbon Future in Africa
Samir Rachidi, Institut de Recherche en Énergie Solaire et en Énergies Nouvelles, Morocco

Membrane Technologies are Key Enablers of the Energy Transition
Ryan Lively, Georgia Institute of Technology, United States

Green Hydrogen Economy and Storage Options for a Sustainable Energy Future
Henrietta Langmi, University of Pretoria, South Africa

Sensing Technologies
Co-Chair: Slimane Bah, Mohammed V University, Morocco
Co-Chair: Amal El Ghazaly, Cornell University, United States

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Anicia Peters, National Commission on Research, Science and Technology, Namibia

Vaccine Manufacturing
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End-to-end mRNA Vaccine Development and Technology Transfer to Enable LMICs to Manufacture their own Vaccines
Caryn Fenner, Afrigen Biologics, South Africa

Genomics of Vero Cells : Understanding this Cell Line and its Virus-host Interactions for Improved and Accessible Vaccine Production
Marie Angelique Sene, Institut Pasteur, Senegal

mRNA Vaccine Manufacturing: From Bench to the Bedside
Mohamad-Gabriel Alameh, Children's Hospital of Pennsylvania, United States

Leveraging mRNA Platform Technologies to Enable Pandemic Supply of COVID-19 Vx at Light Speed
Tatenda Shopera, Pfizer Inc, United States

One Health
Co-Chair: Tarik Benmarhnia, University of California, San Diego, United States
Co-Chair: Salome Bukachi, University of Nairobi, Kenya

One Health: A Frontier in STEM
Irene Naigaga, Makerere University, Uganda

Why we must Integrate Gender and Social Cultural frameworks as Key One Health Competencies in Infectious Disease Mitigation
Hellen Amuguni, Tufts University, United States

Future Proofing Health: One Health Resilience in the Era of Climate Change
Meghana Gadgil, UC Berkeley, United States

Making One-Health Approaches Count: The Data Science and AI Catalysts
Thumbi Mwagani, University of Nairobi, Kenya

Asmeret Asefaw Berhe

Director of the Office of Sciences

U.S. Department of Energy

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Dr. Asmeret Asefaw Berhe is the Director of the Office of Science for the U.S. Department of Energy. Dr. Berhe is currently on leave from the University of California, Merced where she holds the Ted and Jan Falasco Chair in Earth Sciences and Geology; is a Professor of Soil Biogeochemistry; and previously served as Associate Dean for Graduate Education. Her research focus lies at the intersection of soil science, global change science, and political ecology with an emphasis on how the soil system regulates the earth's climate and the dynamic two-way relationship between the natural environment and human communities.

She previously served as the Chair of the U.S. National Committee on Soil Science and member of the Board of International Scientific Organizations at the National Academies; Leadership board member for the Earth Science Women's Network; and founding a co-principal investigator in the ADVANCEGeo Partnership – a National Science Foundation funded effort to empower scientists to respond to and prevent harassment, discrimination, bullying, and other exclusionary behaviors in research environments.

Her scholarship and efforts to ensure equity and inclusion of people from all walks of life in the scientific enterprise have received numerous awards and honors. Dr. Berhe is a member of the National Academy of Engineering; she is also a Fellow of the American Geophysical Union and the Geological Society of America and a member of the inaugural class of the U.S. National Academies' New Voices in Science, Engineering, and Medicine. Berhe received a B.Sc. in Soil and Water Conservation from the University of Asmara; an M.Sc. in Political Ecology from Michigan State University; and a Ph.D. in Biogeochemistry from the University of California, Berkeley.

Science Foundations for the U.S. Energy Transition

Dr. Asmeret Asefaw Berhe is the first earth scientist to serve in the role of Director of the Office of Science (SC) for the U.S. Department of Energy (DOE). One of Dr. Berhe's priorities is ensuring that the deployment of the climate and clean energy solutions is driven by robust science. Among other goals, SC supports the DOE's Energy Earthshot initiative to accelerate breakthroughs for more abundant, affordable, and reliable climate and clean energy solutions within the decade. So far, SC has invested over 250 million US dollars to support fundamental research aimed at closing science gaps that are needed for large scale deployment of hydrogen, offshore wind, carbon dioxide removal, and other Energy Earthshots. Her talk will highlight the programs and funding mechanisms that bridge the gap from basic science research to new innovative green technologies outlined by the Earthshots.

Furthermore, with the increasing awareness and attention devoted to energy and climate justice, the Office of Science is ensuring that science is delivered and funded in a more equitable and inclusive manner. Dr. Berhe will highlight DOE Office of Science programs to broaden participation of people from all walks of life in STEM. Dr. Berhe will also draw from her research expertise that primarily focuses on the role of the soil system in regulating the earth's climate.

Samir Rachidi

Head of Energy, Environment & Natural Resources

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Samir Rachidi is the Director General of IRESEN. With his team, they are developing research projects and demonstration activities focusing on PtX, green chemistry, energy storage, concentrated solar (CSP) and hybridization of solar and bioenergy.

Prior to his current position, Samir served as an R&D program manager at MASEN. His role consisted in catalyzing national R&D efforts in the solar energy field, building international R&D project partnerships and collaborations in the area of solar applications, as well as helping in defining strategic R&D orientation to help unleash a Moroccan industrial potential in the solar sector in the future. Previously, he held a position as an R&D Engineer in a start-up company named "RespInnovation", in Sophia-Antipolis, France.

Samir obtained in 2011 a PhD in the field of Hydrogen PEM Fuel Cells, carried out in collaboration between the CEA of Grenoble and the CNRS institute of "Pprime" in Poitiers, both in France. Samir holds a double degree – Master of Science & Engineering – in Chemical Environmental and Energy Engineering, obtained from Saint-Etienne School of Mines and Jean-Monet University in 2008.

In addition, Samir is also lecturing at the "University Mohammed VI Polytechnic – UM6P" and the "Centrale Casablanca" Engineering School. He has been also recently elected as the General Secretary of the Moroccan Cluster of Green Hydrogen, and he is also leading the green hydrogen task force of the "Green Economy Commission", within CGEM Morocco.

Pioneering Progress: IRESEN's Journey in Morocco's Clean Tech Revolution and Vision for a Low-Carbon Future in Africa

Morocco, under the visionary leadership of His Majesty King Mohammed VI, is actively driving an ambitious energy transition supported by a comprehensive sustainability ecosystem across various sectors. This strategic initiative aligns with the country's commitment to building capacity for a decarbonized future domestically and regionally in Africa.

IRESEN, at the forefront of this transformation and operating under the High Directives of His Majesty, plays a pivotal role. Functioning as both a provider and developer of Research and Innovation Pre-industrial platforms, IRESEN collaborates with partners to cultivate an environment conducive to researchers, students, engineers, and entrepreneurs. These platforms serve as the foundation of an innovation ecosystem, offering cutting-edge infrastructure and fostering collaboration across various clean technology domains.

IRESEN's impact extends beyond providing resources; it catalyzes creating a collaborative space where diverse disciplines can interact, exchange ideas, and co-create innovative solutions. By nurturing this ecosystem, Morocco, through IRESEN, aspires to shape a sustainable and resilient future for itself and the broader African continent. The commitment to research, innovation, and capacity building underscores Morocco's determination to propel clean technologies and lead the transition to a low-carbon future.

In exemplifying IRESEN's contributions to decarbonized technologies, the organization is actively involved in pioneering fields such as renewables, green hydrogen, energy efficiency in buildings, mobility solutions, advanced lighting technologies, agriculture, water-energy-agriculture nexus, and the integration of smart grids and digitalization into energy systems. Collectively, these initiatives showcase Morocco's dedication to advancing sustainable practices and driving transformative change across multiple sectors.

Ryan Lively

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Ryan Lively is the Thomas C. DeLoach Professor in the School of Chemical & Biomolecular Engineering at the Georgia Institute of Technology. His current research seeks to revolutionize fluid separation processes critical to the global energy and carbon infrastructure. He has a specific focus on membrane- and adsorbent-based science and technology to address some of the most difficult chemical separations facing industry and humanity today and in the future. His group's research activities range from fundamental material science and discovery to translational engineering applications focusing on making and testing separation devices. He has received a variety of awards for his research efforts including the 2020 Allan P. Colburn Award from AIChE, and the 2022 Curtis W. McGraw Award from ASEE. He is currently an Editor for the Journal of Membrane Science, the Secretary of the North American Membrane Society, and an ACS Industrial & Engineering Chemistry Division Fellow. He is the Director of the Center for Understanding & Controlling Accelerated and Gradual Evolution of Materials for Energy (UNCAGE-ME), an Energy Frontier Research Center of the US Department of Energy. He has over 170 publications in the field of separations including articles in Science, Nature, and Nature Materials.

Membrane Technologies are Key Enablers of the Energy Transition

The hydrocarbon processing industry is in the midst of a major shift in feedstocks, structure, and products. Aggressive carbon abatement targets and intrinsic efficiency advantages from electrification strongly undercut the advantages of fossil fuels, which are the majority product of this industry. However, the existing value of the hydrocarbon infrastructure and the projected rise in demand for chemicals and plastics over the next 50 years suggests that this industry will remain an integral part of our global economic systems throughout the energy transition and perhaps beyond. Membranes – synthetic materials capable of molecular-scale separations of ions, gasses, water, and chemicals – are an unlikely hero in the quest to make this industry more sustainable. These materials-enabled technologies will play an instrumental role in addressing water scarcity and pollution, carbon capture, green hydrogen, industrial efficiency, and more. In this talk, comments on the future of the refining industry and the important role of membrane separation systems in that future will be discussed in addition to specific research challenges facing membrane technologies.

Henrietta Langmi

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Prof. Henrietta Langmi is currently an Associate Professor and the South African Research Chair Initiative (SARChI) Chair in Advanced Materials and Sustainable Energy at the University of Pretoria, South Africa. She holds a BSc (Hons) from University of Buea, Cameroon, an MSc (Distinction) from Imperial College London, United Kingdom, and a PhD from the University of Birmingham, United Kingdom. After a stint as a Postdoctoral Fellow, she became a Research Scientist at the University of New Brunswick, Canada. She later worked as a Principal Scientist and Key Program Manager for Hydrogen South Africa (HySA) Infrastructure Competence Centre at the Council for Scientific and Industrial Research (CSIR), South Africa. Prof. Langmi is a National Research Foundation (NRF) rated researcher. She is a recipient of the South African Women in Science Award and the International Journal of Hydrogen Energy David Sanborn Scott Award. Her research interests lie in the development of advanced materials with potentially useful properties, especially for sustainable energy applications. Her primary research interests include hydrogen storage, porous materials, and CO2 capture and utilization.

Green Hydrogen Economy and Storage Options for a Sustainable Energy Future

With the rising human population growth and upsurge in standard of living there has been an increase in energy demand globally. Currently, fossil fuels serve most of the world's energy needs. However, the rapid depletion of fossil fuel reserves and the increase in carbon dioxide emissions together with associated effects on climate change have led to the exploration of alternative sources of energy that are clean and sustainable. Green hydrogen is widely regarded as a key component in the transition to renewable and sustainable energy. Although hydrogen is an attractive energy carrier there are socio-economic barriers associated with its widespread implementation. Furthermore, there are still some technical challenges regarding its efficient production, storage, delivery and conversion. Among these, hydrogen storage and delivery presents the greatest hurdle associated with the broader deployment of hydrogen technologies for mobility as well as other energy applications.

Conventionally, hydrogen is stored as compressed gas at high pressures or as a cryogenic liquid. Storage/delivery as liquid carriers where hydrogen chemically bonds to form a new compound, has been investigated. Materials-based storage is an option that can offer a safer and more compact form of hydrogen storage. In this regard, research is directed towards developing new materials and enhancing hydrogen storage properties of various materials namely, hydrogen storage density, thermodynamics and kinetics of hydrogen uptake/release, and cyclability. Materials that store hydrogen by a physisorption process offer several advantages over chemisorption-based materials such as fast kinetics, reversibility and high gravimetric hydrogen storage capacities in the case of high surface area materials. Among the physisorption-based materials, metal-organic frameworks (MOFs) have continued to receive increased attention due to their large surface area, high porosity and tunability. Although the potential of MOFs has been revealed in many studies at the material level, their practical application is hindered because of the challenges in synthesis on a large scale and processing of the powder, among others.

This presentation will provide an overview of the green hydrogen economy as an enabler of a sustainable energy future. The presentation will further discuss the hydrogen storage component with emphasis on the development of MOF materials.

Kenneth Mubea

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Kenneth Mubea, PhD is the Capacity Development Lead, Digital Earth Africa (DE Africa). Kenneth's role includes technical support and user engagement and support, driving usage of the DE Africa services and engaging with the DE Africa network of partners across Africa. Kenneth has previously worked with the Global Partnership for Sustainable Development Data (GPSDD, UN Foundation), and SERVIR Eastern Africa (NASA - USAID initiative). Kenneth sees that a time has come that earth observation will be the critical means for decision making for countries and regional bodies towards achieving the Sustainable Development Goals (SDGs), leaving no one behind.

Digital Earth Africa - Unlocking the Promise of the Future, from Patterns of the Past

Since its first public launch at RCMRD in August 2019, Digital Earth Africa (DE Africa) has progressed rapidly to become an African digital infrastructure providing free and open access to Earth observation (EO) data and services and building capacity across Africa to use EO based insights to address sustainable development challenges and empower country-level climate action.

Through DE Africa, Africa now has ready and reliable access to 3PB of analysis-ready satellite data from Landsat, Sentinel-2 and Sentinel-1, and a range of other key datasets, stored in Cape Town by Amazon Web Services (AWS) in a cloud-optimised format suitable for rapid analysis and machine learning (ML). Data stores are continuously updated, and new decision-ready information is generated for the entire continent at full resolution (usually 10 or 30 metres). Services include dynamic water extent (Water Observations from Space), Geo-Median (GeoMAD), cropland extent, Fractional Cover, monthly NDVI Anomaly and Coastline service.

Capacity building is critical, and DE Africa is building an active community across Africa through training and providing ongoing support to our users. DE Africa free, cloud-based analysis environment allows anyone to explore, learn and develop prototype applications using EO data. The bi-lingual training platform and Help Desk is leading to further growth of diverse and engaged user community and providing more thematic focused training modules built with the support of regional implementing partners.

By measuring and monitoring changes to the natural environment, including coastal erosion and inundation, degradation of water quality in rivers and lakes, monitoring of grasslands, croplands and forest cover, DE Africa enables insight-driven action on multiple fronts to contribute to critical challenges including addressing climate change, food security, and natural resource management.

DE Africa data and services are providing insights that unlock the promise of the future from the patterns of the past. Further, empowering decision-makers across Africa and responding to national development agendas, Sustainable Development Goals (SDGs), and Africa Union Agenda 2063.

Keywords: Digital Earth Africa, Earth Observation, Capacity Building, Climate action, SDGs

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Alfredo Delgado, hailing from a South Texas farm, is considered an expert in remote sensing applications in agriculture. His academic journey led him to Texas A&M University College Station, where he obtained an ecosystem science degree, a master's in Molecular and Environmental Plant Sciences, and completed doctoral coursework in Plant Breeding. He's a recipient of the Borlaug Fellowship in Global Food Security and the Hispanic Leaders in Agriculture and the Environment Fellowship. His expertise focuses on agricultural applications of Ground Penetrating Radar (GPR). Alfredo's research has specialized in root and tuber crop breeding, emphasizing non-destructive, high-throughput remote sensing tools. Alfredo's mission revolves around understanding the complex interplay between species and their environment, especially in the rhizosphere. His passion lies in studying the "Hidden Half" - plant roots - and their pivotal role in breeding and agricultural optimization. Through innovation and dedication, Alfredo strives to promote sustainability and impact on global food security.

Ground Penetrating Radar and The Hidden Half: Harnessing Phenotypic Selection for Revolutionary Plant Breeding

Ground Penetrating Radar (GPR) has emerged as a transformative technology for non-invasive root detection and measurement in agriculture. This innovative approach harnesses the power of radar waves to penetrate the soil and capture intricate details of root structures in real-time. With applications ranging from crop breeding to soil management, GPR provides a high-resolution view of root systems, enabling researchers and agronomists to make informed decisions for optimizing plant health, yield, and resource utilization. This abstract explores the principles, methodologies, and applications of GPR in root detection and measurement, highlighting its potential to revolutionize modern agriculture by unraveling the hidden world beneath our feet.

Haeyoung Noh

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Hae Young Noh is an Associate Professor in the Department of Civil and Environmental Engineering at Stanford University. Her research focuses on indirect sensing and physics-guided data analytics to enable low-cost non-intrusive monitoring of cyber-physical-human systems. She is particularly interested in developing structures to be self-, user-, and surrounding-aware to improve users' quality of life and provide a safe and sustainably built environment. The results of her work have been deployed in a number of real-world applications from trains, to the Amish community, to eldercare centers, to pig farms. Before joining Stanford, she was a faculty member at Carnegie Mellon University. She received her Ph.D. and M.S. degrees in Civil and Environmental Engineering and the second M.S. degree in Electrical Engineering at Stanford University. She earned her B.S. degree in Mechanical and Aerospace Engineering at Cornell University. She received several awards, including the Google Faculty Research Awards (2013, 2016), the Dean's Early Career Fellowship (2018), the NSF CAREER Award (2017), and various Best Paper Awards from ASCE, ASME, ACM, IEEE, and SEM conferences.

Structures as Sensors: Physics-guided Learning for Indirectly Monitoring Humans and Surroundings

'Smart structures' sense, understand, and respond to structure itself, the humans within, and the surrounding environment. Traditional monitoring approaches using dedicated sensors often result in dense sensing systems that are difficult to install and maintain in large-scale structures. In this talk, I introduce "Structures as Sensors" approach that utilizes the structure itself as a sensing medium to indirectly infer multiple types of information (e.g., occupant activity, surrounding infrastructure states) through their influence on the physical response of the structure. Challenges lie in creating robust inference models for analyzing noisy structural response data. To this end, we developed physics-guided data analytics approaches combining statistical signal processing and machine learning with physical principles. I will present two projects as examples of this approach: 1) Vehicles as Sensors: indirect infrastructure health monitoring through vehicle responses; and 2) Buildings as Sensors: occupant tracking and characterization through footstep-induced building vibrations. We developed new learning methods incorporating structural dynamics, wave propagation, and human activity models; and we evaluated our methods with real-world experiments, including our 6-year railway and eldercare center deployments.

Sanaa Ghouzali

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Dr. Sanaa Ghouzali holds a Master's degree and a Ph.D. in Computer Science and Telecommunications, both earned from the University of Mohamed V-Agdal in Rabat, in the years 2004 and 2009, respectively. During her Ph.D. work, she was honored to receive the prestigious Fulbright Grant, which enabled her to embark on a research journey as part of a joint-supervision program at the Visual Communication Laboratory at Cornell University in Ithaca, New York, USA.

From 2009 to 2011, Dr. Ghouzali served as an Assistant Professor at the National School of Applied Sciences (ENSA), Abdelmalek Essaadi University in Tetuan. For 11 years (2012 to 2023), she had the privilege of teaching at the College of Computer and Information Sciences at King Saud University, Riyadh, Saudi Arabia. In 2022, she reached a significant milestone in her academic career by being promoted to the esteemed rank of Full Professor. Since September 2023, she has embarked on a new chapter in her career at the International University of Rabat.

Throughout her career, Dr. Ghouzali's research interests have centered around Machine Learning, Biometrics, and Information Security.

Unlocking Healthcare's Future: Secure Patient Data Sharing with Blockchain Technology

The healthcare sector faces a significant challenge in handling and disseminating the ever-growing volume of medical data, often hindered by the absence of relevant policies and secure data-sharing mechanisms. Blockchain technology, with its capacity for securely storing and sharing sensitive medical data, offers a promising solution that could potentially revolutionize the healthcare industry.

Numerous blockchain-based models have emerged, aiming to enhance medical treatment and research. In this presentation, I will introduce a decentralized, permission-based blockchain application specifically designed to facilitate secure patient data sharing during emergencies. This ground-breaking application empowers medical professionals with rapid access to critical patient information, ultimately leading to faster and more efficient treatment outcomes.

Through the utilization of blockchain technology, healthcare providers can guarantee the security and confidentiality of patient data while simplifying the data-sharing process. This innovative solution holds the potential to significantly enhance healthcare outcomes and improve overall patient care.

Sanmi Koyejo

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Sanmi Koyejo is an Assistant Professor in the Department of Computer Science at Stanford University. Koyejo was previously an Associate Professor in the Department of Computer Science at the University of Illinois at Urbana-Champaign. Koyejo leads the Stanford Trustworthy Artificial Intelligence (STAIR) lab, which works to develop the principles and practice of trustworthy machine learning, focusing on applications to neuroscience and healthcare. Koyejo has been the recipient of several awards, including outstanding paper awards, a Skip Ellis Early Career Award, a Sloan Fellowship, a Terman faculty fellowship, an NSF CAREER award, a Kavli Fellowship, an IJCAI early career spotlight, and a trainee award from the Organization for Human Brain Mapping. Koyejo spends time at Google as a part of the Deepmind team, serves on the Neural Information Processing Systems Foundation Board, the Association for Health Learning and Inference Board, and as president of the Black in AI organization.

Towards a Comprehensive Assessment of Trustworthiness in Large Language Models

Generative Pre-trained Transformer (GPT) models have exhibited exciting progress in capabilities, capturing the interest of practitioners and the public alike. Yet, while the literature on the trustworthiness of GPT models remains limited, practitioners have proposed employing capable GPT models for sensitive applications to healthcare and finance - where mistakes can be costly. To this end, this work proposes a comprehensive trustworthiness evaluation for large language models with a focus on GPT-4 and GPT-3.5, considering diverse perspectives - including toxicity, stereotype bias, adversarial robustness, out-of-distribution robustness, robustness on adversarial demonstrations, privacy, machine ethics, and fairness. Based on our evaluations, we discover previously unpublished vulnerabilities to trustworthiness threats. For instance, we find that GPT models can be easily misled to generate toxic and biased outputs and leak private information in training data and conversation history. We also find that although GPT-4 is usually more trustworthy than GPT-3.5 on standard benchmarks, GPT-4 is more vulnerable given jailbreaking system or user prompts, potentially because GPT-4 follows the (misleading) instructions more precisely. Our work illustrates a comprehensive trustworthiness evaluation of GPT models and sheds light on the trustworthiness gaps.

Girmaw Abebe Tadesse

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Dr. Girmaw Abebe Tadesse is a Principal Research Scientist and Manager at Microsoft AI for Good Research Lab. He leads the Africa team in developing AI solutions for critical challenges in agriculture, healthcare, biodiversity, and more. His research focuses on developing impactful and trustworthy AI solutions with active collaboration with domain experts. He collaborates with partners such as Bill & Melinda Gates Foundation, Stanford University, and Harvard University. He has over 20 patents filed at the U.S. patent office. He is an Executive Member for IEEE Kenya Section and an active contributor to the AI scientific community (Keynote speaker at ICLR 2023, Workshop Chair at ICLR 2024, Program Committee of Deep Learning Indaba, etc.) He has previously worked as a Staff Research Scientist at IBM Research Africa. He has also worked as a Postdoctoral ML Researcher for Healthcare at the University of Oxford, and interned in various research groups across Europe. He received his PhD at Queen Mary University of London, under the Erasmus Mundus Double Doctorate Program in Interactive and Cognitive Environments, with a focus on computer vision and machine learning algorithms.

Want to Achieve a Positive Impact Using AI? Spend More Time on the Data and with the Relevant Stakeholders

With a growing trend of employing machine learning (ML) algorithms to assist decision making, it is vital to frequently involve domain experts (and relevant stakeholders) in the process to facilitate development of impactful ML solutions. In my upcoming talk at the Human-Technology Interaction session, I will share how we, at Microsoft's AI for Good Lab, consistently engage our stakeholders in helping them solve some of the fundamental challenges of our time, such as food security. Similarly, I reflect on my recent works on AI for healthcare that utilized automated identification and characterization of systematic deviations for various tasks, including data quality understanding, temporal drift, treatment effects analysis, and new class detection. Additionally, I'll discuss our methodology for evaluating generative models in an interpretable, domain-agnostic manner. The talk will also highlight the importance of applying data-centric analysis to traditional sources, such as academic materials, showcasing a use case on the representation analysis in dermatology textbooks. This discussion aims to underscore that the true potential of AI lies not only in sophisticated algorithms but also in a deep understanding of the problem and its associated data, end-users, and potential impacts.

Adji Bousso Dieng

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Adji Bousso Dieng is an Assistant Professor of Computer Science at Princeton University where she leads the lab Vertaix on research at the intersection of artificial intelligence and the natural sciences. She is affiliated with the Department of Chemical and Biological Engineering, the Princeton Materials Institute, and the High Meadows Environmental Institute (HMEI). She is also a Research Scientist at Google AI and the founder and President of the nonprofit The Africa I Know. Professor Dieng was recently named an AI2050 Early Career Fellow by Schmidt Futures, an Outstanding Recent Alumni by Columbia University, and the Annie T. Randall Innovator of 2022 for her research and advocacy by the American Statistical Association. She received her Ph.D. from Columbia University. Her doctoral work received much recognition, e.g. a Google Ph.D. Fellowship in Machine Learning, a rising star in Machine Learning nomination by the University of Maryland, and a Savage Award from the International Society for Bayesian Analysis, for her doctoral thesis. Her work is supported by the National Science Foundation, Schmidt Futures, and Princeton University.

Interacting With Data Via Vendi Scoring

In this talk, I will describe the Vendi scores, a family of metrics that are rooted in ecology and quantum mechanics. I will first discuss how to use the scores to evaluate diversity and duplication for both benchmark datasets and generative models. I will also describe how to detect memorization for generative models using the Vendi scores. Finally, I will describe diversity attribution, an algorithm that leverages the Vendi scores to provide a granular view of data collections. Diversity attribution enables its users to interact with data at scale.

Anicia Peters

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Anicia Peters is the Chief Executive Officer of the National Commission of Research, Science and Technology (NCRST) in Namibia, Adjunct Research Professor, and was the Chairperson of the Namibia Presidential Task Force on 4IR (2021-2022). She was a member of Namibia's inaugural Green Hydrogen technical committee and co-established the Namibia Green Hydrogen Research Institute hosted at the University of Namibia. She also co-established the India-Namibia Centre of Excellence in IT at the Namibia University of Science and Technology. She is the founder of the Africa Human Computer Interaction Conference (AfriCHI), serves on the Steering Committee of the ACM CHI conference series and held several editorial roles for computing research outlets. She served on several national and international boards and advisory committees.

She completed a PhD and MSc in Human Computer Interaction from Iowa State University, USA, a Postdoc from Oregon State University and undergraduate degrees from Namibia University of Science and Technology. Her research work spans social computing, e-participation (e-government, e-health, gender, etc) and HCI-AI with over 80 publications and an H-index of 17.

Anicia has over 30 years of academic and industry experience in Namibia and internationally, including developing large scale government systems in Namibia and working in the Silicon Valley in the United States. Her past positions include being a Pro-Vice Chancellor for Research, Innovation and Development at the University of Namibia, and a Faculty Dean for Computing and Informatics at the Namibia University of Science and Technology.

Co-Creating a Human-Centered AI Future for a Green Africa

The continent, marked by its youthful talent and a burgeoning startup ecosystem, presents a landscape rich with challenges that Artificial Intelligence (AI) can address, offering opportunities for technological leapfrogging. While AI holds the potential to augment human capabilities and address continental challenges, it poses significant risks such as ethical dilemmas, bias, digital divides, job losses, linguistic impacts, and the potential reshaping of cultural values —even the risk of weaponization. One inherent danger in AI development lies in the rapid acquisition of AI development skills by African youth, potentially neglecting ethical and responsible design considerations as well as community centeredness. African AI development requires a holistic development, aligning ethical, responsible, and human-centric principles with technological growth.

Drawing inspiration from the evolution of Human-Computer Interaction (HCI), renowned for its community-centric ethos and human-centeredness, there are potential lessons applicable to AI development. While HCI is in its early stages across Africa, its principles and methods offer valuable insights for guiding ethical AI development.

Intersections between HCI and AI will be navigated whilst unraveling connections between humans, machines and value systems. Fundamentals also include among others growing and nurturing talent, building infrastructure, government systems and communities, regulatory frameworks and adequate funding. The talk aims to bridge theory and application, offering insights for the ethical, responsible and human-centered advancement of AI technologies across the African continent.

Caryn Fenner

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Caryn Fenner is an a lumnus of Rhodes University, and the University of Cape Town (UCT) obtaining a BSc Honours in Biotechnology and a PhD in Bioprocess Engineering, respectively. Before joining Afrigen Biologics, she held a research position at the Centre for Bioprocess Engineering Research (CeBER) at UCT, focusing on new product and process development using microbial and enzyme technology. Caryn has technical experience in biomanufacturing of recombinant proteins and therapeutics. She has taught at both undergraduate and postgraduate level, including supervision of postgraduate students. She served on CeBER's executive management team and oversaw operations of the analytical facilities. As an NRF grant-holder, Caryn was the principal investigator of two research projects in the area of biocatalysis. She has co-authored articles and chapters in peer-reviewed journals and books.

Caryn joined Afrigen Biologics mid-2016, as Senior Scientist and Laboratory Manager of the Adjuvant Formulation Centre. She oversaw Afrigen's product development programme; these included Veterinary Health, Human Health, and Novel formulations portfolios, and all scientific and technical operations. The formulation capabilities are based on a nano-encapsulation technology platform including nanoemulsions and liposomes focused on the application of next generation adjuvant formulations for the improvement and development of vaccines for human and animal health.

She was appointed as an executive member of Afrigen's Board in a new role as Technical Director in August 2018. She also has the privilege of serving on UCT's seed fund investment committee and as an advisor to the SA government's Department of Science and Innovation on Health Innovation related programmes. She has also served as an external evaluator on the SAHPRA COVID-19 expert committee.

Most recently Caryn has taken on the executive directorship of the Global mRNA technology transfer and training hub, a WHO-led public/ private partnership consortium to advance mRNA technology development and manufacturing for Africa and other LMICs. She leads the team of highly competent scientists, engineers and pharmacists who are developing the mRNA technology & manufacturing platform as a Greenfields project.

End-to-end mRNA Vaccine Development and Technology Transfer to Enable LMICs to Manufacture their Own Vaccines

The speed at which mRNA vaccines were developed during the Covid-19 pandemic not only demonstrated the potential value of mRNA technology to respond to epidemics/pandemics but to also contribute to the development of new vaccines or the improvement of existing vaccines. However, mRNA technology requires ongoing multi-disciplinary research to fully embed the technology in vaccine R&D and translate into cost effective manufacturing. Leading vaccine developers are primarily located in the global north, with little incentive to focus on neglected diseases in LMICs. The focus of the WHO/MPP mRNA program in a geo-diversified vaccine manufacturing sector is technology development and transfer to 15 partners in LMICs and building end-to-end research, development, and manufacturing capabilities. In the absence of a mRNA technology donor, Afrigen, as the WHO centre for mRNA Technology Development and Transfer Program developed Africa's first (COVID-19) mRNA vaccine by using information in the public domain and forming strategic partnerships in South Africa and abroad. The mRNA vaccine manufacturing process, including mRNA construct, plasmid DNA design and production, cell-free in vitro transcription, mRNA encapsulation in lipid nanoparticles, and associated analytics were established at Afrigen. First evidence of protective efficacy against SARS-CoV-2 by Afrigen's mRNA COVID-19 vaccine candidate, AfriVac 2121 has been shown in a golden Syrian hamster model. This paper will focus on the key elements, including human talent needed for the development of a mRNA vaccine technology and manufacturing platform that has enabled the development of AfriVac 2121, validation of the technology platform and subsequent transfer to partners of the program.

Marie Angelique Sene
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Dr Marie-Angélique Sene is Head of Advanced Vaccine Bioprocessing at the Institut Pasteur de Dakar, leading the establishment of a new laboratory responsible for the acquisition and transfer of novel technology. Marie-Angelique began her studies in engineering school studying Material Science, Mechanical Engineering, Quantic Physics, and Relativity while conducting research at one of the French Atomic Energy Commission laboratories. Afterwards she joined the graduate program in Seoul National University to specialize in Micro/Nano engineering while overseeing the Inter-University Semiconductor Research Center's photolithography equipment Quality Control and offering consulting services for local Korean companies wishing to integrate micro/nanotechnology to their Point-of-Care devices. She worked on projects from various fields such as Agriculture, Green Energies, Semiconductors, Optics, Health among others. Dr Sene now specializes in Vaccines manufacturing and to apply her previously acquired knowledges to this field to contribute in the effort to advance equitable access to vaccines. During her PhD at McGill University in the Kamen Lab, she obtained a patent as main inventor, in collaboration with Sanofi-Pasteur, focusing on the genetic engineering of the Vero cell vaccine production platform providing new possibilities to quickly generate high throughput, globally accessible, and pandemic ready cell-based vaccine platforms to efficiently protect global populations from current and emerging diseases.

Genomics of Vero Cells : Understanding this Cell Line and its Virus-Host Interactions for Improved and Accessible Vaccine Production

Many vaccines were traditionally produced by growing viruses in eggs. This process is labor intensive and requires a significant supply of eggs. Furthermore, during virus growth, egg-adapted changes might arise with significant implications for the body's immune response to vaccination. Therefore, a cell-based vaccine production method has been developed as an alternative. Indeed, using cells instead of eggs to grow viruses has the potential to better protect populations by avoiding egg-adapted changes and by leading to a faster and cost-effective delivery of vaccine candidates in the event of a pandemic. Moreover, cells have been successfully used to produce various licensed vaccines such as vaccines for rotavirus, polio, smallpox, hepatitis, rubella, Ebola, and chickenpox. The Vero cell line is the most used continuous cell line for viral vaccine manufacturing with more than 40 years of accumulated experience in the vaccine industry, emerging as an important discovery and screening tool to support the global research and development efforts including during this COVID-19 pandemic. However, the lack of a reference genome for the Vero cell line has limited our understanding of the cells' adaptation to suspension, host-virus interactions underlying the previously reported affinity of the Vero cell towards key emerging pathogens, and more importantly our ability to re-design high-yield vaccine production processes using Vero cell genome editing. Hence, through the first part of this presentation, we determined the genomic sequence of the Vero cells and identified the genes that it contains. In the second part, we further characterized Vero cells adaptation to suspension and viral reproduction after infection by first detecting in the Vero genome, genes and pathways that are involved in adaptation to suspension and virus replication (i.e., host factors). Finally, the third part focused on genetically modifying the cells targeting those previously identified host factors to create super producers Vero cells that will increase vaccine production quantity, quality and eventually speed. Widely used as a platform for various studies ranging from virus vaccine manufacturing to virus culture for other applications, the Vero cell line has the potential to become a cost-effective, high-throughput platform globally accessible through gene editing to increase virus production and to achieve high yield production and robust scalability of bioprocesses. Thus, by providing a reference genome for Vero cells and through deep quantitative profiling of Vero cells adapted to suspension and virus replication, this study highlights widespread applications of genome analysis and editing tools for the Vero cell line. Considering the use of Vero cells in vaccine manufacturing processes and in particular the acceptance of this cell line by regulatory authorities, successful applications of genome editing can significantly improve virus production and ultimately lower the cost of vaccine manufacturing, thus opening new possibilities to quickly more efficient, globally accessible, and pandemic-ready vaccine platforms to protect global populations from current and emerging diseases.

Mohamad-Gabriel Alameh

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Dr Alameh received his undergraduate degrees from the University of Montreal, and his Ph.D. in Biomedical Engineering from Polytechnique Montreal. His thesis work focused on understanding the intrinsic and extrinsic parameters affecting chitosan-siRNA nanoparticle macromolecular properties and their effect on in vitro, and in vivo efficacy.

Dr. Alameh joined the laboratory of Nobel prize winner Dr. Drew Weissman at the University of Pennsylvania as a Postdoctoral Fellow in 2018. He led multiple mRNA-based vaccine projects as well as projects to better understand the interaction of lipid nanoparticles (LNPs) with the immune system, improve their reactogenicity, and fine tune vaccine responses. Dr. Alameh is also involved in the development of novel proprietary lipids, adjuvants and displays strong interest in optimization of mRNA constructs, in vitro transcription reactions, and process scale up.

Dr. Alameh currently an Assistant professor in the Department of Pathology and Laboratory Medicine at the University of Pennsylvania and the Children Hospital of Philadelphia and the co-director of the Engineered mRNA and Targeted Nanomedicine Core at the Penn Institute for RNA innovation. He has co founded multiple successful startups and collaborate with multiple research groups in low- and middle-income countries to help make RNA based vaccines an affordable reality.

mRNA Vaccine Manufacturing: From Bench to the Bedside

mRNA vaccine manufacturing is a simple process with several issues that need to be resolved for high-quality products including optimization of process parameters. Here, mRNA manufacturing processes at small and larger scales will be described and discussed in the context of quality, immunogenicity, and toxicity.

Tatenda Shopera

Principal Scientist/ Group Leader

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Dr. Shopera is a Principal Scientist and a Group Leader at Pfizer and has been with Pfizer for five years. As a Group Lead at Pfizer, he leads a team of scientists to develop cutting edge technologies and state-of-the-art commercial manufacturing processes to meet global supply of various medicines and vaccines to tackle healthcare challenges across the globe ranging from rare diseases to pandemics. His team is also responsible for driving commercial manufacturing technology innovation and technology transfer. Most notably, his recent ground-breaking work was being part of the Pfizer team that developed the COVID-19 mRNA vaccine, which is the first COVID-19 vaccine. Prior to joining Pfizer, he worked at Millipore Sigma as a Research and Development Scientist in the bioprocess and cell culture media development division.

Dr. Shopera was born and raised in Zimbabwe. He graduated with a Bachelor of Science degree in Biochemical Engineering from Jacobs University, Germany. He holds a Master of Science (MSc.) and Ph.D. in Energy, Environmental, and Chemical Engineering degrees from Washington University in St. Louis. Outside of work, he enjoys outdoor activities, raising awareness on diseases, and engaging and mentoring the next generation of scientists in Africa.

Leveraging mRNA Platform Technologies to Enable Pandemic Supply of COVID-19 Vx at Light Speed

On March 17, 2020 Pfizer and BioNTech announced that they would jointly develop BioNTech's mRNA-based vaccine candidate BNT162 to prevent COVID-19 infection by leveraging expertise and resources of both companies and building from an earlier 2018 agreement to develop an mRNA-based influenza vaccine. However, in the case of the Covid vaccine development, the urgency was utmost as lives were being lost around the world due to the virus and there was no viable treatment available. The Covid pandemic was arguably the biggest challenge facing humanity in a generation.

To this end, the project was termed lightspeed with a highly ambitious goal of developing and gaining authorization/approval within a year. This seemed like an impossible task especially since the average time for vaccine development is typically 10-15 years and the fastest any vaccine had ever been developed was 4 years (mumps vaccine). However, just 248 days later, on Nov 20, 2020 an Emergency Use Authorization was submitted to the FDA demonstrating that mRNA vaccines have lived up to their promise of quick development times. This significantly rapid development of a COVID-19 vaccine was enabled by leveraging mRNA platform technologies coupled with use of rapid process development, scale-up and commercial manufacturing platform technologies. This talk will emphasize how courageous leadership, strong collaboration, and advantages of leveraging pDNA and mRNA platform technologies enabled accelerated process development and pandemic supply of a COVID-19 mRNA Vaccine.

Irene Naigaga

Lecturer

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Dr. Naigaga is the Regional Program Manager for Africa One Health University Network (AFROHUN); an international multidisciplinary network of 19 universities leading change in developing a One Health Workforce in East, Central and West Africa. Dr. Naigaga's roles involve coordination and provision of strategic and policy guidance to AFROHUN. She oversees operationalization of the network's strategic and business plans and promotion of strategic partnership engagement. She also provides leadership and support to program management and capacity development programs in the network. Dr. Naigaga brings on board her passion to transform Africa and nearly 20 years' experience in managing and implementing multistakeholder programs. Dr. Naigaga serves on several international capacity building networks, including Higher Education Resource Services East Africa (HERS-East Africa) where she serves a Board Member; Sub-Saharan Africa Water Resource Network (SSAWRN) under the Regional Initiative for Science and Education (RISE); Training and Research in Aquatic and Environmental Health in Africa (TRAHESA), and the Africa One Health Network (AfOHNet) where she serves as a member of the Steering Committee. Dr. Naigaga continues to offer technical expertise to support One Health integration into regional and continental frameworks including the East African Community One Health Strategic Plan spearheaded by the GIZ Pandemic Preparedness Project; ECOWAS's regional One Health Agenda steered by the West Africa Health Organization (WAHO); Africa CDC Framework for One Health Practice in National Public Health Institutes; and the Animal Health Strategy for Africa led by AU-IBAR. With her veterinary and wildlife background, she holds a PhD in Ichthyology of Rhodes University, South Africa, where she specialized in Aquatic Ecosystem Health. Working with colleagues from Makerere University and the African Chapter of the World Aquaculture Society, she is spearheading the integration of One Health approaches in Aquatic Health Management.

One Health: A Frontier in STEM

One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of humans, animals, plants, and ecosystems. It emphasizes the collaboration and integration of expertise from various disciplines to address complex health challenges at the intersection of humans, animals, and ecosystems. The 21st century continues to present a unique set of challenges that we must navigate as, individuals, professionals, and societies. A few challenges critical to this paper include but not limited to environmental sustainability including resource depletion from climate change and pollution among others; complex Public Health emergencies such as epidemics and pandemics; and technological disruptions in the face of artificial intelligence and the digital revolution. Addressing these challenges surpasses the efforts of one discipline and call for interdisciplinary and transdisciplinary engagements, right from defining the problem, through research, and all the way to intervention design and service delivery.

There need for leaders STEM in the 21st century and beyond, to embrace partnership and collaborative leadership as a key framework is now, if we are to successfully navigate the complex societal challenges of our time, recognizing the value addition of interdisciplinary transdisciplinary engagements. This is where One Health not only becomes revolutionary as an approach to complex problem solving, but also at policy and outcome levels. One Health recognizes the fact that the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent, and promotes a sustainable and healthy future through collaboration, communication, coordination, and capacity building. This paper will unpack the vision for One Health; underscoring some of the mega trends shaping Public Health emergencies in the 21st century; and sound a call to action for leaders in STEM to transform research and service delivery using a One Health Approach.

Hellen Amuguni

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Dr. Hellen Amuguni is an Associate Professor in the Department of Infectious Disease and Global Health at the Cummings School of Veterinary Medicine, Tufts University, Massachusetts, USA with a dual appointment at the School of Medicine, Department of Public Health and Community Medicine. She has expertise in Infectious Disease, Gender and One Health. She works at the cutting edge of the One Health initiative, which combines a multidisciplinary approach and human, animal and environmental health knowledge for monitoring and prevention of current and emerging diseases, and integrates gender components into her work as part of her approach in strengthening collaboration and capacities of the sectors and actors involved in health service delivery. She is the Project Director for the Tufts led USAID funded STOP Spillover One Health grant that focuses on supporting six countries in Africa and Asia to stop spillover of infectious diseases from wildlife to humans, as well as reduce amplification and spread in the human population. She was also the Project Lead for the recently concluded SheVax+, a four year IDRC funded Gender and Livestock Vaccine Innovation Fund grant that focused on strengthening women's agency, empowerment and engagement in the livestock vaccine value chain in Kenya, Uganda and Rwanda.

Why we must Integrate Gender and Social Cultural Frameworks as Key One Health Competencies in Infectious Disease Mitigation

The SARS-CoV-2 pandemic, a complex emergency that required a One Health approach, highlighted the human suffering and loss of life, economic devastation, and social disruption that results if infectious disease spillover is not detected early and contained. The pandemic provided a solemn reminder that evidence-based mitigation efforts can fall short without understanding the gendered socio-cultural systems, behaviors, ecological drivers and institutional weaknesses that facilitate infectious disease spread. Policy implementers, practitioners and researchers are slow to recognize the gender implications, ask why, and build responses accordingly. The glaring sex/gender-based differences in the COVID-19 mortality rate made this a matter of utmost urgency. Socio-cultural and gender based factors have been found to influence the severity of outcomes and the prevalence of several infectious diseases including anthrax, brucellosis, leptospirosis, listeriosis, Q fever, avian influenza as well as SARS and MERS. Gender is therefore a key One Health competency that has to be brought to the forefront, if response measures are to be effective and not reproduce or perpetuate inequities. It is important that gender norms, roles, and relations that influence women's and men's differential vulnerability to infection, exposure to pathogens, and treatment received, as well as decision making access and power dynamics, are considered and addressed. Gender plays a significant role in shaping infectious disease response. It is therefore essential to implement holistic and sustainable Gender Transformative intervention and response models that focus on systemic transformational change within the human, animal and environmental health sectors - that value women's contribution, and support their empowerment. Effective Gender Transformative Approaches (GTA) require political commitment to changing the status quo, allocation of budget for resources for trained staff and their transportation, and adequate time for reflection and change – otherwise, gender inequalities will persist or even increase. Many infectious disease and One Health interventions are complex processes which require buy-in from all stakeholders, and ultimately depend on the social context and the power dynamics in the household, community, and at micro and macro levels in a country. Gender roles and relations in the households intersect with positions, relationships, and responsibilities which must be understood to create truly transformative projects. Gender transformative models aim to change gender relations, and positions of women horizontally and vertically in any infectious disease response, and create entry points for women, so they can influence decision making and policies to enhance their ability to shape their lives. Infectious disease /and One Health technical interventions must therefore be aligned with gender transformative interventions: models that create lasting outcomes have to challenge the social context of gender inequity and enhance resource access and control for different genders, which in turn will transform structural barriers and constraining norms that underpin gender equality.

Meghana Gadgil

Assistant Professor

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Dr. Meghana Gadgil is an Associate Professor of Medicine at the University of California San Francisco (UCSF) and at the UC Berkeley (UCB) School of Public Health. She is the Director of Innovation at the Better Lab, Human Centered Design venture focused on vulnerable populations. Dr. Gadgil received her dual undergraduate degrees and Masters in Public Health (MPH) from UC Berkeley. She completed her residency training in Internal Medicine at Stanford University Hospital in the Global Health track. Dr. Gadgil was previously on the faculty at Dell Medical School at UT Austin.

Dr. Gadgil is an award-winning academic, physician, and educator and has practiced and taught around the globe. Her research interests include health system resilience in response to climate change and environmental health vulnerabilities, food systems and chronic disease in LMICs, and the innovative applications of human centered design to understand and address complex, system-level challenges that cross disciplines. Dr. Gadgil has been recognized with numerous awards, including a Fulbright Fellowship to Bangladesh, the Johnson & Johnson Global Health Scholarship, the UT Austin President's Award for Global Learning. Most recently, she served as a member of the New Voices program with the U.S. National Academies of Science, Engineering, and Medicine.

Future Proofing Health: One Health Resilience in the Era of Climate Change

As the global community grapples with the multifaceted challenges of climate change, the implications for public health are increasingly apparent. In this context, the concept of health system resilience has emerged as a crucial framework to address the capacity of healthcare systems to adapt and respond effectively to the evolving risks posed by a changing climate. This talk explores the intersection of health system resilience and the One Health approach, emphasizing their interconnectedness in mitigating the health impacts of climate change.

Health system resilience encompasses the ability of healthcare systems to anticipate, prepare for, respond to, and recover from adverse health events. Climate change introduces a range of health threats, including the spread of infectious diseases, extreme weather events, and disruptions to healthcare infrastructure. The One Health approach, which recognizes the interconnectedness of human, animal, and environmental health, offers a comprehensive strategy to address these challenges.

In the face of climate-induced health risks, the One Health approach emphasizes collaboration across disciplines and sectors, fostering a holistic understanding of health dynamics. This includes integrating data from human and animal health, as well as considering environmental factors that influence disease transmission. By adopting a One Health perspective, health systems can enhance their capacity to detect emerging health threats early, formulate effective response strategies, and promote sustainable practices that mitigate climate-related health risks.

Effective implementation of the One Health approach requires strong health system resilience. This synergy ensures that health systems are not only responsive to immediate health crises but also equipped to address the underlying environmental and social determinants contributing to climate-induced health challenges. As the global community navigates the complex landscape of climate change, a combined focus on health system resilience and the One Health approach emerges as a powerful strategy to safeguard public health in an era of environmental uncertainty.

Thumbi Mwangi

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Thumbi Mwangi is an infectious disease epidemiologist holding the joint positions as Co-Director of the Center for Epidemiological Modelling and Analysis (CEMA) at the University of Nairobi, Associate Professor at the Paul G Allen School for Global Health at the Washington State University, and Chancellors Fellow in Global Health at the University of Edinburgh. He leads a research team based in Kenya focusing on applied epidemiological modelling for evidence-based public health decisions, and One-Health approaches to the prevention and control of zoonotic diseases, improvement of animal health, production to improve human nutrition and socio-economic wellbeing.

Thumbi earned his Veterinary Medicine and Surgery degree in 2005 and a Master's in Genetics and Animal Breeding in 2008 from the University of Nairobi. He later obtained a Ph.D. in Infectious Disease Epidemiology from the University of Edinburgh in 2012. After a post-doctoral fellowship at Washington State University, he joined the faculty at the Paul G Allen School for Global Health, where he currently leads global health programs in East Africa.

Thumbi has served as the Chair of the National Technical Committee on Modelling advising the Kenya government on COVID-19 responses, member of the National Rabies Elimination Coordination Committee charged with oversight of the implementation of the rabies elimination strategy for Kenya, Chair of the United Against Rabies Working Group on effective use of vaccines, medicines, tools, and technologies of the World Health Organization (WHO), World Organization for Animal Health and the Food and Agricultural Organization of the United Nations among other roles. He is a commissioner of the Lancet Commission on strengthening use of epidemiological modelling of emerging and pandemic infectious diseases, and an Affiliate Fellow of the African Academy of Sciences. He has published over 100 peer reviewed scientific manuscripts including in the Lancet, Nature Reviews, Lancet Infectious Diseases, Lancet Global Health, PLoS Medicine, PNAS among others. He has mentored 10 Ph.D. and 9 masters fellows to completion and currently leads and co-leads training and research programs providing scholarships for 21 Ph.D. students at the University of Nairobi.

Making One-Health Approaches Count: The Data Science and AI Catalysts

The global community faces pressing health challenges at the intersection of human, animal, and environmental health, including the threat of animal pathogens that adapt to infect and spread among humans, and imbalances in animal and environmental health that negatively impact access to healthy and sufficient food. At the core of beneficial One-Health approaches to tackling these challenges is early detection and prediction of disease outbreaks in both animals and humans; development and deployment of intervention tools including diagnostic tests, medicines and vaccines; and optimization of delivery of interventions that protect or improve human health and well-being. Using specific examples of global south health challenges, this talk explores the opportunities provided by advances in data Science and AI in improving early warning systems for animal and human diseases; understanding their transmission and tracking their spread in the population; development and optimal deployment of interventions that protect human, animal and environmental health. Further, this talk provides thoughts on what will be required to move these data science and AI opportunities beyond being proof-of-principle ideas to implementation-at-scale in countries in the global south whose health systems stand to benefit most from these advances.

Bindu Nair

Director for Basic Research

Office of the Secretary of Defense

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Dr. Bindu Nair is the Director for Basic Research within the Office of the Secretary of Defense (OSD). In this role, she is responsible for oversight and coordination of the Department's $2.5 billion investment in basic science. She previously served as the Deputy Director of OSD's Human Performance, Training and Biosystems Directorate. Prior to OSD, Dr. Nair worked for the Department of the Army with oversight responsibilities over the science and technology program in power and energy. She has worked in the Department of Defense laboratory system at Natick Soldier Research, Development and Engineering Center as well as in private industry at Foster Miller. Her research expertise is in the field of Material Science and Engineering including nanomaterials, polymers, and organic electronic materials. She has published primarily in membrane and materials development fields and holds patents in fuel cell technologies. Dr. Nair holds a B.Sc. from the University of Florida and a Ph.D. from the Massachusetts Institute of Technology in Materials Science and Engineering.

Nicholas Kotov

Irving Lanmuir Distinguished University Professor in Chemical Sciences

University of Michigan

Ann Arbor, Michigan, United States

Nicholas A. Kotov is Irving Langmuir Distinguished University Professor in Chemical Sciences at the University of Michigan. He is a pioneer of theoretical foundations and practical implementations of complex systems from 'imperfect' nanoparticles that offer a vast field for the application of data science and machine learning. Chiral nanostructures, biomimetic nanocomposites, and graph theoretical representations are the focal points in his current work. Nicholas is a recipient of more than 60 awards and recognitions. Together with his students, Nicholas founded several startups that commercialized self-assembled nanostructures for the energy, healthcare, and automotive industry. Nicholas is a Fellow of the American Academy of Arts and Sciences and the National Academy of Inventors. He is an advocate for scientists with disabilities.

David K. Robinson

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As Deputy Director, CMC Vaccines Development, David and his team work with internal and external partners to develop manufacturing technologies and execute CMC strategies to advance the foundation's goal to save lives and reduce healthcare inequities. Specifically for COVID, David was co-chair of the COVAX Vaccine Manufacturing SWAT team and was a member of the Vaccine Manufacturing Task Force Leadership Team. David received his Bachelor's degree from the University of California, Berkeley, and his Doctorate from the Massachusetts Institute of Technology, both in chemical engineering. David did his post-doctoral studies at the ETH in Zurich. David previously spent 25 years at Merck & Co, Inc (MSD), holding VP positions as head of Bioprocess R&D, Biologics Project Leadership and CMC Regulatory, and is a member of the National Academy of Engineering (USA).

Daniel Placht

Program Officer

National Academies of Sciences, Engineering, and Medicine

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Daniel Placht is a program officer in the Science and Engineering Capacity Development Theme of the U.S. National Academies of Sciences, Engineering, and Medicine (NASEM). He currently directs the Connections to Sustain Science in Latina America program, and works on projects and activities focused on international science networks and capacity building, including the U.S.-Africa Frontiers and Arab-American Frontiers programs. He also works on the Partnerships for Enhanced Engagement in Research program where he manages research grants in Central Asia, the Middle East and North and Eastern Africa. Before joining NASEM, Daniel worked 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 and a master's degree in environmental science and engineering from Virginia Tech.

Mohamed Abdel-Kader

Chief Innovation Officer and Executive Director

Innovation, Technology, and Research Hub

United States Agency for International Development

Washington, DC, United States

Mohamed Abdel-Kader serves as USAID's Chief Innovation Officer and Executive Director of the Innovation, Technology, and Research Hub. In these roles, he oversees various Agency mechanisms to promote the application of innovation, technology, and research for greater aid effectiveness within USAID and the inter-agency, and with our partners in the international development community, private sector, and civil society.

Prior to USAID, Mohamed advised companies, leading NGOs and multilateral organizations, foundations and educational institutions, and government agencies in addressing their most pressing challenges. He served in the Obama administration as Deputy Assistant Secretary for International and Foreign Language Education in the U.S. Department of Education and later led the Aspen Institute's Stevens Initiative, an international ed-tech program. He has also served several postsecondary institutions in international strategy and major gift fundraising roles.

A speaker of fluent Arabic and basic Spanish, Mohamed is a Truman National Security Fellow, an Eisenhower Fellow, and the author of a children's book about stereotypes. He holds a Bachelor's degree from Clemson University, a Master's degree in Higher Education from Vanderbilt University, and an MBA from Georgetown University's McDonough School of Business. He is also a trustee of the Longview Foundation for International Education & World Affairs.

Conrad Tucker

Director, Carnegie Mellon University–Africa

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Dr. Conrad Tucker is the Director of Carnegie Mellon University-Africa (CMU-Africa) and the Associate Dean for International Programs-Africa. He is a professor of Mechanical Engineering at Carnegie Mellon University and holds courtesy appointments in Machine Learning, Robotics, Biomedical Engineering, and CyLab Security and Privacy. His research focuses on employing Machine Learning (ML)/Artificial Intelligence (AI) techniques to enhance the novelty (i.e., generative designs) and efficiency (i.e., functional evaluations) of engineered systems. His research also explores the challenges of bias and exploitability of AI systems and the potential impacts on people and society.

Dr. Tucker has served as PI/Co-PI on federally/non-federally funded grants from the National Science Foundation, the Air Force Office of Scientific Research, the Defense Advanced Research Projects Agency, the Army Research Laboratory, the Bill and Melinda Gates Foundation, among others. In February 2016, he was invited by National Academy of Engineering (NAE) President Dr. Dan Mote, to serve as a member of the Advisory Committee for the NAE Frontiers of Engineering Education Symposium. He recently served as a Commissioner on the U.S. Chamber of Commerce Artificial Intelligence Commission on Competitiveness, Inclusion, and Innovation and currently serves as a member of the Organisation for Economic Co-operation and Development (OECD) Expert Group on AI risk and accountability ONE AI. Dr. Tucker received his Ph.D., M.S. (Industrial Engineering), and MBA degrees from the University of Illinois at Urbana-Champaign, and his B.S. in Mechanical Engineering from Rose-Hulman Institute of Technology.

Participant Posters

Day 1

1. **Advanced Materials for Green Energy and Sustainable Electrification**
   Geoffrey Geise, University of Virginia, United States
2. **Enhancement of the Non-Invasive Transdermal Vaccination Efficacy Using Nanocarriers**
   Mona Abdelmottaleb, Faculty of Pharmacy, Ain Shams University, Egypt
3. **Low-Cost Geomaterial-Based Membrane in Service of Seawater Desalination**
   Brahim Achiou, Hassan II University of Casablanca, Morocco
4. **Nanocultures: High-throughput Platform for Assessing Microbial Community Dynamics in Sessile Drops**
   Tagbo Niepa, Carnegie Mellon University, United States
5. **Climate Technologies in Green Transition Pathways in Building Industry: Reflections from Nigeria**
   Olufemi Adetunji, Federal University of Technology Akure, Nigeria
6. **Developing Ultra-Sensitive Molecular Sensors to Solve Pressing Societal Issues**
   Judith Su, University of Arizona, United States
7. **Adaptation of Local Rabies Virus Isolates to Cell Lines to Develop Vaccine Strain in Ethiopia**
   Abebe Aga, Armauer Hansen Research Institute, Ethiopia
8. **Using RS Data to Describe the Environmental Process that Links the Water, Energy, and Carbon Cycles**
   Bouchra Ait Hssaine, Mohammed 6 Polytechnic University, Morocco
9. **Combining Incentives for Mobility Electrification with Carbon Policies: A Global Change Analysis Model of the U.S.**
   Ekundayo Shittu, George Washington University, United States
10. **Applications of Foundation Models in Earth Sciences Applied to Remote Sensing Imagery**
    Hamed Alemohammad, Clark University, United States
11. **Earth-Abundant Semiconductors: Advancing Solar Cells and Water Splitting Technologies for Sustainable Energy**
    Lahoucine Atourki, MANAPSE Lab, Faculty of Sciences, Mohammed V University in Rabat, Morocco
12. **Emerging Transportation Modes and Shifts in Human Behavior**
    Andrea Hicks, University of Wisconsin-Madison, United States
13. **Recall, Knowledge, and Compliance to Expanded Program on Immunization and RTS,S/AS01 Schedules Among Caregivers with Children Aged 24-40 Months in Central Tongu, Ghana**
    Diana Awutey, Ghana Health Service, Ghana
14. **Use of Low-Cost Geotracking Methods for Characterizing Human-Animal-Environment Interactions that Contribute to Infectious Disease Outbreaks**
    Kelly Baker, University of Iowa, United States
15. **Learning the Rules of Mtb-Derived Antigen Presentation on MHC-I and MHC-II**
    Bryan Bryson, Massachusetts Institute of Technology, United States
16. **Microbial Profile of Root Canals of Pulpally Infected Teeth in Ghanaians.**
    Akua Konadu, University of Ghana Dental School, Ghana
17. **Methods for Separating and Detecting Double Stranded RNA in Messenger RNA**
    Lloyd Bwanali, Revvity, United States
18. **Development and Evaluation of Therapeutic Nanostructures**
    Martin Conda Sheridan, University of Nebraska Medical Center, United States

19. **Vaccinology Capacity Education and Efforts in Vaccine Development in Africa**
Tolessa Muleta Daba, University of Rwanda, Rwanda

20. **Possibilities of Satellite Earth Observations in West Africa's Changing Coastal Zones**
Olusegun Dada, Federal University of Technology Akure, Nigeria

21. **Climate Smart Agriculture for Rural Communities through the Upscale of Solar Powered Irrigation Systems.**
Felix Amankwah Diawuo, University of Energy and Natural Resources (UENR), Ghana

22. **Characterisation of Mono-Stress Responsive Genes and Protein Over-Expression in Saccharomyces Cerevisiae**
Bellicia Disashi Kamwanya, Institut National de Recherche Biomedicale, Democratic Republic of the Congo

23. **ATR-FTIR: A Potential First Point Screening Tool in Disease Outbreaks**
Blessing Effiong, University of Uyo, Nigeria

24. **Toward Design Justice in Climate Smart Agriculture**
Maaz Gardezi, Virginia Tech, United States

25. **Quantum Computing Based Channel and Signal Modeling for 6G Wireless System**
Ahmed Farouk, South Valley University, Egypt

26. **Integrated Assessment of the Environmental and Human Health Impacts of Wildland Fires**
Fernando Garcia Menendez, North Carolina State University, United States

27. **The Development of Sorption-Enhanced Catalysts to Promote a Circular Carbon Economy**
Kandis Leslie Gilliard-AbdulAziz, University of California, Riverside, United States

28. **Emergence of Colistin mcr-10 and Fosfomycin fosA5 Resistance Genes in Klebsiella Pneumoniae**
Shymaa Enany, Suez Canal University, Egypt

29. **Opportunities for Collaborative Research in Africa Using US. DOE's In-Situ Sensing Technologies**
Samson Hagos, Pacific Northwest National Laboratory, United States

30. **Continuous Processing of Viral Vaccine Products to Reduce Capital and Operating Costs**
Caryn Heldt, Michigan Technological University, United States

31. **One Health Approaches to Methicillin and Vancomycin Resistant Staphylococcus: Interconnection Between Human, Animal and Environmental Health**
Etinosa Ogbomoede Igbinosa, University of Benin, Nigeria

32. **Building Collective Intelligence about Development of Vaccine Manufacturing in Africa to Ensure Equitable Access for Global Health Security**
Rishabh Jhol, Clinton Health Access Initiative, Rwanda

33. **Evaluation of the Effects of Climate on the Ravelling Resistance of Slurry Seals Used in Low Volume Roads**
Petrina Johannes, University of Namibia, Namibia

Day 2

34. **Usable Passwords**
Yvonne Kamegne, University of Central Missouri, United States

35. **Adaptive and Aero-Optical Turbulent Flow Forecasting Using Machine Learning Techniques**
Christopher Wilcox, US Air Force Research Laboratory, United States

36. **Battery + Hydrogen: Hybrid Storage Systems for a Greener Energy Future**
Harish Sarma Krishnamoorthy, University of Houston, United States

37. **Urban Design Impact on Local Climate and its Consequences on Building Energy Demand in Morocco**
Asia Lachir, Ecole Nationale d'Architecture d'Agadir, Morocco

38. **Novel Targeted Electrochemical Detection of TB Associated Biomarkers in Breath Using Engineered Electroactive Solutions in Patients from Kampala, Uganda**
Swomitra Mohanty, University of Utah, United States

39. **Improving Agricultural Production and Mitigating Climate Change through the Use of Biochar**
Mounirou Moustapha Maman, Institut des Radio-Isotopes, Niger

40. **Morphological Features and Electrical Properties of Hollow SnO_2 For Room Temperature CO Sensing**
Bridget Mutuma, University of Nairobi, Kenya

41. **Large Low-Resource Language Models: African Language Technology in Text and Speech for Social Good.**
Ernest Mwebaze, Sunbird AI, Uganda

42. **Building Trust between Humans and Artificial Intelligence (AI): Quality Assessment of Artificial Intelligence Tools in Radiology & Pathology for Precision Cancer Medicine**
Arvind Rao, University of Michigan Ann Arbor, United States

43. **Optimizing the Use of Indigenous African Crops in the Prevention of Non-Communicable Diseases**
Vidushi Neergheen, University of Mauritius, Mauritius

44. **Large Language Models (LLMs) Targeting Non-Communicable Disease Risk Factors Among Kenyan Youth**
Christine Ngaruiya, Yale University, United States

45. **Plant Biomass-Derived Advanced Green Energy Storage Devices**
Balla Diop Ngom, University Cheikh Anta Diop of Dakar, Senegal

46. **Activated Carbon-Ag-SiO_2 Nanocomposite for Heavy Metal and Organic Waste Removal from Waste-Water**
James Nyirenda, The University of Zambia, Zambia

47. **Design of Multifunctional Polymer Membranes for Energy-Efficient Separations**
Hee Jeung Oh, Pennsylvania State University, United States

48. **Disease Inspired Design of Biomimetic Nanocarriers for Targeted Delivery**
Calvin Omolo, United States International University - Africa, Kenya

49. **A Technological Approach to Automated Assessment of Spontaneous Speech to Predict Cognitive Impairment in Early-Stage Dementia**
Rachel Ostrand, IBM Research, United States

50. **Algorithms for Characterizing Mental and Physical Health using Dynamic Biosensing Data**
Rose Faghih, New York University, United States

51. **When a Robot Must Touch You: Ensuring Safety in Human-Robot Systems**
Joshua Schultz, The University of Tulsa, United States

52. **An Internet of Things Water Usage Monitoring System Device**
Sajid Mubashir Sheikh, University of Botswana, Botswana

53. **Leveraging mRNA Platform Technologies to Enable Pandemic Supply of COVID-19 Vx at Light Speed**
Tatenda Shopera, Pfizer Inc, United States

54. **How Genomic Approaches Can Contribute to Malaria Elimination**
Issiaka Soulama, Institut de Recherche en Sciences de la Santé (IRSS), Burkina-Faso

55. **Development of a Low-Cost Assistive Device at the Human-Technology Interface for the Speech Impaired**
Nazmat Surajudeen-Bakinde, University of Ilorin, Nigeria

56. **Clean Hydrogen Made in Africa: Africa's Next Superpower or Exercise in Futility?**
Meron Tesfaye, Energy for Growth Hub, United States

57. **PfRh5-Induced Human Monoclonal Antibodies Show Broadly Neutralizing Activities in P. Falciparum Clinical Isolates**
Laty Gaye Thiam, Institut Pasteur de Dakar, Senegal

58. **Plant Proteins: Future Mines of Bioactive Compounds**
Hankie Uluko, Malawi University of Science and Technology, Malawi

59. **Field-Deployable Biosensors for One Health: Demonstrations in Plants, Animals, Humans, and the Environment**
Mohit Verma, Purdue University, United States

60. **Elucidating Synergistic Strategies: Combination Antibody Therapy Directed at Influenza B Eradication**
Rachael Wolters, Vanderbilt Vaccine Center, United States

61. **Wearable Ultrasound Technologies for Continuous Deep Tissue Monitoring**
Sheng Xu, University of California San Diego, United States

62. **UWB Transparent Antennas with Diversity Features**
Rabia Yahya, Univesité de Nouakchott, Mauritania

63. **Black Start of Coastline Power Networks From Grid-forming Ship-to-Grid Services**
Jie Zhang, University of Texas at Dallas, United States

64. **Gait Health Monitoring Through Footstep-Induced Floor Vibrations**
Haeyoung Noh, Stanford University, United States

65. **Revolutionizing Aquaculture Vaccines Through Multi-Faceted Innovation**
Haitham Sghaier, National Center for Nuclear Sciences and Technology (CNSTN), Tunisia

Participant

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Dr. Mona Abdel-Mottaleb obtained her B.Sc and Masters degree in Drug Technology from the faculty of Pharmacy in Ain Shams University, Egypt. Later she joined the institute of Pharmaceutical Technology in the university of Bonn where she obtained her PhD in 2011. Mona obtained several postdoctoral fellowships in France and Germany before she took the position of an associate professor in Ain Shams University in Cairo. Her major area of expertise is the use of nanotechnology for enhanced dermal and transdermal drug delivery. She is a member of various scientific societies such as the American association for the advancement of science (AAAS), the controlled release society (CRS) and is also a 2019 fellow of Africa Science Leadership Program (ASLP) and the Future Africa initiative at the University of Pretoria. She received various scientific awards including Obada international young distinguished researcher, the international publications award from Ain Shams university (2009-2023), The medal of Excellence from Egypt's President (2019) and the Egyptian State Encouragement Prize in Medical Sciences from the Academy of Scientific Research and Technology of Egypt (2018). She is supervising a large number of graduate students in collaboration with various research institutes and pharmaceutical companies in Egypt and Europe. Mona is currently focusing on development of improved cancer therapeutic approaches and efficient vaccination with a large team in Egypt, France, and Germany.

Poster 2

Enhancement of the Non-Invasive Transdermal Vaccination Efficacy Using Nanocarriers

Vaccines are now considered a necessary tool to achieve active acquired immunity against emerging infectious diseases. Vaccines are usually administered via the par-enteral route with all the subsequent inconveniences of the use of injections. Therefore, research efforts have been always directed towards finding safer alternatives. Although the use of microneedles for the transdermal vaccination purposes might offer an interesting alternative, the use of nanocarriers might enhance the transdermal permeation of vaccines without affecting the integral barrier properties of the skin. Polymeric nanoparticles, especially charged ones, were proven to be superior compared to lipidic ones in dermal deposition and skin retention. They were used to enhance the immune response to a model antigenic protein "ovalbumin". The synthesized particles enhance the permeation of the antigen to the epidermis and dermis layer where an induction of the maturation of dendritic cells was achieved. Topical application of the nanoparticles resulted in a significant elevation of anti-ovalbumin antibodies while the use of ovalbumin alone didnot induce any immunological effects via the transdermal route. Our results demonstrate the potential of the non-invasive patch-type transdermal vaccination platform.

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Brahim ACHIOU is an Assistant Professor in the Department of Chemistry at the Faculty of Sciences and Technologies of Mohammedia. He completed his PhD in Materials Science and Membrane Technology in 2017 at the Laboratory of Materials, Membranes and Environment of Hassan II University. Currently, his research focuses on the preparation of ceramic membranes based on natural pozzolan for microfiltration and ultrafiltration, and the preparation of zeolite-based membranes for pervaporation. The prepared membranes were applied for the treatment of industrial wastewater, the pretreatment for desalination and the dehydration of alcohol solutions. Additionally, he has contributed to the preparation of low-cost membranes made from Moroccan geomaterials such as clays, phosphate, perlite and magnesite. Moreover, He carried out a two-year PostDoc in Chemical and Biochemical Sciences. Green Process Engineering department (CBS.GPE) at Mohammed VI Polytechnic University.

Brahim ACHIOU authored and co-authored 38 scientific articles (SCOPUS Index-h: 20) in highly rated journals and more than 21 oral/poster communications in national and international conferences.

Poster 3

Low-Cost Geomaterial-Based Membrane in Service of Seawater Desalination

The water issue is the one that best illustrates the future challenges of sustainable development, namely economic growth to fight against poverty, the preservation of natural ecosystems and biodiversity. Morocco is already suffering from the impacts of climate change with the reduction of water supply to groundwater, the preservation of the existing hydraulic infrastructure, and the search for new water resources are therefore the major challenges to be addressed. Ceramic membranes are much demanded compared to their polymeric membrane counterparts because of their high mechanical strength, excellent chemical stability in concentrated media and high thermal stability even at high temperatures. However, these commercial ceramic membranes are costly because they are prepared from industrial oxides such as titania, zirconia, alumina and their composites beside they require high sintering temperatures (1300–1500 °C).

In this project, we focus on development of low-cost microfiltration membranes with different configurations (flat disks and tubes) prepared from cheaper geomaterials such as clays, pozzolan and perlite. These materials are in abundance in Morocco and can be processed by pressing and extrusion followed by sintering under conditions less severe with respect to the ones adopted for the preparation of commercial alumina membranes. The idea is to integrate our membranes in the process of desalination to remove suspended particles, bacteria and organic compounds. Thereafter, we could design an efficient hybrid membrane-based process for desalination of seawater and recovery of pollutants. This consists of (i) defining the specifications and reference process, (ii) establishing the general performance assessment of the studied membranes, (iii) integrating the only prototype membranes or with commercial membranes in the developed process, and (iv) estimating the energy consumption of the proposed process.

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Olufemi distinguishes himself as an early career researcher and academics teaching sustainability, climate adaptation, heritage conservation and infrastructure planning at the Department of Architecture, Federal University of Technology, Akure, Nigeria. I am also conducting a funded project 'Climate Risk and Vulnerability of Cultural Heritage in Nigeria: Mapping and Investigating Nature-based Adaptation Strategies'. He concluded doctoral research at the School of Architecture and Built Environment, University of Newcastle, Australia on climate change and related hazards affecting cultural heritage of communities to develop social participation framework involving actions and strategies that when implemented will help in mainstreaming, preparedness and adaptation planning across communities. Olufemi is a member of ICOMOS in Nigeria (full member) and Australia (associate member) as well as member of ICOMOS-ICORP and ICOMOS-ISCES. After coordinating the Emerging Professional Working Group (EPWG) of ICOMOS in the Africa region from 2018 to 2021, Olufemi moved forward to entrench international collaboration and mentoring of emerging professionals in Africa.

Poster 5

Climate Technologies in Green Transition Pathways in Building Industry : Reflections from Nigeria

In Africa, for instance, several extreme weather events and disasters were recorded in 2022 breaking previous records of climate parameters. According to a previous study, the built environment and construction sector accounts for 38% of global carbon emissions which is due to an increase in demand for buildings and infrastructure. The stark consequences of increase in global emissions necessitate the need for transition into green approaches in view to achieve net zero targets for Africa. Nigeria, as the most populous country in Africa, plays a vital role in deciding how to achieve Africa's Net Zero targets by 2050. The study presents the findings of 2-year research into i.) how carbon emissions from the building industry in Nigeria can be reduced, and ii.) what are the barriers and prospects of integrating climate-friendly technology into operations and processes in Nigeria's building sector. Data were collected from relevant public and private organizations, while key building professionals participated in interviews to understand the barriers and potential panacea to the integration of climate-friendly technologies. Findings established that the building industry is at a critical turning point with a 15-18% loss in contribution of the building sector to Nigeria's GDP per capita. The instabilities and uncertainties in national and regional politics also contribute to inaction and weak policy implementations regulating the operations and processes in the sector. Interestingly, the skill capacity of built environment professionals such as architects, civil engineers, surveyors and construction project managers about climate-friendly technology and green transition has improved significantly compared to adoption of the technologies which has slowed across the states. The study, therefore, recommends a roadmap including actions that can be implemented to address increasing emissions from the building sector.

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Abebe Aga received his BSc in applied chemistry from Ambo University and MSc from Addis Ababa University in Biomedical Science. He has been working on the area of vaccines and diagnostics development since 2010 and achieved several research outputs with public health importance. He got experience on cell culture vaccine production, preclinical studies, using laboratory animals like swiss albino mice, rabbits and dogs. He has also conducted in vivo/in vitro quality control of vaccines, and virus isolation using mice and BHK and Vero cell lines. Abebe has conducted several surveys and surveillance related to public health, studied snake bites and their envenomation, and studied molecular epidemiology of infectious disease and vaccine effectiveness study, specifically COVID-19 vaccine effectiveness study. Currently, he is working as project leader in the area of vaccine and diagnostic development for public health important disease in Ethiopia and is still interested to continue in this research area. In addition, he is studying for his PhD in Biotechnology to upgrade his knowledge and research experience in vaccine and diagnostics development.

Poster 7

Adaptation of Local Rabies Virus Isolates to Cell Lines to Develop Vaccine Strain in Ethiopia

Background: Rabies is a zoonotic viral disease which causes acute encephalitis in humans and animals. The case is most severe in developing countries where modern cell culture derived anti-rabies vaccines are unavailable and not affordable for most of the population. In addition, the available nervous tissue-derived vaccines are of questionable immunogenicity and may cause neurological complications. The aim of this study was to adapt local rabies virus isolates on cell lines and mice brain, and to study pathogenicity to intramuscular route inoculation to develop vaccine strain locally.

Methods: The street rabies viruses were isolated from rabid dogs' brain and human saliva and adapted to Swiss albino mice brain and cell lines (BHK-21 and Vero) by several blind passages to increase viral titer. The viral titers were controlled by titration at each five consecutive passages both in vivo and in vitro. For Pathogenicity study, mice were inoculated intramuscularly with 250MICLD50/0.1 ml of each adapted virus isolate and observed for 45 days.

Results: By titration, a minimum of 10* 6.5 TCID50/ml (in vitro) and 10* 4.5 MICLD50/0.03 ml (in vivo) virus titers were obtained. According to Pathogenicity study, only two virus isolates, human origin sululta (HOS) and dog origin (DO) caused 12.5% death indicating presence of virulence to intramuscular route of inoculation.

Conclusion: Increase in viral titer was significant and it is observed for high viral titer by in vitro virus propagation. Death due to intramuscular inoculation can indicate the phylogroup origin of the viruses showing decline in virulence due to adaptation. Adaptation of the viruses to mice brain and cell lines to increase virus infectivity significantly affects viral virulence to intramuscular inoculation. Further, genetic relationship with fixed rabies virus strain need to be studied by molecular techniques and vaccinal strain with local challenge virus should be used from locally isolated viruses.

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Bouchra Ait Hssaine is an Assistant Professor at the center for remote sensing applications (CRSA). Her general research interests lie in modeling the surface atmosphere exchange fluxes, especially the evapotranspiration (ET) which is the main driver of the water, energy, and carbon cycles. Her thesis was carried out at Paul Sabatier (Toulouse) and Cadi Ayyad (Marrakech) Universities (2015-2019), within the Spatial Center for the Study of the BIOsphere (CESBIO) that covers all aspects of remote sensing from the conception of new missions to the use of data acquired by Earth observation satellites and the -LMI TREMA- addresses the questions related to the monitoring of agricultural water use using remote sensing approaches. In 2020, she held a Postdoctoral position at CRSA on the hydrological processes and water and energy balance with a view to improving agricultural water use efficiency while maximizing the crop yield.

Poster 8

Using RS Data to Describe the Environmental Process that Links the Water, Energy, and Carbon Cycles

Evapotranspiration (ET) is the main driver of the environmental process that links the water, energy, and carbon cycles. ET is often limited by available energy which defines the energy-limited evaporation regime (stage I). But under some climates (e.g., arid and semi-arid) and in some seasons (e.g., dry seasons) the capacity of soils to transfer enough water to the land-atmosphere boundary at the surface becomes limiting. Under such conditions, the ET becomes water limited (stage II). The threshold between energy-limited and water-limited ET regimes is (SM*) dependent on seasonal soil water content as well as other near-surface atmosphere conditions. The aim of this work is the use satellite observations only (soil moisture (SM) from NASA's Soil Moisture Active Passive (SMAP) satellite and diurnal temperature (dT) from the geostationary satellite MSG-SEVIRI) to assess the surface inertia to climate variability and define the regions with the most variable environmental forcing and that set to the "tipping-point" in Sahel region. Specifically, to identify and implement an unsupervised classification scheme to categorize regions according to their dominant hydrological regimes in the same region. Therefore, SM at the drydown periods is correlated to dT in order to define whether the region is set to stage I, stage II, or transitional (Stage I and Stage II) regime. For this axis we raise the question of extracting SM* at 9 km resolution by filling the gap at temporal scale of the missed data. For this purpose, the simple methodologies have been proposed, the first one by linearly interpolating SM data (using 3 days moving average method), the second one by merging three sources of SM data (SMAP, AMSR, SMOS), and the third one where a machine learning algorithm is used to predict SM from LST and NDVI (Normalized Difference Vegetation Index). The results of the classification using the three methodologies will be presented during the conference.

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Hamed Alemohammad is an Associate Professor in the Graduate School of Geography and Director of the Center for Geospatial Analytics at Clark University. He is an interdisciplinary scientist with expertise in remote sensing, earth science, and artificial intelligence (AI). His research interest lies at the intersection of geospatial analytics/AI and geography to use observations to better understand the changing Earth system. Hamed has been the PI for several projects focused on developing novel AI models for multispectral, microwave and synthetic aperture radar (SAR) satellite observations. Prior to Clark University, Hamed was the Chief Data Scientist and Executive Director at Radiant Earth Foundation where he established and led the development of Radiant MLHub - the open-access repository for geospatial training data and AI models. He received his Ph.D. in Civil and Environmental Engineering from MIT.

Poster 10

Applications of Foundation Models in Earth Sciences Applied to Remote Sensing Imagery

Foundation Models (FM) are revolutionizing how machine learning (ML) models are developed. FMs are trained using self-supervised techniques on a large number of unlabeled data such as satellite imagery which are abundant at global scale. These models are then fine-tuned for different downstream applications using a limited number of labeled data. This approach has shown to be very effective (in terms of accuracy and training cost); in particular, where collection and curation of labeled data is expensive.

In this presentation, I will demonstrate the value of applying a geospatial FM for three downstream applications of segmentation, image classification, and gap filling. The FM is trained on ~175,000 multi-spectral and multi-temporal image chips from the Harmonized Landsat Sentinel (HLS) imagery. For each of the three downstream tasks, high quality labeled data is curated and a baseline supervised model is also trained for comparison.

I demonstrate the tradeoffs for using the FM versus the baseline in terms of the number of labeled data required to achieve certain accuracy, training cost and the highest achievable accuracy. Overall, using the FM, we achieve similar performance compared to baseline models but using a much smaller sample size.

Lahoucine Atourki

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Dr. Lahoucine Atourki is currently an Associate Professor at Mohammed V University in Rabat, Morocco setting up his group on the materials for energy conversion. He followed a multidisciplinary career, from studying general physics to physical chemistry and materials science. His primary interests lie in the development, modeling, and investigation of novel semiconductor materials for solar energy conversion and photo-electrochemical water splitting. His focus is on studying defects, interfaces engineering and studying degradation pathways in solar and photoelectrochemical devices. Dr. Atourki published 13 1st author articles and coauthored more than 36 publications, which have garnered more than 649 citations and an h-index of 15 (source: Google Scholar). In addition to his academic pursuits, he has a profound commitment to science education and climate change adaptation.

Poster 11

Earth-Abundant Semiconductors: Advancing Solar Cells and Water Splitting Technologies for Sustainable Energy

The pursuit of sustainable energy solutions has led researchers to explore the vast potential of earth-abundant semiconductors in advancing solar cells and water splitting technologies. In our laboratory, we focus on the synthesis of materials for solar cells and water splitting applications. This poster is shedding light on the progress made in developing perovskite and Kesterite solar cells, with particular emphasis on lead-free alternatives that promise enhanced efficiency and environmental friendliness. The integration of earth-abundant semiconductors in photovoltaic (PV) technologies presents a paradigm shift in the solar energy landscape, providing a cost-effective and eco-friendly path towards achieving widespread renewable energy adoption. Additionally, water splitting technologies hold immense promise in the production of clean hydrogen fuel, a key player in the transition to a carbon-neutral future. Our exploration of earth-abundant materials for solar energy applications will highlight their potential to revolutionize the green energy sector.

Diana Awutey

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Miss Awutey currently holds a Master's degree in Public Health (Epidemiology and Disease Control) and is a Health Promotion expert who has a background in community health nursing and public health education. A certified Cervical Cancer Screener and an Advocate. Specialized in community engagement and mobilization. Miss Awutey's job schedule has exposed her to work hand in hand with communities, children, adolescents, adults, and the aged. She has 14 years of varied experience in many fields as she has practiced as District CHPS Coordinator, District Verbal Autopsy Coordinator, Maternal and Child Health Nutrition Program (MCHNP) Coordinator, District In-Service Training Coordinator, District Community Scorecard Coordinator, GRNMA-Treasure, Liaison Coordinator on Water Sanitation and Hygiene (WASH) for World Vision Krachi Cluster, Community Led Total Sanitation Program Coordinator and the Chairman for Krachi West District Risk Communication Committee. Recently appointed as the Central Tongu District level BMC representative on Social Media Focal Person. Research interest in immunization, malaria, cervical cancer, female genital schistosomiasis, adolescent health, and Nutrition.

Miss Awutey's objective is to acquire knowledge and skills in the field of Epidemiology and disease prevention through sound research to contribute to national development. To increase access to knowledge in preventive and curative health by imparting health knowledge to the new generations through health promotion and education.

Poster 13

Recall, Knowledge, and Compliance to Expanded Program on Immunization and RTS,S/AS01 Schedules Among Caregivers with Children Aged 24-40 Months in Central Tongu, Ghana

The globally endorsed Expanded Program on Immunization (EPI) adopted in 1978 in Ghana has contributed to a major reduction in infant morbidity and mortality against vaccine-preventable diseases.7% dropout between the first and third doses of RTS,S malaria vaccine in Ghana. 22.7% dropout rate (3rd & 4th) of RTS,S in Central Tongu. EPI schedule ends at 18 months, the introduction of RTSS/ASO1 Malaria vaccine extended the completion of EPI schedule to 24 months however, maternal recall and compliance with age-appropriate vaccine schedule are central for maximum protection this study assess maternal recall and compliance to age-appropriate for Expanded Program on Immunization & RTS,S/AS01 Malaria vaccine schedules among caregivers with children aged 24-40 months in Central Tongu District

Method: A matched case-control comprising 116 cases & 116 controls among children aged 24 to 40 months. Quantitative–structured questionnaires: observation of BCG scar, review of CWC & visual aid to guide maternal recall. Data analyzed with Stata version 16.0. Mantel-Haenzel odds ratio used for strength of the association. Statistical significance at p-value <0.05: a 95% CI. Likert scale used to assess recall, obstacles, & knowledge of caregivers.

Result: Overall, there was a significant association between overall knowledge of immunization schedules and compliance with immunization (χ^2= 10.23, p<0.001).

Conclusion: having information, good recall & good knowledge about immunization through active social & behavior change communication strategies can increase compliance to age-appropriate for EPI & RTS,S/AS01 schedule that is needed to prevent future outbreaks of diseases, provide optimum protection & herd immunity against vaccine-preventable diseases.

Recommendation: Policymakers should help innovate and utilize modern technology to improve knowledge and information on immunization compliance and its benefits. Health promotion on vaccines should not be ad hoc but a proactive process

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Dr. Baker is an Associate Professor of Occupational and Environmental Health, and Epidemiology at the University of Iowa, with training in global health epidemiology and microbiology. Her research focused on understanding how different environmental and behavioral development strategies - like water and sanitation access, animal housing, and hand and surface hygiene - affects the ecology of enteric and antimicrobial resistant pathogen transmission between humans, domestic animals, and the environment. To support this work, she collaborates with biotech, academic, and governmental institutions to develop and validate methods that improve the detection of enteric pathogens in fecal and environmental materials, like rapid low-cost diagnostics and multi-pathogen molecular arrays. She also develops exposure assessment methods that can identify spatial and behavioral interactions between humans, animals, and environment that lead to pathogen transmission. She has been working with partners in Kenya for over a decade to build laboratory capacity and provide bidirectional professional opportunities for US and Kenyan faculty, staff and students. Her future goals involve partnering with more governments and communities to collect longitudinal evidence that can be used to rigorously evaluate the effectiveness and climate resiliency of developmental projects on the prevention and control of infectious diseases like diarrhea.

Poster 14

Use of Low-Cost Geotracking Methods for Characterizing Human-Animal-Environment Interactions that Contribute to Infectious Disease Outbreaks

Two-thirds of infectious disease in humans is thought to be zoonotic in origin, suggesting transmission of pathogenic agents between animals or by humans back to animals is also common. Many enteric viruses, bacteria, and parasites that contribute to the approximately two billion cases of diarrhea that occur globally in children under five years of age are zoonotic organisms. These pathogens can be transmitted by direct interaction between humans and animals and indirect contact by humans and animals with environments contaminated by human or animal fecal waste. While cross-species transmissibility of many enteric pathogens and other emerging infectious organisms is understood, knowledge on the subtle day-today interactions between young children, animal vectors, and environment reservoirs of pathogens remains poorly characterized. This interactive poster session will describe the development and validation of a low-cost geotracking method for characterizing those daily spatial-temporal interactions between young children, animals, and environments that could lead to cross-species transmission of infectious agents, like enteric pathogens. This protocol is now in use in a large NIH-funded cohort study called PATHOME in Kenya. Protocol development involved a community-based evaluation of the ethics and feasibility of placing small commercially-available geotracking devices on infants and animals and assessing the technical inter- and intra-device reliability. Data on spatial movement and interaction between participating children and their domestic animals were cross-validated with structured behavioral observations. During this presentation, conference attendees will digitally interact with de-identified 24 hour time-lapse videos of interactions between children, animals, and different neighborhood environments in Nairobi, and physically test a geotracker tool themselves to inspire ideas for applying these methods to address their own One Health research questions.

Bryan Bryson

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Bryan Bryson completed his BS in Mechanical Engineering and PhD in Biological Engineering at Massachussets Institute of Technology. He completed postdoctoral training at the Harvard TH Chan School of Public Health. He started his group at MIT in 2018 where his group uses a mix of experimental and computational approaches to understand aspects of phagosome biochemistry, macrophage polarization, and antigen presentation.

Poster 15

Learning the Rules of Mtb-Derived Antigen Presentation on MHC-I and MHC-II

T cell recognition of Mycobacterium tuberculosis (Mtb)-specific peptides presented on major histocompatibility complex class I and II (MHC-I/II) contributes to immunity to tuberculosis (TB), but the principles that govern presentation of Mtb antigens on MHC are incompletely understood. We utilized mass spectrometry (MS) analysis to elucidate the MHC repertoire of Mtb-infected primary human phagocytes revealing that substrates of Mtb's type VII secretion systems (T7SS) are overrepresented among Mtb-derived peptides presented on MHC-I. Quantitative, targeted MS shows that ESX-1 activity contributes to presentation of Mtb antigens on MHC-I, consistent with a model in which Mtb T7SS substrates access a cytosolic antigen processing pathway via ESX-1-mediated phagosome permeabilization. We next optimized a biochemical pipeline for the identification of antigens presented on MHC-II revealing a set of conserved antigens presented on MHC-I and MHC-II suggesting high priority novel vaccine candidates. Our study identifies Mtb antigens presented on MHC that could serve as targets for TB vaccines, and reveals potential explanations for the limited efficacy of BCG in human populations.

Participant

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Lloyd Bwanali received a Ph.D degree in Chemistry from West Virginia University. His research work is focused on biomolecule analysis relevant to biotherapeutics. He has experience characterizing glycosylation, establishing the impact of glycan post-translational modification on antibody efficacy. He has worked on analytical chemistry separations relevant to AAV, DNA, RNA, mRNA and protein.

Poster 17

Methods for Separating and Detecting Double Stranded RNA in Messenger RNA

Single-stranded RNA (ssRNA) is a key component on many RNA therapies such as messenger RNA (mRNA) vaccines. However, double stranded RNA (dsRNA) is a byproduct of manufacturing of ssRNA therapies, and it is a major trigger of unwanted immune response. It is therefore of interest to develop new assays for detecting dsRNA contaminants in ssRNA therapies to ensure their safety and efficacy. A microfluidic electrophoresis method is presented that is able to identify and quantify dsRNA contaminants in ssRNA.

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Dr. Conda Sheridan is a 1st generation Latino scientist with training in organic medicinal chemistry (University of Utah and Purdue University) and nanotechnology (Northwestern University). His research group works at the interface of material sciences and medicinal chemistry with the goal of developing new treatments against infectious diseases.

Currently, his research group is developing therapies against sexually transmitted bacteria such as Chlamydia Trachomatis (a pathogen that is very relevant to Africa because it can lead to trachoma), and in the creation of new drug delivery systems based in self-assembling peptides to treat bacterial infections. Dr. Conda Sheridan has a vested interest in helping minorities and people from 3rd world countries to grow intellectually, scientifically, and educationally. He knows first hand the difference that good mentors and a strong network can do in the scientific career of people from disadvantaged backgrounds. Over the last 8 years, he has been engaged in several activities with researchers from South America and Africa. He has written grants with them (they have just received a NAS-Egypt grant and Dr. Conda Sheridan was part of a NIH-U54 grant with Nigeria, PIs: Happi and Obaro) and presented seminars and lectures as a visiting faculty at various universities in both continents. For example, he has taught Medicinal chemistry clases (on line) at the University of Itajuba (Brasil) and Redeemer's University (Nigeria); and biomaterials classes at the University of Buenos Aires (Argentina) and Reddemer's University (Nigeria).

Poster 18

Development and Evaluation of Therapeutic Nanostructures

Drug resistant bacterial infections are a serious health concern across the globe. New technologies and interventions are needed to deal with this problem. Peptide amphiphiles are self-assembling materials that can form diverse nanostructures in water. In this poster, I will discuss the use of peptide amphiphiles as nano-antibacterials and their activity against various bacteria. I will also discuss their morphology, cell toxicity, and metabolic stability. The relationship between supramolecular morphology, charge, size, and lipophilicity and potency will be introduced. Next, I will discuss their mechanism of action and their ability to damage bacterial membranes. I will also assess the ability of the nanostructures to work as drug nanocarrier and their ability to synergize with small molecule antibacterials. The rate of drug release and their encapsulation efficiency will be presented. Finally, I will present the ability of the nanostructures to cover different surfaces using electrochemistry. I will show results relate to biological action, diffusion, physical stability, and morphology when attached to surfaces. the toxicity against human cells will also be presented.

Tolessa Muleta Daba

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Dr. Tolessa, is an MSc., PhD, and Lecturer of Biochemistry and Molecular Biology, currently chair department of Medical Biochemistry, Molecular Biology and Genetics at the School of Medicine and Pharmacy, College of Medicine and Health Sciences-University of Rwanda. He obtained his bachelor in biology from Jimma University, Ethiopia in 2007, his MSc. in Microbiology from Hawassa University, Ethiopia in 2012 and his PhD in Biochemistry and Molecular Biology in 2020 from Harbin Medical University, China. Throughout his career he has been immensely involved in academics, research, capacity building, and administration in different positions in Universities. He has served as director of academic programs at Bule Hora University, Ethiopia, director of reform and good governance at Adama Science and Technology University, Ethiopia he is serving as acting chair of the department of Medical Biochemistry, Molecular Biology and Genetics at University of Rwanda. Dr. Tolessa research interest focuses on the following research areas:

- Gene expression and gene therapy
- Vaccinology and Vaccine development research
- Molecular mechanisms of infectious and non-infectious diseases (inflammation, apoptosis, necrosis, necroptosis)
- Cancer diseases and its underlying mechanism
- Disease model (animal, cell) and experimental medicine
- Molecular toxicology (Hepatotoxicity, Cardiotoxicity, nephrotoxicity and other).
- Phytomedicine and other bioactive metabolites
- Molecular pathways

Poster 19

Vaccinology Capacity Education and Efforts in Vaccine Development in Africa

Africa as a continent has the second largest population on the globe, with about 1.3 billion people and currently facing the challenges of inadequate pharmaceutical manufacturing services. The continuous surge of emerging infectious diseases with regional catastrophic consequences has put untold pressure on the quality of healthcare, especially in Africa where the public health infrastructure is in a moribund state. The understanding of vaccines among the African population varies widely across the continent. In some countries, there is a high level of mistrust and misinformation surrounding vaccines, while in others, there is a robust understanding and acceptance of their benefits. This is primarily due to the legacy of medical exploitation and misinformation campaigns, which has caused distrust in medical institutions and healthcare providers in some African communities. However, efforts are underway to address these challenges and improve vaccine literacy across the continent from national governments, private and international partners. This review was aimed at assessing the current situation of education in vaccinology and in vaccinology-related sciences in Africa, as well as proffering solutions to ways in which vaccines and vaccine education could reach every deserving member of the African population. The new commitments of African countries to increase investment in vaccine manufacturing, curriculum development in vaccinology-related courses and other strategies aimed at making the population healthier and safer made the future of African brighter in this context. Information used in this review were obtained by searching related literatures of the relevant articles published using different search engines.

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Dr Olusegun A. Dada is a Senior Lecturer at the Department of Marine Science and Technology, School of Earth and Mineral Sciences, The Federal University of Technology, Akure (FUTA), Nigeria. For more than 10 years, Dr Dada has been teaching and researching. He has researched both in Nigeria and globally on diverse topics related to coastal oceanography and the development of remote sensing for coastal applications. He has authored and co-authored more than 25 peer-reviewed publications in Q1/Q2 journals. He is equally a reviewer of 16 earth sciences-related journals in Elsevier and Springers. His impact as a researcher has been recognized nationally and globally by the geoscience research community. He is a recipient of many scholarships and fellowship awards. Dr Dada earned both his PhD and Doctor of Science in Marine Geology from the Ocean University of China, Qingdao, China in 2016. He also received an M.Sc. in Exploration and Mining Geology from the University of Jos, Nigeria and a B. Tech in Applied Geology from FUTA, Nigeria.

Poster 20

Possibilities of Satellite Earth Observations in West Africa's Changing Coastal Zones

The West African coastal population and ecosystems are becoming increasingly vulnerable to a variety of coastal hazards, especially in the face of changing global climate and growing human activity. The capacity to understand coastal changes has been hampered by a lack of understanding of the mechanisms involved and the difficulties in gathering precise data. Recent improvements in satellite technology have enabled the collection of large coastal data sets, which can provide a solid platform for enhancing climate change adaptation strategies for humanity and strengthening ecosystem resilience for sustainable development. This presentation examines the West African coastal structure and current socioeconomic issues, as well as critical parameters that may be monitored and many coastal management initiatives that rely on satellite technology to monitor indicators at the regional level. It identifies difficulties that prevent coastal practitioners and decision-makers from exploiting satellite data; and outlines a plan for accurately responding to these challenges, as well as how a better satellite earth observation approach might benefit future coastal zone management in West Africa.

Felix Amankwah Diawuo

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Dr. Amankwah Diawuo is a faculty member at the Department of Renewable Energy Engineering, University of Energy and Natural Resources (UENR), Ghana. At UENR, he is also a research lead at the Regional Centre of Energy and Environmental Sustainability (RCEES). Previously, he was a Research Affiliate at the Lawrence Berkeley National Laboratory (LBNL), United States . His research interests include clean fuel and energy technologies, supply and demand side management strategies, energy policy, electrical power systems and sustainable cities. He has published several articles in these areas in different reputable international journals. He is a certified energy auditor and also a digital education expert with great experience in developing curricula. He has participated in a range of energy projects sponsored by the European Commission, the World Bank, the United States Agency for International Development (USAID), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), etc. Dr. Amankwah Diawuo holds a Ph.D. in Sustainable Energy Systems under the MIT Portugal PhD program from the Technical University of Lisbon (IST), double degree from the Erasmus Mundus European Master program in Environomical Pathways for Sustainable Energy Systems (SELECT) from IST-Portugal and KTH-Sweden. His bachelor education in Electrical and Electronic Engineering was received at the Kwame Nkrumah University of Science and Technology (KNUST), Ghana. He has additionally completed the EIT KIC InnoEnergy PhD school programme.

Poster 21

Climate Smart Agriculture for Rural Communities through the Upscale of Solar Powered Irrigation Systems

Agriculture has been identified as a climate-sensitive activity, however most of the population in the rural communities depend on it for their livelihood, making them vulnerable to the effects of climate change. In an era where there is water scarcity and increasing energy demands, the integration of smart technologies and practices into agriculture has become an undeniable imperative. Considering the seasonal farming in Africa, one of the threats to food production is water scarcity. Coupled with this is the unsustainability of irrigation systems, where fossil-based fuel are frequently used in the face of climate change. In this light, this study looks at how to facilitate year-round farming using clean energy technology which has the capacity to mitigate the effects of climate change. Solar powered irrigation system is one of the technologies which has the potential to support rural farming, however, it is entangled with many adoption barriers such as limited policy support, market-related issues and most especially the cost of technology. The upscale of this technology requires a responsive and sustainable financial scheme. This study investigates and develops financial models tailored to meet the needs of local farmers. This study will facilitate and provide input to the development of government-led climate friendly investment plans while assisting private investment agencies on how to effectively support agricultural activities especially in the local communities.

Bellicia Disashi Kamwanya

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Dr. Disashi Kamwanya is a research biologist working at the Institut National de Recherche Biomedicale (INRB), Kinshasa, in the Democratic Republic of the Congo (DRC). Since 2019, she has worked in a genetic and parasitology research laboratory, where she obtained research experience studying various parasitic diseases such as, but not limited to, malaria, Trypanosomiasis, toxoplasmosis, and viral diseases like Rubella and Ebola virus disease. Besides, she has also worked on the diagnosis of genetic diseases. However, since the DRC is home to various parasitic diseases, she focuses her efforts on studying malaria. Her interests lie in the development and manufacturing of vaccines with multiple antigens targeting the different stages of the infection. Adding to that, she also has a strong interest in biotechnology techniques, particularly using Saccharomyces cerevisiae yeast as a model system to produce recombinant proteins such as RTS,S which is used as a malaria vaccine.

Poster 22

Characterisation of Mono-Stress Responsive Genes and Protein Over-Expression in Saccharomyces Cerevisiae

Saccharomyces cerevisiae Yeast is a powerful tool utilized in the biopharmaceutical industry to produce heterologous proteins used in the manufacturing of many therapeutic drugs like insulin and vaccines like the RTS,S malaria vaccine. The production of foreign proteins in yeast is likely to induce a stress response in the yeast cell, which may sometimes result in failure to produce recombinant proteins. Being able to identify the type of stress caused by protein overexpression may enable the optimization of protein production. To this end, we identified two mono-stress-responsive promoter genes, SSA4 and MEP2, that were cloned in a plasmid construct to control the expression of two fluorescent reporter genes for stress response detection. By monitoring fluorescent protein production, the stress responsiveness of the novel reporter constructs was characterized, revealing the SSA4 and MEP2 promoters were responsive to common stresses, however with different intensities. Co-transforming the stress reporters with a yeast multi-copy library revealed that some library clones caused stress induction in yeast. However, the data obtained did not reveal the mono-stress responsiveness of SSA4 and MEP2 promoters.

Blessing Effiong

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Dr. Blessing Obinaju Effiong is a Toxicologist and holds a Ph.D. in Biological Sciences from Lancaster University, Lancaster, United Kingdom. She is a 2011 Fellow of The Schlumberger Faculty for the Future Program, 2013 UKEMS Young Scientist Poster Awardee and a research scientist with interests in the application of Infrared and other Spectroscopy techniques for Clinical diagnostics, particularly for infectious diseases such as Malaria, HIV, Tuberculosis etc. Dr. Effiong has authored and coauthored publications in highly reputable peer-reviewed journals. She is currently a Senior Lecturer, and the Acting Head of the Department of Medical Biochemistry in the Faculty of Basic Medical Sciences, University of Uyo. As an academic, Dr. Effiong is responsible for teaching both Undergraduate and Postgraduate students in her field. She has done this passionately for a little over ten (10) years so far.

With a certificate in Professional Life Coaching and over the last 7 years, Dr. Effiong has actively championed the encouragement of girls and women into Science, Technology, Engineering and Mathematics (STEM), through the activities of The Network of Nigerian Women in Science (NWiSTEM). Her personal crusade to help women and girls live impactful lives personally and professionally, is carried out by her many Personal development messages geared towards helping individuals achieve Self Awareness and Emotional Intelligence.

Poster 23

ATR-FTIR: A Potential First Point Screening Tool in Disease Outbreaks

Timely and accurate diagnosis of infected individuals is key to controlling the spread of infectious diseases as infectious diseases continue to remain a severe global public health concern. These diseases are thought to be largely driven by Socio-economic, environmental and ecological factors which impact hugely on

global economies as well as public health. In developing nations, malaria and other diseases such as HIV-1/AIDS, Hepatitis B (HBV) and Tuberculosis (TB), exert a huge health burden and have called for rapid, simple, inexpensive and robust diagnostics to facilitate on-site diagnosis and treatment monitoring (1). In the

recent widespread of COVID-19 around the world, the need for rapid, robust and inexpensive testing to help identify, isolate and contain these diseases, have grown even more expedient. Sensor technology has provided the possibility of achieving point of care system for diseases such as Malaria (2) and Cancers (3).

Sensor technology boasts of methods that can achieve rapid, real-time and label-free detection of various pathogenic and disease biomarkers (1). Using COVID-19 as a reference, we explore the potential of Attenuated Total Reflection Infrared Spectroscopy to rapidly and effectively screen samples in the event of an or suspected outbreak of an infectious disease within developing nations.

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Dr. Shymaa Enany is a professor of Microbiology, Suez Canal University, Egypt and currently in the Armed Force College of Medicine, Cairo, Egypt. She received her PhD from School of Medical Sciences, Niigata University, Japan. Her postdoc was in the USA and Japan. She was one of the first Arab scientists who applied bacterial proteomic techniques helping in revealing good markers for microbes spreading in the community.

She received many awards for her scientific contributions. She won the International Science Council (ISC) Award for Early Career Scientist in Africa, 2021. She was awarded the most prestigious award in Egypt; the state encouragement prize for women in the field of health and pharmaceutical sciences, 2019. Also, she was awarded The World Academy of Sciences (TWAS) Young Arab Scientist Prize 2018 for Scientific Achievement in Medical Sciences. She was appointed the Arab Region Executive Board Regional Member of Organization for Women in Science for Developing World (OWSD).

She is part of the Microbiology National Committee working for achieving sustainable development goals for a better future. She is a selected member in COVID-19 Diagnostics group in Africa and the co-chair of the COVID-19 Clinical Research Coalition platform (Immunology, Virology and Diagnostics Working Group) in low- and middle-income countries. Latterly, she is selected as an African science leadership program fellow.

Poster 28

Emergence of Colistin mcr-10 and Fosfomycin fosA5 Resistance Genes in Klebsiella Pneumoniae

Antimicrobial resistance is a major concern in the dairy industry. This study investigated the prevalence, antimicrobial resistance phenotypes, and genome sequencing of Gram negative bacteria isolated from clinical (n = 350) and subclinical (n = 95) bovine mastitis, and raw unpasteurized milk (n = 125). Klebsiella pneumoniae, Aeromonas hydrophila, Enterobacter cloacae (100% each), Escherichia coli (87.78%), and Proteus mirabilis (69.7%) were the most prevalent multidrug-resistant (MDR) species. Extensive drugresistance (XDR) phenotype was found in P. mirabilis (30.30%) and E. coli (3.33%) isolates. Ten isolates (four E. coli , three Klebsiella species and three P. mirabilis) that displayed the highest multiple antibiotic resistance (MAR) indices (0.54–0.83), were exposed to whole-genome sequencing (WGS). Two multilocus sequence types (MLST): ST2165 and ST7624 were identified among the sequenced E. coli isolates. Three E. coli isolates (two from clinical mastitis and one from raw milk) belonging to ST2165 showed similar profile of plasmid replicon types: IncFIA, IncFIB, IncFII, and IncQ1 with an exception to an isolate that contained IncR, whereas E. coli ST7624 showed a different plasmid profile including IncHI2, IncHI2A, IncI1a , and IncFII replicon types. ResFinder findings revealed the presence of plasmid-mediated colistin mcr -10 and Fosfomycin fosA 5 resistance genes in a K. pneumoniae (K1) isolate from bovine milk. Sequence analysis of the reconstructed mcr-10 plasmid from WGS of K1 isolate, showed that mcr-10 gene was bracketed by xer C and insertion sequence IS26 on an IncFIB plasmid. This study reports the first emergence of K. pneumoniae co-harboring mcr -10 and fosA5 genes from bovine milk in the Middle East, which constitutes a public health threat and heralds the penetration of the last-resort antibiotics. Hence, pruden use of antibiotics in both humans and animals and antimicrobial surveillance plans are urgently required.

Rose Faghih

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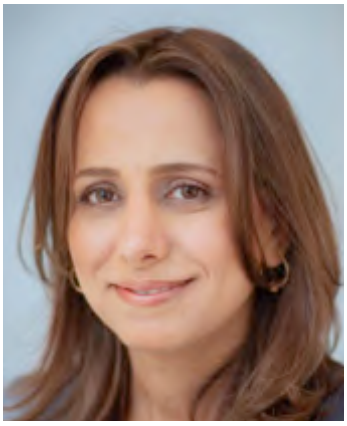

Dr. Rose T. Faghih is an associate professor of Biomedical Engineering at the New York University (NYU) where she directs the Computational Medicine Laboratory. She received a bachelor's degree (summa cum laude) in Electrical Engineering (Honors Program Citation) from the University of Maryland (UMD), and S.M. and Ph.D. degrees in Electrical Engineering and Computer Science with a minor in Mathematics from MIT. She completed her postdoctoral training at the Department of Brain and Cognitive Sciences and the Picower Institute for Learning and Memory at MIT as well as the Department of Anesthesia, Critical Care and Pain Medicine at the Massachusetts General Hospital. Rose is the recipient of various awards including a 2022 UMD School of Engineering Early Career Distinguished Alumni Society Award, an MIT Technology Review 2020 Innovator Under 35 award, a 2020 National Science Foundation CAREER Award, a 2020 Research Excellence award as well as a 2020 Teaching Excellence Award from the University of Houston's College of Engineering, a 2016 IEEE-USA New Face of Engineering award, and a National Science Foundation Graduate Research Fellowship, an MIT Graduate Fellowship. In 2020, Rose was featured by the IEEE Women in Engineering Magazine as a "Woman to Watch". Her research interests include data science algorithm design for wearable and portable sensing technologies, computational medicine for closed-loop therapy, and smartwatch-brain interfaces for human-technology interactions.

Poster 50

Algorithms for Characterizing Mental and Physical Health using Dynamic Biosensing Data

As new physiological sensing technologies become available for continuous monitoring of physiological signals, the dynamic response to external influences such as environmental inputs, medication, and surgery can be quantified. This research focuses on developing mathematical algorithms for understanding and tracking the physiological processes and health states related to (1) mental health, and physical health: (I) metabolism, and (II) inflammation. (1) Mental Health Focus: We design algorithms for a closed-loop neural wearable architecture called MINDWATCH for mental and cognitive well-being. We first infer arousal-related autonomic nervous system (ANS) activations. Employing a Bayesian state-space framework, we model and decode cognitive arousal and performance brain states: the inferred ANS activations and behavioral data can be used as arousal and performance observations, respectively. We use neurofeedback to close the loop and modulate cognitive arousal and performance. (2) Physical Health Focus: (I) Metabolism: We investigate the effect of bromocriptine on metabolism and leptin secretory dynamics in obesity. By analyzing leptin hormone data taken over a 24-hour time period from eighteen healthy premenopausal obese women before and after treatment with bromocriptine, we find that there is an overall decrease in leptin secretion, particularly during sleep. (II) Inflammation: We investigate clinical data from ten patients undergoing coronary arterial bypass graft surgery to study the response of four cytokines [interleukins (IL) - IL6, IL8, IL10, and tumor necrosis factor (TNF)-α] and the neuroendocrine hormone cortisol. We perform deconvolution to obtain the secretory pulses underlying their pulsatile production and analyze causal interactions, mathematically uncovering some interactive relationships. The ultimate goal is to design tool sets that can provide clinically relevant information using biosensors to prevent, diagnose, and manage health conditions.

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Ahmed Farouk is currently an assistant professor at the Faculty of Computers and Artificial Intelligence, South Valley University, Egypt. Before, he was a postdoctoral fellow at Wilfrid Laurier University. He joined the QML stream at Creative Destruction Lab at the University of Toronto and was selected as one of the top 20 technical co-founders, leading to a $40K investment. He is one of the academic team Collaborative Research and Development Grant for Quantum-Resistance and Efficiency of Communications in Connected and Autonomous Vehicles NSERC with fund > 1 M CAD. Ahmed is an early career scientist demonstrating excellence in research by publishing more than 100 research papers with a high impact (+3800 citations and 33 H-index). Most are published in top venues such as IEEE WCM, IEEE TAI, IEEE IOTJ, IEEE TITS, IEEE TII, and IEEE TNSE. He is becoming nationally and internationally recognized as a leading researcher. This is clear from receiving the State Encouragement Award in Advanced Technological Sciences and a European Commission Horizon Europe seal of excellence. Furthermore, he was selected as one of 17 African researchers to attend the 70th Lindau Meeting of Nobel Laureates. His work as a volunteer is apparent as he serves on the Editorial Board of various reputed journals, organize various workshops, and is a track chair for various IEEE conferences. His research interests are Cybersecurity, Quantum Communication, Cryptography, Quantum Machine Learning and 6G.

Poster 25

Quantum Computing Based Channel and Signal Modeling for 6G Wireless System

Sixth-generation wireless technology (6G) introduces a paradigm shift and fundamental transformation of digital wireless connectivity by converging pillars of softwarization, virtualization, and wireless networks. Terahertz (THz) communication technologies are predicted to become more significant in 6G applications as the requirement for bandwidth grows and wireless cell sizes shrink. As a result, 6G will be able to deal with and manage numerous devices and services requiring enhanced spectral throughput and efficiently work with high interference levels. This convergence highlights the increased threat surface of 6G networks and the potentially severe impacts of sophisticated cyber incidents. Furthermore, the heterogeneity of connected devices and provided services will generate a huge amount of data to be processed and managed efficiently. Quantum computing (QC) can efficiently solve several 6G computationally hard problems with a quadratic speedup and provide adaptive techniques for controlling the current and future significant security threats of the 6G network. This poster will discuss the role of various QC components on 6G and explore the opportunities and challenges to achieving such transformation.

Fernando Garcia Menendez

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Fernando Garcia Menendez is an Associate Professor in the Department of Civil, Construction, and Environmental Engineering at North Carolina State University. He received his Ph.D. in Environmental Engineering from the Georgia Institute of Technology. He completed his M.S. in Civil and Environmental Engineering from Stanford University and B.S. in Chemical Engineering from Tecnologico de Monterrey (ITESM). Prior to joining NC State, he was a Postdoctoral Associate at the Center for Global Change Science at the Massachusetts Institute of Technology. Additionally, he has spent time working in industry and environmental advocacy. Dr. Garcia Menendez uses computer models to explore interdisciplinary questions related to air pollution, climate change, public health, 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. A major goal of his current research is to investigate the connections between wildland fires and their human driver and impacts. Specifically, Dr. Garcia Menendez is leading efforts to study the links between fire, air pollution, ecosystem sustainability, public health, and land management in the United States and other global regions.

Poster 26

Integrated Assessment of the Environmental and Human Health Impacts of Wildland Fires

Wildfire is a natural phenomenon common to many environments. It is critical in fire-adapted ecosystems, where species depend on its occurrence. However, wildfires have major impacts on health, infrastructure, and other human values. Additionally, climate change is increasing the wildfire severity, while development rapidly expands into the urban-wildland interface and places communities near fire-prone land. One of the most important ways through which fires affect public health is air pollution. Smoke from wildland fires causes hundreds of thousands of premature deaths annually and is linked to negative health outcomes, including respiratory and cardiovascular effects. Human intervention, such as fire suppression, fire manipulation, or deforestation, can modify natural fire patterns, but are often expensive, dangerous, or unsustainable. To address these challenges, wildland fires and societies must be treated as coupled human-natural systems.

A key goal of the research group I lead is to develop computational frameworks that guide land management by capturing the risks, benefits, and costs associated with fire decisions. Our research provides tools that align ecological and public health goals as sustainable fire regimes are sought. Here, we highlight research in two distinct regions: the U.S. Southeast and Amazonia. We show the important role of fires on Southeastern U.S. air quality, and how integrated modeling can be used to explore management scenarios that jointly consider wildfire risk, ecosystem needs, human health, and economic impacts. Our research in South America assesses the impacts of deforestation on regional pollution and health, and their connections to climate change policy. I am greatly interested in expanding our work into Sub-Saharan Africa, the global region with the largest health burden associated with fire emissions. Africa offers exceptional opportunities to grow our research on coupled human-natural systems and pursue new collaborations.

Maaz Gardezi

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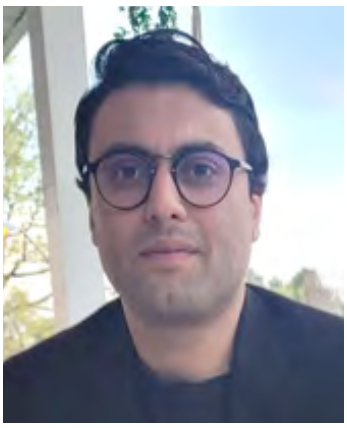

Dr. Maaz Gardezi, an assistant professor in the Department of Sociology at Virginia Tech, is dedicated to exploring the intersection of climate change and the social and political implications of emerging digital technologies in food and agriculture systems. His interdisciplinary research and teaching focus on building sustainable and socially just regional, national, and international food and agricultural systems. Dr. Gardezi emphasizes the role of social science in promoting innovation and democracy, from design to governance. He is the Principal Investigator of projects funded by the National Science Foundation (NSF) Future of Work at the Human Technology Frontier Program (Award 2202706 US$3.5M) and the USDA NIFA Social Implications of Emerging Technologies (NIFA Award 2023-67023-40216, US$649,355). Dr. Gardezi's participatory research and design methods involve farmers and farm workers as co-designers and co-evaluators of Artificial Intelligence solutions, along with nonprofit organizations and industry experts to balance innovation with demands of social justice. Additionally, his research journey has taken him to the Global South where he has pursued multiple research projects focused on climate adaptation and vulnerability in South Asia, examining power structures, outlining policy-relevant paths to empower marginalized communities, and innovating methods and theories relating to sustainability and climate.

Poster 24

Toward Design Justice in Climate Smart Agriculture

Rapid political and economic responses to global climate change have largely been defined by technological innovation and proliferation. In the US, precision agriculture (PA) technologies are promising to help farmers increase farm productivity and reduce the use of harmful and expensive farm inputs. In South Asia and Africa, climate smart agriculture is being hailed as a panacea to reduce farmers' excessive reliance on fossil fuels for groundwater irrigation and to increase their farm income. New technologies are important instruments of sustainability governance, yet can perpetuate inequalities across axes of social differences. For instance, PA tools are being predominantly developed using machine learning algorithms that "learn" using data derived from larger farms and commodity crops (e.g. corn, soybean, and wheat). Thus, the potential bias in data collection is likely to exacerbate inequality over time by PA tools generating recommendations that only suit larger farm operations that can afford expensive equipment. In South Asia and Africa, solar irrigation technologies are expensive for smallholders to purchase, use, and maintain. Innovators design them for a specific type of farmer in the global South; those that own large acreage, are wealthy, and have the administrative capacity to seek government subsidies. From a sociomaterial perspective, technologies embody and replicate the values and decisions of those who shape them, such as powerful social actors in the innovation governance space, including technology designers, regulators, university researchers, and more affluent farmers. Their choices are performative, so that they influence how some nature-society relations are represented in technology and public policies and others are marginalized and excluded. The poster presents findings from our National Science Foundation funded projects to showcase technological governance that can keep justice at the front and center of tech design and implementation.

Geoffrey Geise

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Geoffrey M. Geise is an associate professor at the University of Virginia (UVA) in the Departments of Chemical Engineering and Materials Science and Engineering. He earned a Ph.D. in chemical engineering from the University of Texas at Austin where he 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 postdoctoral scholar at the Pennsylvania State University to study electric potential-driven ion transport in polymers. At UVA, 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 the need for clean energy. He has received several professional and academic awards and honors including the NSF CAREER Award, 2020 Class of Influential Researchers (ACS: Ind. Eng. Chem. Res.), Best ES&T Letters Paper for 2019, 2018 and 2021 Robert A. Moore, Jr. Award in Chemical Engineering, Ralph E. Powe Junior Faculty award, the Young Membrane Scientist Award from the North American Membrane Society, the New Professor Travel Award from Engineering Conferences International, and a UVA Excellence in Diversity Fellowship. His publications (including 56 journal articles) have been cited over 4,425 times, and his h-index is 30.

Poster 1

Advanced Materials for Green Energy and Sustainable Electrification

Energy storage will play a central role in making clean and renewable sources of electricity widely available to realize the benefits of electrification as a key tool in the fight against global climate change. Additionally, energy storage will play a key role in climate adaptation as extreme weather events and other factors apply substantial stress to aging electrical grids. Batteries will help enable electrification and climate adaptation by storing and providing energy over ranges of magnitude and time, but new approaches are needed to make batteries more sustainable and effective. Flow battery technology, for example, can store and deliver grid-scale energy, and emerging non-aqueous flow batteries could enable operation at higher voltages and energy densities compared to other battery systems. Critical to the viability of non-aqueous flow batteries will be to engineer a suitable membrane separator to be stable in aggressive solvent environments, to offer high conductivity, and to prevent cross-over of redox active molecules. Such membranes are not widely available today. This presentation reports synthesis and characterization of a new class of charged polymers that have exhibited dimensional stability for several months in a non-aqueous electrolyte, favorable conductivity, and a unique decoupling of ion and redox active molecule transport via a unique thermodynamic mechanism that yields high selectivity. Beyond flow batteries, there is an urgent need to expand access to battery materials via extraction and recycling approaches. Selective capture of critical materials, such as lithium or cobalt, and isolation and purification of battery material precursors are critical components of battery recycling and critical materials availability. This presentation discusses unique recycling and brine extraction approaches developed by our team for capture and purification of battery critical materials using highly selective solid and polymeric membrane materials.

Kandis Leslie Gilliard-AbdulAziz

Assistant Professor

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Dr. Kandis Leslie Gilliard-AbdulAziz directs the Sustainable Lab, which primarily focuses on developing novel materials for sustainable catalytic processes for low-carbon chemical production. Her primary research focus is novel catalyst development for CO2 sequestration and utilization using an interdisciplinary toolset from physical chemistry, material science, chemical, and environmental engineering. Dr. Gilliard-AbdulAziz is also the founder of AgriCarbon, a company that transforms waste into water filters. She is a 2021 Scialog Negative Emissions Science and National Academy Frontiers of Engineering fellow. She was awarded an NSF Career Award in 2022 for developing sorption-enhanced bifunctional catalysts for carbon capture and utilization.

Dr. Gilliard-AbdulAziz is an incoming Gabilan Assistant Professor in the Sonny Astani Civil and Environmental Engineering department at the University of Southern California. Before joining USC, she directed the Sustainable Lab at the University of California, Riverside, between 2018 – 2023. She earned her Ph.D. in Chemistry from the University of Illinois at Urbana-Champaign and was a Provost postdoctoral fellow at the University of Pennsylvania. She worked previously as a Forensic scientist for the Philadelphia police department and as a Refinery chemist at Sunoco Chemicals in Philadelphia.

Poster 27

The Development of Sorption-Enhanced Catalysts to Promote a Circular Carbon Economy

A circular CO2 economy aims to redefine growth, focusing on society-wide benefits and looking beyond the current take-make-waste industrial model. Developing thermally-robust catalysts and sorbents can help create new processes for full CO2 utilization. This presentation will start with insights from previous experience as a refinery chemist on the societal benefits of pursuing a circular economy. Insights from this brief industrial experience will lead to the discussion of the technological aspects for developing sorption-enhanced catalysts, including two examples, Ni/CaO/Zr and Ni/Li2SiO3 catalysts for the ready capture and conversion of CO2. The developed catalysts are used within a cyclical CO2 capture and conversion process to convert CO2 from simulated flue gas into methane (Power-to-gas). Typically, the embedded catalyst and sorbent materials deactivate quickly due to thermal fluxes that promote sintering and carbon deposition. The loss of surface area in both the sorbent and catalyst leads to a decrease in the CO2 capture capacity and productivity. Our recent studies into using Ni/CaO/Zr and Ni/Li2SiO3 have shown improved thermal stability, leading to insights on further catalyst/sorbent development to reach industrial practicality. Finally, future insights are discussed for catalyst and absorbent oxide material developments.

Samson Hagos

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Dr. Hagos earned his PhD in Atmospheric Sciences in 2008 from Cornell University and was a Postdoctoral Research Associate at the University of Miami, Rosenstiel School of Marine and Atmospheric Sciences before joining PNNL in 2009.Dr. Hagos' research interests are focused on understanding and modeling of precipitation processes over a wide range of spatio-temporal scales, from the life-cycles of individual convective cells, to tropical intra-seasonal oscillations, atmospheric rivers and inter-annual to multi-decadal variations of monsoon systems. Dr. Hagos is also interested in in-situ observations of atmospheric processes such as cloud and precipitation radars.

Poster 29

Opportunities for Collaborative Research in Africa Using US. DOE's In-Situ Sensing Technologies

The US Department of Energy's Atmospheric Radiation Program (ARM) provide atmospheric measurements at strategic locations and variable climate regimes. The measurements include aerosols, clouds, precipitation, and radiation and their interactions. They are aimed at improving understanding of atmospheric processes and improve their representation of these processes in models. In this presentation I will discuss the available instrument suits, the process of developing a field campaign proposal and deployment. Then I will brain storm the scientific problems that can be tackled through the deployment of ARM instrument over various regions of Africa, the opportunities for collaboration and capacity building associated with such ARM campaigns.

Caryn Heldt

Professor

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After receiving her PhD in Chemical Engineering from North Carolina State, Dr. Heldt completed a two-year postdoc at Rensselaer Polytechnic Institute. Since 2010, she has been a professor at Michigan Tech. Her research lab has two major thrust areas, vaccine manufacturing and viral biophysics. In vaccine manufacturing, the lab's focus is to create a continuous downstream purification process. Most purification processes are done in batch. Batch has large costs to cleaning and validation between batches, uses large amounts of buffer, and requires large equipment. However, there is not currently a fully continuous downstream process. The lab is developing both the hardware and the chemical conditions to continuously process viral vaccines. Their economic analysis supports the reduction in cost. They are working with Dr. Michael Betenbaugh at Johns Hopkins to support the upstream work and to create an end to end continuous process. In support of their continuous processing work, through Dr. Heldt's NSF CAREER award, the lab has developed a method with an atomic force microscope (AFM) to study the surface chemistry and structural stability of viral particles. This allows them to better understand how the interaction of the different processing conditions can improve the process development. Dr. Heldt has graduated seven PhD students and has 50 peer-reviewed publications, most in the area of viral particle purification and characterization.

Poster 30

Continuous Processing of Viral Vaccine Products to Reduce Capital and Operating Costs

Rapid and cost-effective vaccine production has life-saving potential. However, vaccine access is not equitable across the globe. To increase access, we are developing a continuous manufacturing platform for viral products. Continuous processing simultaneously decreases capital costs to build new manufacturing facilities and the operating costs to run the facility. While continuous processing is increasingly common for protein therapeutics, adoption of continuous processing for viral products is lagging.

Upstream production of viral products can be done with a perfusion bioreactor. We are developing a multi-reactor system to continuously produce and harvest virus like particles (VLPs) from an Sf9 insect cell culture system. For the downstream system, our process involves a single-pass tangential flow filtration (SPTFF) for concentration, two aqueous two-phase extraction (ATPE) units, a flow-through polishing filter, and a final SPTFF. We have focused heavily on the ATPE units which use high PEG and salt concentrations to create two phases for extraction. The first is a purification step and the second is to recover the viral product from the viscous polymer phase. The mixing and settling of these systems have been challenging for our continuous runs. Methods to improve and monitor each unit will demonstrate how we have improved the system and use our batch separations as the standard to know when we have achieved the desired outcomes. We have been able to recover 66% of the infectious titer of a model non-enveloped porcine parvovirus with 91% removal of protein impurities and 94% host cell DNA removal with only the ATPE steps. Economically, we have determined that the downstream purification system will save 50% on production costs and up to 90% on capital costs. This would allow continuous manufacturing to be more distributed and increase equity of vaccination across the globe.

Andrea Hicks

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Dr. Hicks' research focuses on the environmental impacts and sustainability implications of emerging technologies. In particular, she is interested in how people use, misuse, and change their behavior based on the adoption of emerging technologies and how that changes the foretasted environmental impacts of the technologies. She is currently an associate professor in the Department of Civil and Environmental Engineering at the University of Wisconsin-Madison, and the Director for Sustainability Education and Research. She earned her BS in environmental engineering from Michigan Technological University in 2009, her MS in environmental engineering from Clemson University in 2010, and her PhD in civil engineering 2014 from the University of Illinois at Chicago (UIC). After that she completed a postdoc at the Institute for Environmental Science and Policy at UIC in engineered nano-materials with a focus in the role of human behavior on shifting environmental impacts. Since that time she has worked on emerging technologies such as micro-mobility and autonomous vehicles, carbon capture and utilization, closed loop farming systems, and nutrient management among others. She also does research in the area of improving sustainability education through experiential learning. With respect to awards she has received honors such as the NSF CAREER, Laudise Medal, ACS-CEI, SNO Emerging Investigator, and multiple teaching awards. She holds the Hanson Family Fellowship in sustainability and Nosbusch named professorship.

Poster 12

Emerging Transportation Modes and Shifts in Human Behavior

Modes of transportation have evolved throughout history, and as they have evolved they have changed how people move through geography. For example, the invention of the automobile shifted not only the speed by which people could travel, but also where new housing developments were located. Current and forecasted advances include the advent of autonomous vehicles and micro-mobility (such as electric bicycles and scooters, along with sharing platforms). The adoption and use of these emerging forms of transportation will change how people move through the landscape. The results of multiple survey and modeling efforts will be presented that present how these shifts may occur, and the environmental implications of the adoption and use of these modes. The survey and modeling effort around autonomous vehicle ride-sharing suggests the potential for a modal shift from shared public transportation to autonomous vehicles as a function of cost and convenience, at the same time, if these are conventional gasoline vehicles there will be an increase in associated environmental impacts. When members of an e-bike sharing service were surveyed, some members reported switching from conventional automobiles to the e-bikes, while others moved from walking. This suggests that there will be heterogeneity in how these modes will be adopted and utilized. Recently, we deployed a study where participants used an impact calculator for trips which compared the carbon emissions of different potential modes for the trip to an index of the environmental impact of cheeseburgers. Overall, participants liked the grounding of carbon emissions to something tangible and accessible, and some selected different modes as a result of using the calculator. In short, new modes of transportation affect how people move through their spaces, and the environmental impact of how they move. This work investigates changes in human transportation behavior as a function of the adoption and use of new technology.

Etinosa Ogbomoede Igbinosa

Professor

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Etinosa Igbinosa holds a PhD in Microbiology from the University of Fort Hare, South Africa. He was a Postdoctoral Fellow at UNESCO-IHE Institute for Water Education Delft, Netherlands and Universidade Federal de Viçosa, Brazil, and a visiting scientist at the University of Ottawa, Ottawa, Canada. He was a senior Alexander von Humboldt Fellow at the Max-Rubner Institut (MRI) Kiel, Germany, and German Federal Institute for Risk Assessment (BfR), Berlin, Germany. In 2019, He was awarded the Africa Oxford Visiting Fellowship Program (AfOx fellow) at the University of Oxford, United Kingdom, and a visiting scholar at the Stellenbosch Institute for Advanced Study (STIAS), South Africa. He is a grant holder and Principal Investigator (PI) to Alexander von Humboldt Germany and Cambridge-Africa ALBORADA United Kingdom, an expert in pathogen biology and disease transmission. In addition, he served as PI or co-PI for over 16 grants of ~USD 850,000. He has trained and graduated 11 PhD, 38 MSc and >75 BSc (Hons) students. He is a member of several reputable scientific societies and a Fellow of the Africa Science Leadership Programme (FASLP) at the University of Pretoria, South Africa. He is a consultant expert on foodborne antimicrobial resistance (AMR) to the Joint FAO/WHO Committee on food safety. A DAAD Fellow and International Deans' Course (IDC) Alumnus. He is a Fellow of the prestigious African Academy of Sciences.

Poster 31

One Health Approaches to Methicillin and Vancomycin Resistant Staphylococcus: Interconnection Between Human, Animal and Environmental Health

The emergence and spread of methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant Staphylococcus aureus (VRSA) present significant challenges to public health. Taking a One Health perspective is crucial in understanding the interconnectedness of human, animal and environmental factors in the transmission and control of MRSA and VRSA. This study aims to uncover the One Health perspective on MRSA and VRSA, providing insights into the interactions between humans, animals and the environment. We collected 700 non-duplicate swabs samples (200 nasal samples each from pigs and cows; 50 nasal samples each from the pigs and cow's handlers; 100 environmental samples each from the pigs and cow's environment) in Southern Nigeria. The environmental samples consisted of the drinking water and surrounding soils. Isolates were culturally selected using selective S. aureus media supplemented with methicillin or vancomycin antibiotics. MALDI-TOF MS Biotyper carried out the identification of species. Isolates were screened for antimicrobial susceptibility, PCR characterization for resistance genes, virulence genes, staphylococcal cassette chromosome mec (SCCmec) and spa typing. From 700 samples, MRSA 183(26.1%) and VRSA 92(13.1%) were positive. MRSA isolates, cows 73(39.8%), pigs 91(49.7%), animal handlers 17(9.3%), soil 9(4.9%), and water 4(2.2%) were recovered. VRSA isolates, cows 32(34.8%), pigs 44(47.8%), animal handlers 7(7.6%), soil 8(8.7%), and water 1(1.1%). All isolates harboured mecA genes and antimicrobial and virulence genes such as coA, vanA/B, enterotoxin, and haemolysin. All SCCmec IVa and SCCmec V positive isolates harboured the PVL gene and were recovered only from environmental sources. Isolates from SCCmec III were only recovered from human-linked isolates. Some enterotoxigenic MRSA and VRSA spa types are identical to food animals, the environment and handlers, which may suggest a possible transmission and health hazards.

Rishabh Jhol

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Dr. Jhol is a Technical Advisor at Clinton Health Access Initiative, Inc. (CHAI), a global health organization that works to save lives and reduce the burden of disease in low- and middle-income countries. Dr. Jhol has over 14 years of experience in management consulting, fundraising, finance, and policy advocacy, with a focus on social impact and public health.

As a Technical Advisor, Dr. Jhol supports the development and implementation of strategies and interventions to increase the availability and affordability of vaccines in Africa. Dr. Jhol leverages his expertise in financial risk management, public-private partnerships, and market analysis to facilitate the creation of regional vaccine manufacturing hubs on the continent. Prior to CHAI, he worked as an Engagement Lead with IQVIA. where he managed delivery of more than USD 1 million across projects with multilateral institutes and Ministry of Health (MoH) of various African countries for health system strengthening. He also represented IQVIA at WEF Davos 2022, assisting in development of key strategic partnerships with global health stakeholders.

He is also a published author and a fellow of various leadership programs, where he shares his insights and perspectives on global health security, diplomacy, and development.

Poster 32

Building Collective Intelligence about Development of Vaccine Manufacturing in Africa to Ensure Equitable Access for Global Health Security

The inequitable rollout of COVID-19 vaccines drew global attention and investments to the lack of vaccine manufacturing capacity in Africa. However, with ~30 new initiatives aimed at expanding vaccine manufacturing within Africa, there is a risk of unviable investments. A sustainable AVM footprint can strategically align stakeholder initiatives with goals of improved PPR (pandemic preparedness and response), robust global antigen market, and commercial viability of manufacturers.

Currently Africa has 9 manufacturers with a commercial-scale vaccine facility installed, representing ~2Bn doses DP capacity installed, which is already higher than the fit-for-purpose African vaccine manufacturing footprint and the 2030 African demand of 1.5 billion doses. Worryingly though, 80% of this immense DP capacity lacks tech transfers, leading to a risk of under-utilization, and thus hampering manufacturers' long-term commercial sustainability. Conversely, DS manufacturing in Africa is limited when compared to both DP capacity and the fit-for-purpose AVM footprint, and thus fails to achieve PPR requirements in the short-term.

Additionally, structural cost disadvantages for African vaccine manufacturers mean that without policy support from local governments and initiatives such as the Gavi AVMA, their products won't be cost-competitive. Demand commitment by governments for African-made vaccines is pivotal to generating required economies of scale beyond domestic borders and fostering trust in local products.

To address market risks and achieve a sustainable manufacturing footprint, four intervention areas have been identified: 1) appropriate financial incentives to support manufacturers' competitiveness, 2) coordination and capability strengthening of select high-potential manufacturers, 3) demand materialization (incl. demand commitments) for African-made vaccines, and 4) an enabling environment that enhances global competitiveness.

Petrina Johannes

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Dr. Petrina Johannes is a Civil Engineer by profession. She holds a BSC in Civil Engineering from the University of Cape Town, South Africa, and both an MSC and PhD in Civil Engineering from the University of Wisconsin Madison in the USA. She currently works as the Associated Dean for the School of Engineering and the Built Environment at the University of Namibia (UNAM) as well as a Campus Director for Jose Eduardo Dos Santos Campus at UNAM. She has previously served as the Dean of the Faculty of Engineering and IT at UNAM. Overall, Dr. Johannes has over 8 years of academic leadership and management experience, over 9 years of lecturing experience and a combined 20 years of research and publications experience. She has taught at both UNAM as a full-time academic and the University of Cape Town as a part-time academic for over 7 years. She has authored and co-authored over 20 journal and conference publications in various areas, spanning from materials, pavements and water.

Dr. Johannes also has a wealth of cooperate governance experience. She currently sits on the board of directors for the Namibian Road Fund Administration and on the Engineering Council of Namibia where she serves as the Chairperson for the Academic Committee. Prior to that, she served on the Board for the Roads Contractor Company and on the Review Panel for the Ministry of Finance. She also has over 10 years of industry experience and currently undertakes consultancy projects with consultants in Namibia.

Poster 33

Evaluation of the Effects of Climate on the Ravelling Resistance of Slurry Seals Used in Low Volume Roads

Slurry Seals are key tools for pavement maintenance and preservation. They used to preserve the structural integrity, maintain functional characteristics, slow the rate of deterioration and correct pavement surface deficiencies. Over 80% of surfaced roads in Namibia are covered with surface seals with majoring of low Volume Roads covered with a Cape Seal, Slurry Seal.

Beside their prevalent use, current methods for designing, specifying and selecting materials for slurry surfacing systems slurry seals are not related to field performance and or field climate. This research evaluated the effect of climate on the ravelling resistance of common materials used in slurry seals. Emulsions and aggregates form various suppliers we test using the Wet Track Abrasion Test. Samples were tested at various conditions during and after conditioning. The results show that climate has significant impacts on the ravelling resistance of slurry seals. It is recommended that actual field that mixture designs for slurry seals be tested under and evaluated under conditions similar to those in field during the mixture design phase.

Participant

Yvonne Kamegne

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Assistant Professor in the Department of Computer Science and Cyber Security at the University of Central Missouri. Her research interest focuses on human computer interaction, cyber security, cross-cultural design, and human centered design. Much of her research involves usability testing with humans to gather data useful in understanding user requirements. The endeavor of her research is to design usable, accessible, user friendly, secure, and inclusive technologies for all. Excited to apply her knowledge and experience in teaching and research.

Poster 34

Usable Passwords

Graphical passwords are an alternative to alphanumeric passwords to bridge the gap between usability and security and to improve passwords usability. They are said to be usable and appealing because users are better at recalling images better than words. However, there is a gap in research about the user requirements of graphical passwords such as, the user's reasons for selecting a particular image during a graphical password creation or the influence of a participant's culture on his behavior intention towards graphical passwords. Moreover, marginalized cultural groups such as African cultures are often overlooked during design phases, and use technology predominantly designed for western cultural groups. Thus the aim of this research is to design usable authentications and technologie targeted primarily at African users.

Akua Konadu

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Dr. Akua Boakyewaa Konadu is a Senior Lecturer at the University of Ghana Dental School. She is a Fellow of the Ghana College of Physicians and Surgeons and the West African College of Surgeons (Part I). She has undergone post-graduate training in Oral Implantology at the Academy of Medical Science (AMS) in Frankfurt, Germany. Dr. Konadu has a Certificate in Health Administration and Management (HAM) from the Ghana Institute of Management and Public Administration (GIMPA), Accra. She also holds Policy Development and Advocacy certificates in Global Health and Implementation Science from the e-learning Department of Global Health, University of Washington. She is pursuing a Master's Course in MA Bioethics with NYU School of Global Public Health. Her current research interest is in endodontic microbiology and the role of oral health conditions and their associations with developing and managing other non–communicable diseases, looking at the effect of oral health on the quality of life of patients with stroke.

Dr. Konadu is passionate about her work and dedicated to passing on her knowledge and skills. She believes in mentoring and grooming undergraduate and post-graduate students, especially females, to aspire to be researchers in a research-oriented institution like the University of Ghana. She has 16 peer-reviewed publications to her credit.

Poster 16

Microbial Profile of Root Canals of Pulpally Infected Teeth in Ghanaians

Introduction: Pulpal and periapical infections are initiated by microorganisms when they gain access to the dental pulp. The success of root canal treatment principally depends on the eradication of the microorganisms in the root canal system.

Aim: The aim of this study was to evaluate the viable microbial profile of root canals with various stages of infection in Ghanaians.

Material and Methods: Forty-four consecutive patients with sixty teeth referred to the Restorative Dentistry Clinic requiring root canal treatment were recruited. Root canal samples were collected from the teeth with sterile paper points. The samples were processed and subjected to microbial analysis and identification using Matrix-assisted laser desorption/ ionization-time of flight (MALDI-TOF) mass spectrometry (MS).

Results: A total of 259 isolates were recovered from the 60 infected root canals, belonging to twenty different microbial genera. Out of the 259 microbial species isolated, only two were Candida albicans, a fungi; 257 (99.2%) were bacterial isolates belonging to 19 genera. The 19 genera encompassed 53 bacterial species, out of which 26 (49.1%) were identified as facultative anaerobes, 15 (28.3 %.) as obligate anaerobes and 12 (22.6%) were aerobes. Streptococcus species (Streptococcus oralis, Streptococcus mitis, Streptococcus mutans and Streptococcus constellatus) were the most predominant isolates, followed by Prevotella sp, Actinomyces sp, Enterococcus faecalis and Rothia sp respectively.

Conclusion: The findings of this study show that infected root canals are polymicrobial in nature. The determination of the microbial profile aids in understanding the pathogenesis of pulpal and periradicular infections and helps in choosing effective antimicrobial irrigation and medicament for root canal treatment.

Keywords: Endodontics; Primary periapical periodontitis; Microbiota; Bacteria; Streptococcus; Mass Spectrometry, Matrix-assisted laser desorption-ionization.

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Dr. Harish S. Krishnamoorthy (Senior Member, IEEE) received his B. Tech. degree from the EEE Department, National Institute of Technology (NIT) Trichy, India, and his Ph. D. degree from the ECE Department, Texas A&M University, College Station, USA, in 2008 and 2015, respectively. From Jun. 2008 to Jul. 2010, he worked at GE Energy, India, and received the Lean 6-Sigma Green Belt certification. From Apr. 2015 to July 2017, he was with Schlumberger, TX, USA. He also worked at Ford and Google. Since Aug. 2017, Dr. Krishnamoorthy has been a faculty in the ECE department of the University of Houston (UH), where he is currently a rising Associate Professor. He has over 95 conference/journal papers in refereed publications, one granted U.S. patent, and three U.S. patent applications. He has further contributed to a book chapter for the IET. He is an Associate Editor of the IEEE Transactions on Power Electronics (TPEL) and the Standards Liaison for the IEEE PELS TC7. He is also on the organizing committees of IEEE APEC-2023, ECCE-2023, etc. He received the UH College of Engineering's Research Excellence Award in 2022 and Teaching Excellence Award in 2021. He was named an 'OTC Emerging Leader' by the Offshore Technology Conference in 2022, and an Early Career Research Fellow (ECRF) by the Gulf Research Program of the US National Academies. In 2023, Dr. Krishnamoorthy received two prestigious honors: the NSF CAREER Award and the IEEE PELS Young Professional Exceptional Service Award.

Poster 36

Battery + Hydrogen: Hybrid Storage Systems for a Greener Energy Future

With the increased penetration of renewable energy sources (RES) in the grid and their intermittent way of producing output power based on the weather and certain period of the day, Energy Storage Systems (ESSs) seem to be the best solution to manage the power grid's instability and balance the grid's supply-demand requirements. They also help in improving the capacity factor of clean energy sources like wind, solar, etc. The ESSs' idea is to store the excess power of RES when the grid is fully capable of providing the loads' demand, and during scarce times the stored energy can be used later to meet load demands. Different energy storage systems can be put together with each other to take advantage of their characteristics and obtain what can be called a hybrid energy storage system (HESS). ESSs should meet long-term energy requirements and, at the same time, sudden power demands. In addition, the determination of ESS comprises the system performance and parameters cost. An intriguing aspect to add to this is the potential for artificial intelligence (AI) to rectify the incorrect predictions made by the EMS. By considering longer-duration predictions and accounting for seasonal effects, the management of energy over extended periods can be effectively addressed. Taking all these factors into account, this poster will discuss HESS concepts based on hydrogen and battery storage technologies along with novel optimal energy management solutions (EMS) for grids/microgrids with high renewable penetration. The focus will be on efficient power conversion system architectures and optimization of EMS for reducing overall energy costs.

Asia Lachir

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Dr. Lachir graduated in civil engineering in 2010, from l'Ecole Mohammedia des Ingénieurs, which is the most prestigious engineering school in Morocco. There, she developed fundamental knowledge on urban design, construction and building materials. Then, she completed PhD studies under the joint supervision of Dr. Messouli Mohamed, Professor at Cadi Ayyad University in Morocco and Dr. Bounoua Lahouari, Senior scientist at NASA Goddard Space Flight Center (GSFC) in the USA. Her thesis objective was to use multi-scale remote sensing data and the Simple Biosphere Model (SiB2) to assess the impact of urbanization as a form of land cover modification on the surface climate of the city of Marrakech in Morocco. Since then she developed a big interest in research in sustainability and climate change. Her current research activities are closely related to sustainability in architecture and urban design with a focus on energy efficiency, bioclimatic design, urban climate and particularly urban heat island.

Poster 37

Urban Design Impact on Local Climate and its Consequences on Building Energy Demand in Morocco

Urbanization is a major and irreversible land cover transformation. It alters the natural landscapes through the construction of structures and impervious surfaces. The modified land surface morphology and the construction materials considerably affect the reflected and absorbed solar radiation, the direction and velocity of the wind and the water and energy balances at the land–atmosphere interface. Thus, urbanization disrupts the local climate and results in the creation of an urban microclimate, characterized mainly by the Urban Heat Island (UHI). This phenomenon is highly exacerbated by climate change and can significantly affect comfort, human health and energy consumption. In a previous study we showed that in Marrakech, a semiarid city in Morocco, an increase of 1◦C in the maximum mean air temperature can cause an increase in electricity usage use of 4.4% at city level. This is explained by a higher use of air conditioning to provide thermal comfort inside buildings.

Most cities, and particularly in Morocco, are designed without considerations of the resulting changes in microclimatic conditions. And the energy efficiency of buildings is often studied without considering the neighborhood characteristics. In this study, we use an urban climate model combined with a building's energy simulation software to estimate the urban heat island in different urban settings and its impact on energy demand for heating and cooling in a typical Moroccan residential building. The simulations are conducted on the same building scheme but in different neighborhood contexts and different climates. The resulting differences in normalized energy demand explain the local UHI impacts and help determine the most effective urban design strategies for each climate zone in Morocco that will help reduce energy consumption for air conditioning.

Swomitra Mohanty

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Dr. Mohanty is an Associate Professor in Chemical Engineering and joining the University of Utah as a faculty member, he has spent the last several years developing his lab called the Advanced Materials and Microtechnology Laboratory (AM2LAB). The primary focus of his research group is to address world-wide problems primarily (but not exclusively) in low resource settings. The following statistics directly motivate the research that is conducted in his lab:

Tuberculosis, a completely curable disease, infected 10 million people worldwide and killed 1.6 million in 2021, with Africa and Asia being affected disproportionately by the disease.

- 800 million people around the world lack access to clean water
- Pneumonia is one of leading causes of death in children under the age of five years accounting for 14% of all deaths; the total number of child deaths was 740,180 in 2019
- It is hard to fathom that in 2023, these are still significant problems that need to be addressed, especially in low resource settings.

Over the last several years he has been fortunate enough to be trained in a variety of disciplines with excellent mentors. This training included specific skill sets in BioMEMS, sensors/microfluidics/lab-on-a-chip, applied nanotechnology/nanofluidics, and nanomaterials synthesis/renewable energy. This background has allowed him to take various aspects of each discipline and combine them in unique ways to address problems that his research group is very passionate about solving.

Poster 38

Novel Targeted Electrochemical Detection of TB Associated Biomarkers in Breath Using Engineered Electroactive Solutions in Patients from Kampala, Uganda

Tuberculosis (TB) remains a significant global health issue, with early, accurate, and inexpensive point-of-care detection critical aspects of effective treatment. The development of rapid, non-sputum-based tuberculosis (TB) diagnostics and triage tools at the point of care are considered high priority by the World Health Organization. Methyl nicotinate (MN) has been identified as a promising breath biomarker specific for mycobacterium tuberculosis and efforts are underway to create a sensing platform for point-of-care detection. This work presents a novel method of detecting MN from breath using a new electroactive engineered solution (EAS) designed to specifically bind MN. This method is designed to specifically target biomarkers of interest from complex breath samples. The goal of the study is to understand how the sensor responds to the breath of patients with and without TB when scanned over a wide voltage potential range. This work presents a clinical demonstration for a sensor detecting methyl-nicotine. The sensor was initially tested on 57 adult patients in Kampala, Uganda, 42 TB positive and 15 TB-negative patients. We employed a copper(II) liquid metal salt solution with a square wave voltammetry method designed for MN detection using available screen-printed electrodes. The sensor accuracy was evaluated by applying machine learning methods that utilized an extreme gradient boosted random forest approach. The results from this exploratory machine learning analysis showed sensitivity and specificity values greater than 85% which is within the range of the WHO published target product profile range (Sensitivity: 75-91% , Specificity: 77-94%). These initial results indicate that the sensor can effectively discriminate between TB-positive and TB-negative samples, providing a promising tool for non-invasive and rapid TB detection in clinical settings.

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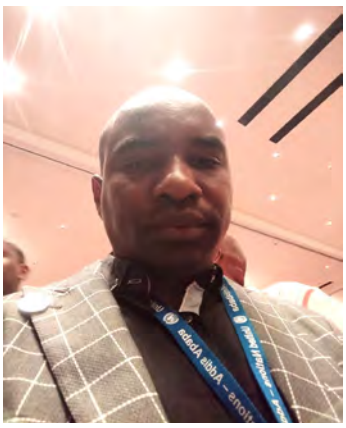

Mounirou Moustapha Maman is an agricultural engineer in Plant Production. He has a PhD in Soil Science and Plant Nutrition from the University of Ankara, Turkey, and was the winner of the Best Student Award for the 2018-2019 academic year from the President of the Republic of Turkey. He received the First Prize for Research and Innovation by Abdou Moumouni University and completed a professional internship and post-doctoral at the Institut National de la Recherche Agronomique from 2019-2021. He is a Research Associate at the Université Abdou Moumouni, Radio-Isotopes Institute, Radio-Agronomy and Plant Ecophysiology Department since August 2022 (permanent position). He received an official testimonial of satisfaction from the Minister of Youth and Sport for the significant contribution to the training of young people from the Diffa region in Agro-Sylvo-Pastoralism 2022-2023.

Technical skills: crop production, soil fertility management, plant nutrition, processing/upgrading of local products and expertise in agricultural value chains, with five scientific publications.

Poster 39

Improving Agricultural Production and Mitigating Climate Change through the Use of Biochar

To combat the effects of climate change and rising energy costs, obtaining fertilizers and energy from organic waste is one of today's top priorities. On the other hand, the world's population is growing fast, and with increasing food demand due to changing dietary habits and shrinking arable farmland, fertilizers appear to be one of the most important inputs for healthy, sustainable agriculture. It is therefore imperative to promote the development of new technologies for the processing of organic fertilizers and their use in agricultural areas. The use of pyrolysed organic materials with a high organic carbon content, emitting less CO2 into the atmosphere, is gaining in importance in areas with dry and semi-arid climatic conditions. That's why converting manure into biochar can have a positive and sustainable impact on the environment and food supply. The conversion of animal manure into biochar by pyrolysis has many positive aspects compared with direct application. Indeed, volumes of agricultural waste are reduced by pyrolysis, pathogen risks are also reduced, carbon stabilization is achieved in soils and gas emissions into the atmosphere are reduced. In recent decades, more and more academic studies have been carried out on the importance of biochar.

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Dr. Bridget Mutuma is a Researcher in the Department of Chemistry, University of Nairobi. She is an AAS affiliate (Cohort 6), a fellow of the Africa Science Leadership Programme (ASLP, 2021), and a fellow of the Africa Research Initiative for Scientific Excellence (ARISE, 2022). She has a BSc. degree in Analytical Chemistry from Kenyatta University, (Kenya, 2009), an MSc degree in Material Science and Engineering from Kangwon National University (South Korea, 2013) and a PhD in Chemistry from the University of Witwatersrand (South Africa, 2016). Her research interest is in the development of plastic waste-derived carbon nanomaterials/ core-shell nanostructures for use in gas sensors, photocatalysis, energy storage and conversion systems. Her research findings have been published in over 32 peer-reviewed articles and presented in several national and international conferences. Dr Mutuma has been a member of the India-Brazil-South Africa (IBSA); Solar energy project, South African Chemical Society, the Royal Society of Chemistry (RSC) and Materials Research Society of Kenya (MRSK). As a result of her research achievements, she has received several awards and fellowships; ACS PITTCON travel grant (USA, 2020), Visiting research fellowship (MEXT, Japan, 2020), CNPq Visiting PhD Research Fellowship (Brazil, 2016), Penny Huddle Memorial Award (Witwatersrand University, 2015) and the Korean Government Scholarship Award (South Korea, 2010), among others.

Poster 40

Morphological Features and Electrical Properties of Hollow SnO2 For Room Temperature CO Sensing

This work highlights the synthesis of hollow SnO2 nanostructures by hydrothermal method and investigation of their morphological features, crystal structure, surface area, elemental composition, and change in resistance to gas as the electrical properties. The synthesis of hollow SnO2 nanostructures was accomplished by using a modified hydrothermal method starting with a core@shell SiO2 template , and its nanostructure properties were compared with a SiO2@SnO2 and template-free SnO2. The STEM analysis revealed that the SnO2 nanomaterials had a spherical morphology. The crystallite diameters of the hollow and template-free SnO2 spheres were 3.3, and 4.6 nm, respectively, and these optical bandgap energies were determined to be 4.10, and 3.90 eV, respectively, indicating the influence of quantum confinement effects. The compositions of the core-shell SiO2@SnO2 and the hollow SnO2 nanomaterials were ascertained by XPS studies which confirmed the purity of SnO2. By a simple sensing test, the hollow SnO2 structures were utilized in the sensing of CO at room temperature and the sensor response was found to be six times higher than that of the template-free SnO2 spheres due to their lower domain size and a large number of active sites. This study indicated that the hollow SnO2 obtained from a core@shell SiO2 template has the potential to become a viable sensor material for CO detection at room temperature.

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Ernest Mwebaze obtained his doctorate in machine learning from the University of Groningen. He has over 10 years experience in academia where he was part of the faculty at the School of Computing and Informatics Technology of Makerere University in Uganda. At Makerere University he co-led the Makerere Artificial Intelligence research lab and headed several research projects. He has worked with the UN at the Pulse Lab Kampala and with Google AI, in Accra, Ghana. His current portfolio includes being the Executive Director at Sunbird AI, a non-profit focused on building practical AI systems for social good.

Poster 41

Large Low-Resource Language Models: African Language Technology in Text and Speech for Social Good

Language is the next frontier for AI. Current progress is in building AI that reasons and this necessarily means AI that consumes language in more complicated patterns than ever before. The occurrence of foundational models and Large Language Models is the first step in this journey. At Sunbird AI we have been developing low resource language resources in text and speech for machine translation, speech recognition and speech synthesis and applying this to interesting social good projects in agriculture, health and citizen governance. By understanding the context and leveraging that we are able to train some models with better performance than some Google translate models. The poster will talk about some of this work we are doing and our contextual use of data to train high performance models.

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Dr. Neergheen is an associate professor at the Biopharmaceutical Unit of the Centre for Biomedical and Biomaterials Research at the University of Mauritius. She graduated with a PhD in Biosciences in 2008 from the University of Mauritius, with part of my PhD work conducted at the Seoul National University in South Korea. For the past 20 years, her research has focused on scientifically validating the bioactivities of food/medicinal plants and marine organisms, endemic and indigenous to Mauritius to understand how these can positively impact the prevention of non-communicable diseases (NCDs), particularly cancer and diabetes. The field is highly interdisciplinary and holds much promise in reducing the burden of these NCDs in African countries. Since existing prevention and treatment strategies have proven insufficient, the realization that using dietary components with relevant effectiveness offers an exciting prospect to reduce the global burden imposed by NCDs. The work has culminated in 55+ peer-reviewed publications, 25 book chapters, and >50 presentations at conferences, with an H-index of 22 and a citation index of 3848. She has contributed to the panel discussions on biodiversity and biomedicine at the World Social Science Forum held in 2018 in Fukuoka, Japan and at the 14th International Conference on Urban Health, organized by the InterAcademy Partnership for Health in 2016, held in Beijing, China.

Poster 43

Optimizing the Use of Indigenous African Crops in the Prevention of Non-Communicable Diseases

Non-communicable diseases are increasingly becoming the leading cause of mortality in sub-Saharan Africa (WHO, 2023). These diseases, which include cardiovascular diseases, cancers, diabetes and chronic respiratory disorders, are, to a large extent, preventable. In addition, they share a number of primary risk factors and biological mechanisms that underlie their development. Research findings from our group have shown that indigenous food and medicinal plants which are rich sources of secondary metabolites hold much promise in fighting oxidative stress, inflammation and immunomodulation which are common processes in chronic diseases. Our research focuses on validating the nutritional and health potential of the available crops locally, very often underutilized, via cell-based models or clinical studies. The use of these resources to curb diseases is a practical approach that draws on traditional knowledge and resources that are well-adapted to the local environment to provide sustainable and cost-effective solutions to public health management. Hence, leveraging the wealth of indigenous foods, many of which are common in the region, can contribute significantly to disease prevention and public health improvement across the continent. Thus, evidence-based research on the health benefits of these foods can only encourage their integration into modern eating habits or their transformation into nutraceuticals, which can effectively improve health outcomes. This calls for collaborative efforts between researchers, communities, healthcare professionals, and policymakers to implement sustainable strategies that harness indigenous foods in the fight against NCDs.

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Dr. Christine Ngaruiya is an Associate Professor in the Department of Emergency Medicine (DEM) at Yale University. She completed the Global Health and International Emergency Medicine fellowship in the DEM in 2015, also matriculating with a Master of Science and Diploma in Tropical Medicine and International Health from the London School of Hygiene and Tropical Medicine at that time. She is also a graduate of the NIH Training Institute for Dissemination and Implementation Research in Health (TIDIRH) program, which she was competitively selected for from a national pool of applicants for the 2019-2020 cohort. Her research centers on: Non-communicable Diseases, barriers to care, and implementation science with a particular focus on Africa. Some honors include being selected in 2020 as 1 of 24 Women Leaders in Global Health from a national pool as part of the Stanford-affiliated, Gates Foundation WomenLift Health program. To that end, she has held several national and international leadership positions. She has sat on several NIH panels related to global NCD topics, and has lectured both nationally and internationally on the same. Her research has been funded by the US National Institutes of Health, USAID, the World Bank and the Gates foundation, among others. Furthermore, she was selected as one of twenty Yale Public Voice Fellows for 2015-2016 from across campus with around 30 publications in outlets such as Time, Huffington Post, Medium, and The Hill since that time.

Poster 44

Large Language Models (LLMs) Targeting Non-Communicable Disease Risk Factors Among Kenyan Youth

The use of digital technology with Artificial Intelligence (AI) is one of the most promising tools for improving equity and access to health care for marginalized communities. Among public health concerns, non-communicable diseases (NCDs) constitute the leading cause of mortality globally. This percentage is projected to rise in the next fifteen years, with the steepest increase in morbidity and mortality from NCDs projected to occur in LMICs like Kenya. Kenya is a lower middle-income country in East Africa with a population of more than 50 million people. The country is the most economically successful in the region, and has 80% literacy. Furthermore, Kenya has been recognized as a technology front-runner including and with the majority of Kenyans (82%) having mobile phone connectivity. Thus, Kenya constitutes an ideal site for testing implementation and dissemination of such interventions. Leading risk factors for NCDs are: diet, tobacco use, physical inactivity, and alcohol use. In the study to be presented, we will target high-risk Kenyan youth for NCD risk factors (18-34yo). We hypothesize that the use of an application-supported Large Language Model (LLM) will be effective among the youth at improving knowledge, attitudes and practices pertaining to NCD risk factors and that our study will provide better understanding of feasibility, opportunities and challenges related to use. We will assess this through the following objectives:

1. Develop an interdisciplinary Community Advisory Board (CAB) including government officials, practitioners, researchers and target end-users (youth population) to guide tool design, analysis and dissemination.
2. Assess knowledge, attitudes, practices, and feasibility of Large Language Models (LLMs) and their use.
3. Assess knowledge, attitudes and practices on NCD risk factors (tobacco, alcohol, exercise diet, salt intake) and efficacy of an LLM application-supported tool to improve these outcomes.

Balla Diop Ngom

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Balla Diop Ngom is a Professor of Nanomaterials Physics originally trained in solid-state physics at the University Cheikh Anta Diop of Dakar (UCAD) in Dakar, Senegal. His keen interest led him to complete doctoral studies in Physics at the same university. His scientific curiosity led him to pursue a second Ph.D. in nanomaterials physics at the University of the Western Cape (UWC), Cape Town, South Africa. Building on this high-level training, excellent academic record, and uncommon motivation and dedication, he returned to Senegal to embark on an academic career of high promise, already delivering spectacular results and outcomes. As a result of these distinguished academic achievements, Prof Balla has gained some twelve years of in-depth knowledge and experience in the multi-disciplinary field of nanoscience, focusing on green technology for energy and climate mitigation. He has co-authored more than 80 ISI scientific publications, and given more than 50 invited lectures at national and international conferences, universities, and research institutions including ten lectures at multinational companies. Prof. Ngom is also actively involved in the promotion of science, technology, and education motors of development in Africa and the global South, for example via website and social media platforms. Prof Balla is the President of the African Materials Research Society (AMRS) and the Chairman of the NanoSciences African Network (NanoAfnet).

Poster 45

Plant Biomass-Derived Advanced Green Energy Storage Devices

Energy as a commodity is facing a global crisis due to its high demand and consumption in all areas. Overuse of fossil fuels is also causing environmental problems such as global warming and depletion of the ozone layer. To solve this problem, researchers have been interested in developing efficient, sustainable, and clean energy storage systems to boost the use of renewable energy. We report on green and eco-friendly biomass-derived devices for energy storage applications. From our results on activated carbon nanostructures from peanut shell waste using different porosity-enhancing agents, an asymmetric supercapacitor device was assembled in a neutral electrolyte (2.5 M KNO3) at a cell voltage of 1.8 V, which yielded 224.3 F g−1 specific capacitance at a specific current of 1 A g−1 with a corresponding specific energy of 25.2 W h kg−1 and 0.9 kW kg−1 of specific power. To enhance the performance of the device, ex-situ nitrogen-doped porous carbon was synthesized and investigated in the same electrolyte. The fabricated device exhibited a 251.2 F g-1 of specific capacitance at a gravimetric current of 1 A g-1) at a wide cell voltage of 2.0 V. A specific energy of 35 Wh kg-1 with a corresponding specific power of 1 kW kg-1 at 1 A g-1 was obtained. For future development of environmentally friendly and sustainable electrode materials, we developed sustainable binary vanadium pentoxide carbon graphene foam composites (V2O5@C-R2HS/GF) using a green method. The device showed high specific energy and specific power values of 55 W h kg−1 and 707 W kg−1, respectively, at a specific current of 1 A g−1. The device presented a good stability test showing 99% capacity retention up to 10000 cycles confirmed by the floating time up to 150 h with specific energy an increase of 23.6% after the first 10 h.

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Dr. Niepa is an Associate Professor of Chemical Engineering at Carnegie Mellon University (CMU). He began his academic journey in Côte d'Ivoire and obtained an Associate Degree in Food Science, followed by research experience at the Pasteur Institute. He pursued bioengineering studies in Germany at the University of Dortmund. He later transferred to Syracuse University, earning his B.Sc. in Bioengineering in 2009 and Ph.D. in Chemical Engineering with honors in 2014. His Ph.D. research focused on developing an electrochemical technology to combat drug-resistant and persistent bacteria. Dr. Niepa co-founded Helios Innovative Technologies Inc., a medical device company addressing bacterial cross-contamination. He then held a Postdoctoral Fellowship at the University of Pennsylvania, working on studying microbial dynamics. In 2017, he joined the University of Pittsburgh and currently leads the microBiointerface Lab at CMU, focusing on multidisciplinary approaches to address microorganism-related challenges. Dr. Niepa has received prestigious awards, including the 2022 NIH Director's New Innovator, 2022 NSF CAREER, and 2019 NSF S-STEM Awards, emphasizing diversity and excellence in engineering research and education.

Poster 4

Nanocultures: High-throughput Platform for Assessing Microbial Community Dynamics in Sessile Drops

The need for assessment tools for microbial dynamics has necessitated the miniaturization of cell-culturing techniques and the design of microsystems that facilitate the interrogation of microorganisms in well-defined environments. The nanocultures are such an assessment tool: nanoliter-sized microcapsules generated using a flow-focusing microfluidic device to sequester and cultivate microbes in a high-throughput manner. Each nanoculture begins as a nanoliter droplet of cell suspension encapsulated by a polydimethylsiloxane (PDMS) membrane. By manipulating the chemistry of their polymeric shell, the nanocultures can achieve functionalities, such as selective permeability facilitating the transport of metabolites and other small molecules essential to cell growth and community dynamics. The nanocultures allow the diffusion of antibiotics, signaling molecules, and functional fluorescent probes to interrogate cell physiology and facilitate microbial interactions across the confining vessel. Alternatively, multiple species of microbes can be co-cultured within the nanocultures. Because of the chemical exchange occurring within and across the shell, the nanocultures can help investigate microbial pathophysiology. Here, we demonstrate this platform by exploring broad ranges of direct and indirect microbial dynamics. This versatile new tool has broad potential for addressing biological questions associated with drug resistance, chronic infections, antibiotic discovery, and microbiome dynamics relevant to complex microbial communities.

Participant

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Hae Young Noh is an Associate Professor in the Department of Civil and Environmental Engineering at Stanford University. Her research focuses on indirect sensing and physics-guided data analytics to enable low-cost non-intrusive monitoring of cyber-physical-human systems. She is particularly interested in developing structures to be self-, user-, and surrounding-aware to improve users' quality of life and provide a safe and sustainably built environment. The results of her work have been deployed in a number of real-world applications from trains, to the Amish community, to eldercare centers, to pig farms. Before joining Stanford, she was a faculty member at Carnegie Mellon University. She received her Ph.D. and M.S. degrees in Civil and Environmental Engineering and the second M.S. degree in Electrical Engineering at Stanford University. She earned her B.S. degree in Mechanical and Aerospace Engineering at Cornell University. She received several awards, including the Google Faculty Research Awards (2013, 2016), the Dean's Early Career Fellowship (2018), the NSF CAREER Award (2017), and various Best Paper Awards from ASCE, ASME, ACM, IEEE, and SEM conferences.

Poster 64

Gait Health Monitoring Through Footstep-Induced Floor Vibrations

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James Nyirenda has over 10 years experience in chemistry and biochemistry and has a Bachelor of Science degree in Chemistry which he obtained from the University of Zambia and graduated with merit. He also holds a Master of Science in Biochemistry obtained at Hamdard University-India. His doctoral research at Kyushu University, focused on protein chemistry, x-ray crystallography, protein disulphide bond engineering, site directed mutagenesis and enzyme kinetics of an archaeon oligosaccharyltransferase, a pivotal enzyme in protein Asparagine-linked glycosylation in both health and onset of disease. At the University of Zambia, his work involves exploring plant natural products with respect to finding low cost treatment regimens against zoonoses, prozoans, helminths and non-communicable diseases; diabetes and hypertension as a cohort. Other research involves the exploitation of conducting polymers and synthesis of nanomaterials in design of biosensing platforms for whole cell organisms and biomarkers as well as environmental remediation studies to improve human health.

Poster 46

Activated Carbon-Ag-SiO2 Nanocomposite for Heavy Metal and Organic Waste Removal from Waste-Water

We report synthesis and characterization of an activated carbon-supported silver-silica nanocomposite (AC-Ag-SiO2) for removal of Cu2+, Pb2+, Cd2+ and Zn2+ ions from single and multi-metal aqueous solutions. Characterisation experiments included Atomic force microscopy (AFM), Ultraviolet-visible spectrophotometry (UV-Vis), Fourier transform Infrared spectrophotometry (FT-IR) and X-ray diffraction (XRD) analysis. Adsorption of heavy metals onto the composite strongly depended on contact time (280 min maximal), adsorbent dosage (0.1-0.4 g), solution pH (5.5 ± 0.5 maximal), temperature (298-328 K) and initial metal concentration. Equilibrium data were fitted to the Langmuir, Freundlich and Temkin isotherm models. Kinetic data were fitted to pseudo-first-order and pseudo-second-order kinetic models with the Freundlich isotherm model (R2 > 0.99) and pseudo-second-order kinetic mode (R2 > 0.999) providing a better fit to the experimental data. The maximum adsorption capacity was found to be 84.75 ± 0.24, 81.30 ± 0.2, 87.72 ± 0.96 and 81.97 ± 0.39 mg/g for Cu2+, Pb2+, Cd2+ and Zn2+ ions, respectively. The obtained values of thermodynamic parameters such as ΔG° (-13.72 ± 0.20 to -5.45 ± 0.35 kJ/mol), ΔH° (95.10 ± 14.33 to 162.4 ± 27.17 J/K.mol), and ΔS° (22.81 ± 4.50 to 39.12 ± 8.70 kJ/mol) showed that the adsorption process of Cu2+, Pb2+, Cd2+ and Zn2+ ions onto AC-Ag-SiO2 composite was spontaneous, feasible, endothermic and physical in nature. Regeneration studies suggested that AC-Ag-SiO2 composite could be reused effectively with no statistical significance among the cycles (p > 0.9 for all the four metal ions).

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Dr. Jeung Oh's group designs polymer membranes that can enable the world's most important, but also most challenging separations for energy, environment, and health. Specifically, they design highly selective functional polymers, fabricate previously nonexistent structures, and explore the effect of polymer's chemical and physical structures on transport in polymers. Separating molecules is and will be the backbone of modern society, whether applied to conventional separations or future Carbon-Free separations.

Poster 47

Design of Multifunctional Polymer Membranes for Energy-Efficient Separations

Separating molecules is and will be the backbone of modern society. The advancement of separations is dependent on polymer membranes which can selectively transport desired molecules while maintaining chemical stability. Designing innovative polymer membranes with previously unachievable transport property sets will have an enormous impact on various applications in environment, energy, and health. Here two projects are presented for designing new charged polymer membranes for improved molecule separations. First, melt processed ion-exchange membranes without using toxic solvents are presented for obtaining clean water. Second, designing structured polymer membranes for a new biomedical separation, "drug capture," to remove toxic chemotherapy drugs before they spread through the body, is discussed.

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Prof. Calvin Andeve Omolo is an Associate Professor of Pharmacy and the Chair of the Department for Pharmaceutics and Pharmacy Practice at the School of Pharmacy and Health Sciences, United States International University – Africa (USIU-Africa) in Nairobi. He was awarded a scholarship by the College of Health Sciences, University of KwaZulu-Natal (UKZN) in South Africa, which enabled him to pursue his master's and Ph.D. His research primarily revolves around the design and synthesis of biomaterials used in formulating and characterizing novel dosage forms for treating various diseases. Over the past five years, his research has particularly focused on developing novel materials and drug delivery systems to target specific disease sites. His significant contributions in this field have established him as an emerging global researcher.

Prof. Omolo's current h-index is 17 (Google Scholar) with 717 citations, he has published papers in Q1/Top 10 pharmaceutical sciences, medicine, and bioengineering journals such as Advanced Functional Material, Journal of Controlled Release, International Journal of Biological Macromolecules, International Journal of Pharmaceutics and WIREs Nanomedicine & Nanobiotechnology. He has 50 publications, and 6 book chapters, in reputable ISI journals and Publishing houses and his work has been presented in various scientific conferences worldwide.

Poster 48

Disease Inspired Design of Biomimetic Nanocarriers for Targeted Delivery

Introduction: Innovative strategies are needed to enhance the targeting and efficacy of antibiotics against bacterial infections and sepsis. This study aims to formulate hybrid nanoparticles (HNPs) derived from Oleylamine (OLA) and tannic acid (TA) for targeted delivery of ciprofloxacin (CIP) in bacterial-induced sepsis.

Methods: CIP-loaded tannic acid hybrid nanoparticles (CIP-loaded TAH-NPs) were prepared using a hot ultrasound dispersion method and characterized for size, polydispersity index (PDI), zeta potential (ZP), encapsulation efficiency (EE%), drug loading capacity (DL%), surface morphology, in vitro drug release, antibacterial, antibiofilm, efflux pump inhibition, time killing, and binding affinity studies.

Results: CIP-loaded TAH-NPs had an average size of 85.65±0.89 nm, PDI of 0.126±0.007, ZP of +16.3±0.230 mV, EE% of 68.73±0.54%, and DL% of 6.86±0.095%. The nanoparticles exhibited sustained CIP release over 48 hours. They showed enhanced antibacterial and efflux pump inhibition activity, eradicating biofilms of MRSA and P. aeruginosa more effectively than bare CIP. Time killing assays demonstrated complete bacterial clearance within 8 hours. In silico and MST studies confirmed strong binding affinity of TA and its nanoformulation to human Toll-like receptor 4 (TLR4) compared to lipopolysaccharide (LPS).

Conclusions: CIP-loaded TAH-NPs have the potential to be an innovative nanocarrier for effective and targeted antibiotic delivery against bacterial-induced sepsis. Further studies on anti-inflammatory, antioxidant effects, and in vivo assessments are in progress.

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Dr. Ostrand is a cognitive scientist and she studies psycholinguistics – how our brains produce and understand language. She received her PhD in Cognitive Science from University of California San Diego (California, USA) in 2016, and then moved to IBM Research (New York, USA), where she is currently a Staff Research Scientist. She has two main areas of research. The first is understanding how speakers and listeners learn from experience interacting with their conversational partners, and use that prior experience to adapt their future linguistic interactions to their partner's linguistic abilities and preferences. In particular, she is interested in how people modify the words they produce when interacting with a non-human conversational partner (like a chatbot or a large language model), which they may expect to have low levels of language proficiency. Her second research area is investigating the use of speech to diagnose Alzheimer's disease and other dementias. She has developed natural language processing tools to automatically calculate certain properties of an at-risk patient's speech, and then use those properties to predict whether the patient is currently impaired or is likely to exhibit cognitive decline in the near future. In particular, she is interested in how speech production changes over time with the progression of dementia, and in developing an interactive technology which could automatically detect changes in a person's speech production as an early-warning signal for cognitive decline.

Poster 49

A Technological Approach to Automated Assessment of Spontaneous Speech to Predict Cognitive Impairment in Early-Stage Dementia

Dementia, and its precursor mild cognitive impairment, affects millions of people. Traditionally, assessment and diagnosis is performed via an extensive clinical battery, consisting of multiple hours of neuropsychological testing; neuroimaging tests such as MRI; blood draws; spinal taps; and/or genetic testing. This is expensive, difficult, and burdensome for the patient, and thus is not a practical method for frequent monitoring of an at-risk person's status. This diagnostic status quo also raises issues of equity of access for people with fewer resources or who live far away from major urban centers, as they may not even have the opportunity to access such testing. However, speech production has recently been shown to contain properties which are predictive of even early-stage cognitive impairment. My research investigates what properties of speech production correlate with current cognitive status and are predictive of future dementia, using an automated pipeline that I have built for computing these properties from speech transcripts. In particular, my work focuses on lexical and contextual features of language: features like word frequency, part of speech counts, and linguistic surprisal, which can jointly reflect a person's underlying degree of cognitive impairment. Across patients with different degrees of impairment, and who responded to different types of speech elicitation prompts, certain language features, largely those which capture some facet of semantic specificity and lexical retrieval difficulty, are highly correlated with and predictive of participants' cognitive status. This suggests that speech production, which can be collected easily and thus relatively frequently with low participant burden, could be used as a remote and ongoing metric for monitoring cognitive decline, without the patient ever needing to leave their home.

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Overall Research Theme: Develop methodologies for the analysis and integrative interpretation of spatially based, multi-modal, omics datasets (e.g., imaging, genomics, spatial profiling) for improved disease understanding and clinical decision making.

1. Artificial Intelligence (AI) methods for Medicine: Our expertise is evidenced by two streams of work: (1) Developing statistical and machine learning (ML) methods to analyze and interpret multi-modal image/genomic data; (2) application of AI/ML formalisms for predictive models based on genomics, radiology and pathology imaging. These are used to assess disease stage, suitability for specific drug targets, molecular therapies & immunotherapies. More recently, we have been working on problems of bias, fairness determination as well as auditing of AI solutions in healthcare.

2. Precision Medicine: My research group develops methods for analyzing and integrating radiology, pathology, genomics data towards recommending appropriate therapies for patients undergoing care for oncology, in addition to developing methods for the derivation of biomarkers (based on imaging and genomics data). An important component of this is our participation in the international TCGA project. This also led to directions involving AI for digital pathology in the context of precision medicine.

Poster 42

Building Trust between Humans and Artificial Intelligence (AI): Quality Assessment of Artificial Intelligence Tools in Radiology & Pathology for Precision Cancer Medicine

Recent technological advances in machine learning and Artificial Intelligence (AI) (e.g. deep learning, & more recently, generative AI etc.) have provided nice user-friendly tools for the construction of AI models from large-scale datasets. These methods are poised to make (if not already) significant impacts on human healthcare. In order to provide a calibrated sense of utility for these AI-enabled devices/tools, there is need to understand the underpinnings of performance analysis, challenges in training, testing and deployment of such AI tools; as well as real world challenges around continually evolving systems (i.e.: data noise, data veracity, data-drift, quality assurance, verification and calibration issues, human-machine teaming, among others). Rigorous statistical methodology and failure-proof designs are required to responsibly audit these AI systems in the context of their deployment for mission-critical applications. The need for quality assessments of these AI pipelines is further challenged by the asymmetric cost nature and high-stakes modes of failure that if encountered can lead to incorrect decisions with catastrophic consequences. In this poster presentation, we aim to cover aspects of these considerations in the ecosystem of “Data-Model-Inference-feedback” for the healthcare setting, wherein deployment of such tools that evolve with data create an interesting challenge around rigorous calibration of the “system properties” for AI such tools. Using case studies from radiology (specifically, brain tumor segmentation), and pathology (AI-assisted tumor grading) this presentation aimed to characterize the modes of AI-system variability and credibility around its various ingredients (viz. data, models, inference and feedback control). Aspects about data curation, model parametrization and uncertainty quantification (UQ) will be discussed alongside typical modes of performance failure in the context of radiology and pathology AI.

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Dr. Schultz is the director of the Biological Robotics at Tulsa (BRAT) research group. He received his Ph.D. from Georgia Institute of Technology in 2012, performing his doctoral dissertation research in the area of damage-tolerant artificial muscles for robotics applications. His postdoctoral training was at the Istituto Italiano di Tecnologia on actuators for soft robotic hands. Since joining the University of Tulsa, he has been active in the areas of highly functional compliant robot hands with a small number of motors, robot walking, robots for rehabilitation, and inflatable fabric-reinforced soft robots made of soft silicone materials. He has served as a Technical Editor of IEEE/ASME Transactions on Mechatronics and on the organizing committee of the 2023 IEEE/SICE International Symposium on System Integration.

Poster 51

When a Robot Must Touch You: Ensuring Safety in Human-Robot Systems

Joshua Schultz, The University of Tulsa, United States

Effective Robot rehabilitation, human augmentation and assistance has been a dream of robot researchers for decades. However, applications of real-world robotic systems that are capable of coming into real, physical contact with human beings creates the potential for injury, and even the perception that an injury might occur, however unlikely, can get in the way of the goal for which the robot was created. Oftentimes use of padding, making the robot out of soft materials, having rounded edges and running at low velocities lead practitioners to say that the robot “should” be safe. This is not sufficient to ensure safety, and designers should be able to state quantitatively with confidence that forces, torques, and stresses applied to the body of the patient or human receiving assistance will not be enough to cause injury. This poster presentation will describe how researchers at The University of Tulsa and its partners and collaborators are evaluating the human experience interacting with the robot so that the likelihood of injury is known to be safe with confidence.

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Prof. Dr. Ir. Haïtham SGHAIER (ISO 15189 / ISO 17025 Lead/Technical Assessor), is an Engineer in Biotechnology and a Professor (Full) of Biological Engineering (Cellular and Molecular Bioengineering) — Radiation & Computational Microbiology — at the National Center for Nuclear Sciences and Technology (CNSTN) in Tunisia. He was educated at Technical School (Kebili, Tunisia), INAT (Tunis, Tunisia) and ENIS (Sfax, Tunisia). He obtained a master's degree (2004) from Kiryu Faculty of Engineering (Japan) and a Ph.D. (2007) following his research done at the Japan Atomic Energy Agency (JAEA, Japan). In 2007, he joined the CNSTN. He won the 2016 TWAS Young Arab Scientist (YAS) Prize. Dr. Ir. Haïtham SGHAIER is the Founding President of the Tunisian Association for Computational Sciences (TACoS; JORT of August 05, 2017). His basic research is related to the study of microbial resistomes, (oxidative) stress tolerance and interactions among prokaryotes/eukaryotes through computational biology and omics tools (http://orcid.org/0000-0002-8210-5345). He has published on the evolution of ionizing-radiation-resistant prokaryotes (IRRP). Also, he has published on bioremediation issues, particularly on bioremediation of radioactive waste using IRRP. Currently, he is involved in two ongoing projects (2022–2025/2027), funded by the International Atomic Energy Agency, as a Project CounterPart (PCP) / Chief Scientific Investigator (CSI), about the development of irradiated vaccines.

Poster 65

Revolutionizing Aquaculture Vaccines through Multi-Faceted Innovation

The International Atomic Energy Agency (IAEA) Technical Cooperation Project TUN5032, known as AquaVac-ir, aims to establish in Tunisia a pioneering national certified pipeline for aquaculture vaccine production by irradiation. This comprehensive initiative spans five distinct processes, each bringing forth innovative strategies to revolutionize aquaculture vaccine development and deployment. In Process 1 (comprehensive immune response assessment), a novel approach emerges through the fusion of proteomic, transcriptomic and flow cytometry techniques. By exploring the immune response of Dicentrarchus labrax post-vaccination with irradiated nodavirus, the project uniquely captures a holistic view. Additionally, Process 2 (harnessing radiation-inducible promoters and spheroplasts) works on employing radiation-inducible promoters and enlarged bacterial spaces of selected radioresistant strains to produce nodavirus capsid protein. Moreover, Process 3 aims to preserve epitopes of lethally irradiated nodavirus using, among other solutions, native in silico predicted radioprotective decapeptides of Deinococcus radiodurans. In Process 4 (artificial intelligence (AI)-driven immunogenicity and reactogenicity prediction), the project leverages AI algorithms to forecast signatures of irradiated vaccine immunogenicity and reactogenicity. Finally, in Process 5, the project embraces systems biology to construct a "European seabass-nodavirus interacting metabolic model". Collectively, the AquaVac-ir Project revolutionizes aquaculture vaccine development through its five innovative processes. The project paves the way for a new era of effective and precisely tailored aquaculture vaccines. This endeavor stands as a beacon of transformative innovation in the realm of aquatic health and vaccine manufacturing.

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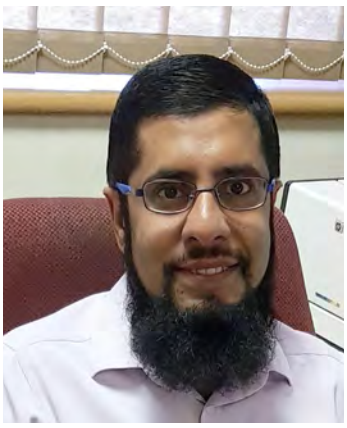

Dr. Sajid M. Sheikh is an academic, researcher and consultant. He is currently a Senior Lecturer in the Department of Electrical Engineering, Faculty of Engineering and Technology, University of Botswana (UB). He is also the Postgraduate coordinator at UB and Cisco Instructor and the academy coordinator at the UB-FET Cisco Academy. Dr. Sajid M. Sheikh holds qualifications of PhD in Electrical Engineering from University of Stellenbosch, MSc in Electronic Systems Engineering from the University of Botswana, BEng in Electrical and Electronic from the University of Botswana, CCNA 1, 2, 3 and 4 Instructor qualification Courses from UB-FET Cisco Academy, IT Essentials Instructor qualification Course from Sci-Bono ICT Academy, Johannesburg and IT Essentials Instructor Training Qualification from the Networking Academy Instructor Trainer Cisco Systems, South Africa. He is author of many international journal papers, international peer reviewed conference papers and book chapters in the area of Internet of Things innovation product prototype designs; wireless mesh network protocol design for bandwidth constraint networks; and Web radio. He has been / is the reviewer of many international conferences and Journals.

Poster 52

An Internet of Things Water Usage Monitoring System Device

Some countries like Botswana and South Africa have faced major water shortages in the past. Water charges have also increased over the years. Usually in homes and business premises, there are some taps that have high water usage such as garden taps. For such taps, to control and monitor the water usage can help control high bills as well as reduce water wastage. Currently places get a water connection from the Water Utilities Corporation for their water supply. Currently there is no system in place to detect when there is high water usage and notify the users; detect if there is a water leak, unless the water shows physically on the ground surface; detect if the water is clean to drink and to detect the water pressure. In this work, an Internet of Things (IoT) based device is proposed to be developed that can be connected to any pipe or tap to monitor water usage, detect high water usage and send notifications by SMS or email for both bulk water and domestic systems.

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Ekundayo Shittu is an Associate Professor in the Department of Engineering Management and Systems Engineering at The George Washington University, Washington, D.C. His research agenda in the arena of technology management and the economics of renewable energy focuses on the interplay between public policy, competition and energy technology investments. His research also studies the strategic interaction between firms' technology stocks and the external environment through the lenses of transaction cost economics and resource-based view. His research has been supported by the National Science Foundation, Department of Energy, Department of Defense, Alfred P. Sloan Foundation, Toyota Mobility Foundation, etc. He is an Assistant Editor for the Journal, Applied Energy, and he publishes in IEEE Transactions in Engineering Management, Computers and Industrial Engineering, Production and Operations Management, EJOR, Utilities Policy, Energy Policy, Systems Engineering, and Climate Policy. He was a Lead Author on Chapter 2, Integrated Risk and Uncertainty Assessment of Climate Change Response Policies," of WG III to AR5 of the IPCC. He is a member of INFORMS, POMS, SMS, Industry Studies Association and INCOSE. He holds a B.Eng. in Electrical Engineering from the University of Ilorin, Nigeria, an M.S. in Industrial Engineering from the American University in Cairo, Egypt, and a Ph.D. in Industrial Engineering and Operations Research from the University of Massachusetts Amherst, U.S.

Poster 9

Combining Incentives for Mobility Electrification with Carbon Policies: A Global Change Analysis Model of the U.S.

The objective of this study is to investigate the impact of the combination of low-carbon energy policies with electric vehicle (EV) incentives on technology choices and the rate of adoption of EVs in the United States. There are significant differences across state lines about the bi-directional impact of state-level enactments in shaping federal pronouncements and vice-versa. Specifically, these duplex interactions between state policies aimed at low-carbon technologies and national-level decarbonization efforts influence the decisions on the capacity expansion of electricity generation technologies. However, the extent of the differentials across the country is unknown. To shed light on this issue, a new methodology that integrates greenhouse gas (GHG) emission-oriented scenario generation into the Global Change Analysis Model (GCAM-USA). GCAM, a climate-economy modeling platform, is employed to evaluate state-level carbon tax policies and EV tax credit incentives to assess their effects on the adoption of EVs and the capacities of the technologies to deploy to achieve specific decarbonization objectives. There are three important outcomes from this analysis. Firstly, the inclusion of a carbon tax policy magnifies the already positive effect of EV incentives at reducing GHG emissions. Secondly, when considering the optimal technology mix, wind and carbon capture and storage (CCS) technologies show significant decarbonization effects particularly for EV charging infrastructure. Thirdly, this analysis highlights the value of considering locational conditional variances in the efficacy of policies and incentives in the transition to a decarbonized economy. The lesson for other parts of the world is that It is essential to harmonize both top-down and bottom-up policies in a way that accentuates and accelerates the right technological mix for the achievement of a decarbonized economy.

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Dr. Shopera is a Principal Scientist and a Group Leader at Pfizer and has been with Pfizer for five years. As a Group Lead at Pfizer, he leads a team of scientists to develop cutting edge technologies and state-of-the-art commercial manufacturing processes to meet global supply of various medicines and vaccines to tackle healthcare challenges across the globe ranging from rare diseases to pandemics. His team is also responsible for driving commercial manufacturing technology innovation and technology transfer. Most notably, his recent ground-breaking work was being part of the Pfizer team that developed the COVID-19 mRNA vaccine, which is the first COVID-19 vaccine. Prior to joining Pfizer, he worked at Millipore Sigma as a Research and Development Scientist in the bioprocess and cell culture media development division.

Dr. Shopera was born and raised in Zimbabwe. He graduated with a Bachelor of Science degree in Biochemical Engineering from Jacobs University, Germany. He holds a Master of Science (MSc.) and Ph.D. in Energy, Environmental, and Chemical Engineering degrees from Washington University in St. Louis. Outside of work, he enjoys outdoor activities, raising awareness on diseases, and engaging and mentoring the next generation of scientists in Africa.

Poster 53

Leveraging mRNA Platform Technologies to Enable Pandemic Supply of COVID-19 Vx at Light Speed

On March 17, 2020 Pfizer and BioNTech announced that they would jointly develop BioNTech's mRNA-based vaccine candidate BNT162 to prevent COVID-19 infection by leveraging expertise and resources of both companies and building from an earlier 2018 agreement to develop an mRNA-based influenza vaccine. However, in the case of the Covid vaccine development, the urgency was utmost as lives were being lost around the world due to the virus and there was no viable treatment available. The Covid pandemic was arguably the biggest challenge facing humanity in a generation.

To this end, the project was termed lightspeed with a highly ambitious goal of developing and gaining authorization/approval within a year. This seemed like an impossible task especially since the average time for vaccine development is typically 10-15 years and the fastest any vaccine had ever been developed was 4 years (mumps vaccine). However, just 248 days later, on Nov 20, 2020 an Emergency Use Authorization was submitted to the FDA demonstrating that mRNA vaccines have lived up to their promise of quick development times. This significantly rapid development of a COVID-19 vaccine was enabled by leveraging mRNA platform technologies coupled with use of rapid process development, scale-up and commercial manufacturing platform technologies. This talk will emphasize how courageous leadership, strong collaboration, and advantages of leveraging pDNA and mRNA platform technologies enabled accelerated process development and pandemic supply of a COVID-19 mRNA Vaccine.

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Dr. Soulama is a molecular parasitologist working in the field of human and pathogen molecular interaction at the Institut de Recherche en Sciences de la Santé (IRSS) part of the National Research Center for Sciences and Technology in Burkina Faso. Since his PharmD in 2003, he has worked as a pharmacist in different vaccines and drugs clinical trials in Burkina Faso to bring his support in the management of investigational products. He worked as sub-coordinator in different clinical trials and had an active role as study coordinator in the West African Network for Clinical trials of Antimalarial.

Since his PhD in 2010 in Molecular Parasitology at the University of Ouagadougou (Burkina Faso), Dr Soulama has been trained at the Broad Institute and Havard Medical School on malaria genome as a bridge between clinical trial and the fundamentals science in order to well understand human and parasite interaction.

In order to further strengthen his competences and knowledge in the molecular field, he followed a certified training course at Stanford University, in the United States, where he obtained a professional certificate in Genetic and Genomic in 2020. Working in collaboration with different teams in the USA, Europe, Abu Dhabi, and Africa.

As a lecturer in Molecular Biology at the University of Ouagadougou, and at the Center of Excellence in Genomic and Molecular biology at the University Nazi Bony in Burkina Faso, he is involved in the supervision of many masters and PhD students.

Poster 54

How Genomic Approaches Can Contribute to Malaria Elimination

Despite the recent progress in malaria control including the urge to use WHO recommended strategies including vector control, chemoprevention, diagnostic testing and treatment, malaria still remains the most tropical killer disease. Indeed, Progress in reducing cases and deaths has plateaued at unacceptably high levels, with more than 200 million cases and 400 000 deaths reported annually. In 2019, the WHO African Region accounted for 94% of the global malaria mortality and morbidity burden, and only nine out of 47 countries achieved the 2020 milestones. Two countries – the Democratic Republic of the Congo and Nigeria – still account for about 40% of the estimated morbidity and mortality due to malaria worldwide. While a malaria vaccine is yet to be administered to many African children in coming years, the challenge will still remain the elimination and the eradication of the disease in the Sub-Saharan area.

However, recent progress in genomics and molecular genetics has empowered novel approaches being considered as an opportunity to closely understand and set surveillance systems that can lead to disease control and elimination.

These new genomic methods are being applied in Africa slowly, especially in West Africa in Senegal, Burkina Faso, but also in East African countries such as Ethiopia, Tanzania to ensure initially a monitoring and adaptation of control strategies based on scientific results by the National malaria control program. In addition, the undeniable contribution of genomic methods in the search for a vaccine against Covid19 inevitably opens opportunities to accelerate malaria vaccine research. All this must be done within an appropriate ethical and regulatory framework.

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Judith Su is an Associate Professor in Biomedical Engineering and an Associate Professor in Optical Sciences at the University of Arizona. Judith received her B.S. and M.S. from MIT in Mechanical Engineering and her Ph.D. from Caltech in Biochemistry & Molecular Biophysics. Her lab focuses on building next generation optical sensing platforms and, with these sensors, collaborating with top researchers to solve the most significant and pressing problems in science, medicine, and issues confronting society. She is a recipient of an NSF CAREER award, an NIH R35 Outstanding Investigator Award and an American Society of Laser Surgery and Medicine Young Investigator Award. She was a Siegman International School on Lasers Lecturer and a Scialog: Chemical Machinery of the Cell Fellow. She was on the Board of Scientific Counselors for the National Institute for Occupational Safety and Health (NIOSH). She gave a keynote talk at SPIE Photonics West 2022 and was the opening and closing speaker for IONS (International OSA Network of Students (IONS)) in Busan, Korea in 2023. She was the general co-chair for Optica's 2023 Advanced Photonics Congress, Integrated Photonics Research (IPR) Conference in Busan, Korea and is the incoming general co-chair for Optica's 2024 IPR conference in Quebec City, Canada.

Poster 6

Developing Ultra-Sensitive Molecular Sensors to Solve Pressing Societal Issues

Microtoroid optical resonators, when combined with frequency locking, balanced detection, and data processing techniques, are capable of label-free single molecule detection at attomolar concentrations in under 30 seconds. We have developed such a system called FLOWER (frequency locked optical whispering evanescent resonator). We present the principles of FLOWER, including noise analysis, and how, at such low concentrations, we can achieve sensing times on the order of seconds. In addition, we will show our ongoing use of FLOWER for fundamental studies on taste, and a variety of applications including drug screening, medical diagnostics for ovarian cancer, and chemical threat sensing. We validate our technology against existing approaches and perform detection in complex biological fluids. Finally, we discuss our next generation sensing platforms, including how we combine FLOWER with frequency comb technology to enable simultaneous detection and absorption spectroscopy, our work on high sensitivity photothermal spectroscopy, and our work towards a robust, portable, translatable device.

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Dr Nazmat Surajudeen-Bakinde, an Associate Professor of Electrical and Electronics Engineering is a highly accomplished and innovative registered engineer with the Council for the Regulation of Engineering in Nigeria and lecturer of more than twenty years in University of Ilorin, Nigeria. She earned her Bachelor and Master of Electrical Engineering from the prestigious University of Ilorin, graduating with second class upper and distinction respectively. Her Ph.D. studies was carried out successfully at the renowned University of Liverpool, UK on the highly competitive Commonwealth Scholarship. She equally had a Certificate in Advanced Studies in Academic Practice at Grenoble School of Management, France. She has since been applying the methods of teaching pedagogy in her classes making them interactive and engaging. She was a past Chairman of the Association of Professional Women Engineers in Nigeria, Ilorin branch where she propagated the Girl-Child Education Initiative to the rural areas. She is a member of five other professional bodies. She has more than 70 papers published in reputable journals, book chapters and conference proceedings. She has supervised and examined more than hundred students at undergraduate and postgraduate levels. Her main research interests are Internet of Things, Television White Space; Propagation Models; Co-location of GSM base stations; Renewable Energy; Computation Intelligence; Telemedicine. She was a resource person to 4 national agencies

Poster 55

Development of a Low-Cost Assistive Device at the Human-Technology Interface for the Speech Impaired

In Africa, there is a growing adoption of technologies at the interface of improving human existence and surmounting the challenges that may be associated with living. One inhibiting factor to this trend is the cost of acquiring these technologies. A rural dweller who is challenged by difficulties in speech has lower quality of life, due to lack of wherewithal to access the available technologies to ameliorate the challenges.

The research to be presented at the 2nd US-Africa Frontiers Symposium is developing affordable local devices based on human-technology interaction, such as systems enabled by Internet-of-Things (IoT) and speech recognition for cost-effective alternatives that are motivated by how the rural dweller, who is clinically proven to be mute and speech-impaired, lacks control and is not able to interact with common household appliances and devices.

The market's current solutions do not offer seamless and effective control options; and when they do, they are exorbitant. This problem is being addressed with a locally-designed smart home assistant that combines computer vision and artificial intelligence routines related to image classification in an IoT ecosystem.

By enabling gesture recognition and interpretation, the device empowers the mute and speech-impaired people to easily control a variety of appliances in their homes. A locally-assembled infrared-enabled camera module built into the device records images of user gestures that are processed and classified in real-time using Convolutional Neural Networks. The materials for the camera and the paraphernalia of the IoT system are all cheaply sourced. The system's accuracy in identifying gestures compares with costly sophisticated equivalents.

Future research will concentrate on expanding the gesture recognition system's capabilities, improving its accuracy and investigating additional applications in various domains and development for improved and affordable assistive technologies.

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Dr. Meron Tesfaye is scientist turned policy enthusiast. Meron holds a PhD in Chemical Engineering from the University of California at Berkeley, where she conducted research to improve the performance and cost of hydrogen-powered, zero-emission vehicles. Meron obtained a Bachelor of Science degree in Chemical Engineering with a minor in Engineering Leadership Development from the University of Maryland, College Park. Meron applies her decade-long experience at the frontiers of clean hydrogen and clean energy research to design federal policy interventions that alleviate impacts of climate change. Meron was a Senior Policy Fellow at Carbon180 developing US federal policies that enable biomass-based carbon removal and climate mitigation solutions. Prior to that, Meron was a California Council on Science and Technology Fellow at the California Senate Budget Committee, helping to analyze California state's budget priorities. Meron works as a Senior Policy Analyst at the Bipartisan Policy Center to develop policy solutions that enable meaningful deployment of clean hydrogen, industrial decarbonization and carbon management solutions at-scale. Meron is also an independent researcher collaborating with Energy for Growth Hub on the role of Hydrogen in Africa.

Poster 56

Clean Hydrogen Made in Africa: Africa's Next Superpower or Exercise in Futility ?

In 2023, amidst record-breaking global temperatures, escalating climate impacts and changing global political dynamics, the Global North is swiftly embracing clean hydrogen as a vital emission reduction tool for transportation, industry, and power sectors. Anticipating up to a five-fold surge in clean hydrogen demand over the next three decades, numerous African nations, including South Africa, Nigeria, Uganda, Namibia, Mauritania, Egypt, Morocco, and Kenya, are positioning themselves to supply hydrogen and hydrogen derivatives to Europe. With $19 billion already committed to clean hydrogen projects across Africa by 2030, deeper scrutiny is needed to ensure equitable benefits for African countries. This study investigates the potential of Africa's low-cost renewable energy to foster domestic growth amidst export-oriented strategies. It also examines the emission benefits of the hydrogen export market ecosystem, and evaluates regulatory and market frameworks to prevent extractive industries. Africa's ascent in the clean hydrogen landscape embodies global transformative potential, necessitating comprehensive examination and collaborative action to foster sustainable development and inclusive growth.

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Dr. Gaye Thiam holds a PhD in molecular cell biology of infectious diseases from the University of Ghana. His PhD research primarily focused on investigating factors influencing the variation in Plasmodium falciparum invasion pathways, which triggered his interest in malaria vaccinology and immunity to the malaria parasites. One of the main challenges that have so far thwarted the progress of a highly effective malaria vaccine is the extent of genetic diversity, which constitutes a major immune evasion strategy deployed by P. falciparum. As a postdoctoral researcher, he has spent the last 3 years of his career investigating the impact of natural genetic diversity on vaccine efficacy and or immune evasion. His research aims to decipher the mechanistic relationship between genetic diversity and immune evasion of Plasmodium falciparum from vaccine-induced antibodies. He uses a multidisciplinary approach combining genetic and genomic approaches with structural biology and functional phenotypic assays to decode the key mechanistic relationships between genetic diversity and reduced susceptibility and/or immune evasion of P. falciparum clinical isolates from vaccine-induced or naturally acquired antibodies to blood-stage malaria vaccine candidate antigens. Another area of my research interest is the exploration of perspectives related to the development of mRNA-based vaccine formulations targeting the blood-stage of the malaria parasite.

Poster 57

PfRh5-Induced Human Monoclonal Antibodies Show Broadly Neutralizing Activities in P. Falciparum Clinical Isolates

Malaria continues to afflict humankind, with over 200 million cases and more than 400,000 deaths reported in 2020, while vaccine development strategies are so far thwarted by the extent of the parasite's genetic diversity, which favors the development of strain-specific immunity. Early testing of the effect of naturally arising Plasmodium falciparum's genetic diversity is critical for achieving the urgent need of designing a strain transcendent malaria vaccine. The P. falciparum reticulocyte binding homologue 5 (PfRh5) protein and its complex members are promising blood-stage vaccine candidates. Antibodies against members of this complex are highly inhibitory in P. falciparum laboratory lines and short-term adapted clinical isolates. Moreover, vaccine-induced monoclonal antibodies to PfRh5 have recently been shown to exhibit high invasion inhibitory activities, both in in-vitro and clinical human malaria infection studies, although their potential has not been fully tested on the more diverse parasite population circulation in endemic settings. Here, we combine ex-vivo growth inhibitory activity (GIA) assays of vaccine-derived monoclonal antibodies (mAbs) to PfRh5 and next-generation sequencing on twenty P. falciparum clinical isolates and proposed a genotype-phenotype association study. Our data show a wide range of antibody susceptibility across the P. falciparum clinical isolates herein reported. Overall, all mAbs previously shown as inhibitory in laboratory lines were also inhibitory in the clinical isolates, with the most potent mAbs yielding between 60-90% inhibition at 10ug/ml and 150ug/ml, respectively. As natural P. falciparum infections occur as polygenomic, ongoing investigations regarding the NGS-related analyses and experimental genetics will shed light on the genotype-phenotype association in the observed antibody susceptibility outcomes. Results from these investigations will be presented along with the functional GIA data.

Hankie Uluko

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Dr. Uluko has been teaching and researching in areas related to functional foods from animal proteins producing bioactive peptides using ultrasound, microwave and heat pretreatments, hydrolysis, membrane filtration in order to come up with novel and green technologies for health products.

Poster 58

Plant Proteins: Future Mines of Bioactive Compounds

The paper reviews current trends in bioactive compounds mining from plant proteins. Previous works have focussed on hydrolysing animal based proteins to get bioactive peptides but the new direction is to tap a wide range of complex proteins from plants. Pretreatment technologies such as ultrasound, high pressure, pulsed electric and microwave can be used to enhance bioactive mining from plant proteins. The bioactive compounds could then be assayed for anticancer, anti aging and antimicrobial activities and help in the fight for improved health in the world.

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Dr. Verma is a biological engineer specializing in nanotechnology, biosensors, and point-of-need diagnostics. His innovative research encompasses a wide spectrum of applications, spanning plants, animals, humans, and the environment. His laboratory pioneers field-deployable biosensors, offering swift detection solutions for viruses, bacteria, antimicrobial resistance genes, and fungi. This transformative technology has seamlessly transitioned to commercialization through his startup, Krishi Inc. Dr. Verma's lab addresses critical challenges, including bovine respiratory disease (causing annual losses of $900 million in the U.S.), and the global African swine fever outbreak. His expertise extends to zoonotic transmission (e.g., COVID-19), environmental risk assessment for food safety (fresh produce and meat products), and plant pathogen detection. He has a publication record of 45 peer-reviewed journal articles, four book chapters, and 16 conference proceedings, totaling over 1800 citations (h-index 22, i10-index 33 on Google Scholar). He has given 27 invited talks. He holds three patents and has submitted 23 patent applications (including provisional ones). Dr. Verma has secured over $7 million in funding through grants, awards, and contracts, as PI while actively contributing to additional diverse interdisciplinary projects as co-PI.

Poster 59 :

Field-Deployable Biosensors for One Health: Demonstrations in Plants, Animals, Humans, and the Environment

The intricate interplay among plant, animal, human, and ecosystem health underscores the need for innovative approaches capable of monitoring and identifying potential threats across species boundaries. Field-deployable biosensors have the potential to advance the principles of One Health, by offering rapid insights and circumventing the delay associated with traditional lab-based methods. In this context, we have harnessed loop-mediated isothermal amplification (LAMP) on microfluidic paper-based analytical devices (µPADs) as a versatile biosensor platform.

This biosensor facilitates the detection of nucleic acids (RNA/DNA) through a simple heat source (e.g., a consumer-grade sous vide cooker acting as a water bath) and generates a colorimetric response visible to the naked eye. Furthermore, the adoption of µPADs streamlines operation, simplifying user involvement to merely introducing the sample of interest.

Illustrating the utility of biosensors in the context of infectious diseases, we present a series of case studies spanning diverse applications. In plant health, we showcase the identification of viral pathogens affecting crops. Transitioning to animal health, our biosensor platform successfully detects bacteria, viruses, and antimicrobial resistance genes pertinent to the cattle and swine industries. For human health, we exhibit the detection of SARS-CoV-2 in saliva samples. In an environmental context, we emphasize the quantitative assessment of fecal contamination, enabling the evaluation of food safety risks stemming from animal operations.

We validate the field-deployable nature of these biosensors and demonstrate their high concordance with conventional lab-based results. Looking ahead, the integration of these tools across ecosystems holds the potential to mitigate critical challenges such as emerging infectious diseases and antimicrobial resistance, aligning with the comprehensive framework of One Health.

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Christopher C. Wilcox, PhD is an Electrical Engineer at the US Air Force Research Laboratory. Prior to this, Dr. Wilcox worked in the field of Adaptive Optics, Optical Interferometry, and Wavefront Sensing & Control at the US Naval Research Laboratory for 15 years. His research areas include optics, adaptive optics, mathematics, and hardware interfacing. He earned his PhD in Engineering at the University of New Mexico in 2009 in which his dissertation topic was a model for atmospheric turbulence and holds several government patents. Dr. Wilcox is a Research Fellow at the US Naval Postgraduate School at the Adaptive Optics Center of Excellence in National Security. He is a Fellow of SPIE, the international society for optics and photonics, in which he served several years as chair of the SPIE Information Technologies Committee, served on the Publications, Strategic Planning, and Symposia Committees, and has chaired over a dozen technical conference sessions. Previous work also includes working for the National Radio Astronomy Observatory at the Karl G. Jansky Very Large Array outside of Socorro, New Mexico. Dr. Wilcox has also had many years of experience in the development of mobile applications for smartphones including Android and iOS as well as web development and assisted in the development of SPIE's first smartphone apps as well as the highly utilized SPIE Conferences app.

Poster 35

Adaptive and Aero-Optical Turbulent Flow Forecasting Using Machine Learning Techniques

The use of artificial neural network predictive models for closed-loop system performance improvement has been increasing [1-4]. In addition, the advancement of optical system sensing technologies has driven the quality and quantity of data in this space. The demand for these higher-fidelity systems has also increased and thus driving cost and supply into complex regimes. In an airborne optical system, the environment induces unwanted and rapid index of refraction fluctuations from the varying air densities surrounding an airborne platform. These are referred to as aero-optical distortions. At AFRL, in partnership with cutting-edge universities in this field, we have implemented data-driven and artificial neural network predictive models to forecast the state of turbulence in a closed-loop adaptive optical system to reduce latency. We have demonstrated results that can extract useful dynamics from high-speed, turbulent conditions and apply them to forecasting techniques to increase system performance.

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Rachael is a research fellow and Ph.D. candidate in the lab of James Crowe at the Vanderbilt Vaccine Center. Before joining the Crowe lab, she earned her BS and DVM from the University of Tennessee. Her work currently focuses on the humoral immune response to influenza and uses air-liquid interface cell culture techniques and animal models to test antibodies as therapeutic candidates. She is interested in antibodies as drugs for vulnerable populations, pandemic preparedness, and the intersection of vaccinology with OneHealth.

Poster 60

Elucidating Synergistic Strategies: Combination Antibody Therapy Directed at Influenza B Eradication

Influenza causes an estimated 1 billion cases yearly, with severe cases leading to fatal bronchopneumonia. Influenza type A (IAV) and influenza type B (IBV) comprise the strains that circulate yearly. Because IBV does not have an animal reservoir, it is thought to be an eradicable disease, an effort that will require strategic interventions to reduce the disease prevalence. Particularly vulnerable populations are pediatric, geriatric, and immunocompromised individuals. Influenza virions express two major surface glycoproteins, hemagglutinin (HA) and neuraminidase (NA), both of which elicit a protective humoral immune response with distinct mechanisms of action. Monoclonal antibodies (mAbs) directed at HA are often able to neutralize by blocking the receptor interaction with sialic acid. In contrast, NA-directed mAbs protect by blocking the egress of viral particles. Understanding the interplay and dynamics of these classes of antibodies is a largely understudied area in IBV infection. Here we describe a panel of mAbs isolated from a naturally infected human donor. Donor plasmablasts were single-cell sequenced, and IBV HA and NA reactive clones were identified from a screen of expressed mAbs. First, the mAbs were tested for binding on ELISA, and the broadest and most potent mAbs were selected. HA mAbs were tested for function on real-time cell analysis neutralization and hemagglutination inhibition. NA mAbs were tested for enzymatic inhibition on the NA-Fluor and Enzyme-linked lectin assay. We found a panel of 10 broadly reactive HA mAbs, with variable neutralization, and 20 broad and potent NA mAbs. These data support the role of both HA and NA-directed mAbs in a protective immune response to IBV. In summary, these data provide a large panel of diverse mAbs in response to natural infection, promising findings that have implications in monoclonal drug cocktails that target two stages of the viral life cycle.

Sheng Xu

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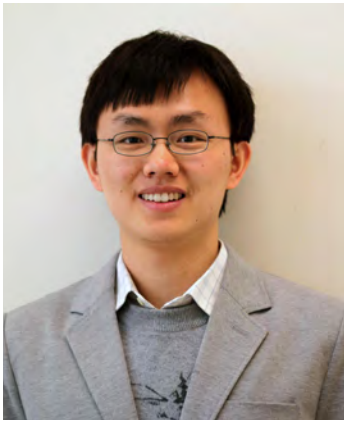

Dr. Sheng Xu holds the position of Associate Professor and Jacobs Faculty Scholar at the University of California San Diego. He earned his B.S. degree in Chemistry from Peking University and his Ph.D. in Materials Science and Engineering from the Georgia Institute of Technology. Subsequently, he engaged in postdoctoral studies at the Materials Research Laboratory at the University of Illinois at Urbana-Champaign. The focus of his research group is the development of new materials and fabrication methods for flexible health monitoring and energy harvesting devices. His research has been presented to the United States Congress as a testimony to the significance and impact of funding from the National Institutes of Health. He has received numerous awards and honors, including the NIH Maximizing Investigators' Research Award, NIH Trailblazer Award, Sloan Fellowship, Wellcome Trust Innovator Award, MIT Technology Review 35 Innovators Under 35, IEEE EMBS Technical Achievement Award, ISBE Outstanding Youth Award, ETH Zürich Materials Research Prize for Young Investigators, and MRS Outstanding Early Career Investigator Award.

Poster 61

Wearable Ultrasound Technologies for Continuous Deep Tissue Monitoring

The use of wearable electronic devices that can acquire vital signs from the human body noninvasively and continuously is a significant trend for healthcare. The combination of materials design and advanced microfabrication techniques enables the integration of various components and devices onto a wearable platform, resulting in functional systems with minimal limitations on the human body. Physiological signals from deep tissues are particularly valuable as they have a stronger and faster correlation with the internal events within the body compared to signals obtained from the surface of the skin. In this presentation, I will demonstrate a soft ultrasonic technology that can noninvasively and continuously acquire dynamic information about deep tissues and central organs. I will also showcase examples of this technology's use in recording blood pressure and flow waveforms in central vessels, monitoring cardiac chamber activities, and measuring core body temperatures. The soft ultrasonic technology presented represents a platform with vast potential for applications in consumer electronics, defense medicine, and clinical practices.

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Dr. Rabia Yahya is an assistant professor with 8 years experience in teaching in the area of Electronics, Electromagnetism and Telecommunications. She is a researcher with a number of published articles and book chapters in prestigious international journals and conferences, with multiple skills and fluency in three different languages.

Poster 62

UWB Transparent Antennas with Diversity Features

Transparent antennas with UWB performance and diversity features are presented. Antennas' transparency has been used for Solar panels, screens of mobile phones, automotive communications, smart glasses and so on. Where the transparent characteristics can be applied unlimitedly on any surface. Along with UWB and diversity features, the proposed antennas can be of a great value for a variety of applications such as base stations for cellular communications as well as smart glasses for virtual reality and more importantly for medical applications where the glasses can be helpful in diagnosis of a number of diseases. The proposed antennas provide compact size- through the employment of CPW and PCB technologies-, dual orthogonal-polarization, good isolation as well as MIMO performance.

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Dr. Jie Zhang is currently an Associate Professor in the Department of Mechanical Engineering and Department of Electrical and Computer Engineering (Affiliated) at the University of Texas at Dallas (UTD). Dr. Zhang received his Ph.D. (2012) in Mechanical Engineering from Rensselaer Polytechnic Institute (RPI), Troy, NY, USA. His research expertise and interests are power & energy systems, renewable integration, machine learning, complex engineered systems, and multidisciplinary design optimization. This research has resulted in over 200 peer-reviewed journal and conference publications. His research has been funded by the U.S. Department of Energy, Department of Defense, National Science Foundation, and energy industry. His major awards include: ONR's Young Investigator Award, ASME Design Automation Young Investigator Award, Fulbright U.S. Scholar Award, 12 best paper awards from multiple journal and IEEE, ASME, AIAA, ASM conferences. He is an Associate Editor of Solar Energy, Journal of Energy Engineering, and Journal of Mechanical Design (Guest Editor). He is a member of AIAA Multidisciplinary Design Optimization technical committee.

Poster 63

Black Start of Coastline Power Networks From Grid-forming Ship-to-Grid Services

The expansion of electric ships in the transportation sector, along with environmental advantages, has the potential to enhance the resilience and stability of coastline power grids during blackouts or emergencies through ship-to-grid technology. The power grids located in remote coastal and island communities often face high energy costs and are more vulnerable to blackouts due to their increased risk of natural disasters. Ship-to-grid technology offers an innovative localized solution that enables onshore utilities to avoid the need for installing excessive on-land energy storage capacity to enhance stability and resiliency in the coastline power grid. Electric ships can provide a flexible source to restart power to critical facilities such as hospitals and communication networks. In this paper, a comprehensive scheme for integrating ships into the grid system is proposed, which involves a grid-forming control approach through a DC-link connection. The approach employs a droop-based control strategy, current limiter control, and voltage source grid interface to regulate both voltage and frequency at various stages of the coastline power network restoration. The approach is verified using a 4-zone shipboard power system with grid-forming DC-link connection, for black start of a modified IEEE 30-bus test system during a multi-step black start and re-energization process.

Dalal Najib

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Dr. Dalal Najib is the senior director for Science and Engineering Capacity Development activities at the Policy and Global Affairs (PGA) Division of the U.S. National Academies of Sciences, Engineering and Medicine (NASEM).

Dr. Najib manages the Arab-American and US-Africa Frontiers programs. She has worked for nearly 10 years on the USAID- funded Partnerships for Enhanced Engagement in Research (PEER) program where she managed the sub-Saharan Africa, Middle East and the Central Asia regions. She is the principal investigator of multiple awards from various agencies, including NSF (6), USAID, NASA and DOD. Dr. Najib 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 Climate and Space Sciences and Engineering and a master's degree in public policy (MPP) from University of Michigan. Prior to that, she received her undergraduate degree in aerospace and aeronautical engineering from Supaero (Toulouse, France).

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Rose Parker is a senior program assistant on the Science and Engineering Capacity Development Board at the U.S. National Academy of Sciences. Prior to her work at the Academies, she was a social media intern at AGE+, an Oregon-based aging rights advocacy organization, and an outreach intern at FairVote, a ranked-choice-voting advocacy organization. She holds a Bachelor of Arts in Political Science and Hispanic Studies from Vassar College.

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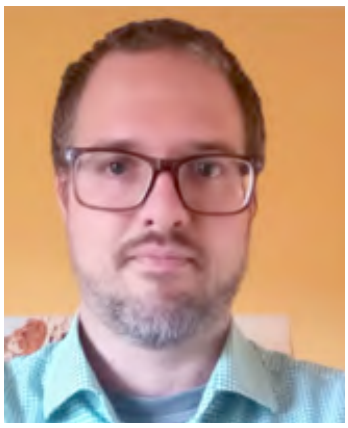

Daniel Placht is a program officer in the Science and Engineering Capacity Development Theme of the U.S. National Academies of Sciences, Engineering, and Medicine (NASEM). He currently directs the Connections to Sustain Science in Latina America program, and works on projects and activities focused on international science networks and capacity building, including the U.S.-Africa Frontiers and Arab-American Frontiers programs. He also works on the Partnerships for Enhanced Engagement in Research program where he manages research grants in Central Asia, the Middle East and North and Eastern Africa. Before joining NASEM, Daniel worked 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 and a master's degree in environmental science and engineering from Virginia Tech.

Omar Fassi-Fehri

Permanent Secretary

Hassan II Academy of Science and Technology

Rabat, Morocco

Omar Fassi-Fehri, the Permanent Secretary of the Hassan II Academy of Science and Technology (nominated since July 2004 by His Majesty the King Mohammed VI). From 2002 to 2004 he was Minister Delegate in charge of Scientific Research. From 1998 to 2002 he served as Secretary of State in charge of Scientific Research.

He began his academic career at the Faculty of Sciences (Rabat, Morocco) as Professor of Mechanics, he directed since 1981 the Mechanics and Materials Laboratory of the Faculty of Sciences (Rabat). He was Member of the Jury of aggregation in Physics (1988-1992) and President of the Jury of aggregation in Mechanical engineering from 1989 to 1991. He served as Director of the National Higher School for Technical Education (Ecole Normale Supérieure de l'Enseignement Technique, Rabat, from 1991 to 1998).

Prof. Fassi-Fehri received a Master degree from the University of Paris (France) and his Ph.D. in Mechanics from the University of Metz (France). His research area is High Energy, Cosmology, Materials, Mechanical Engineering, Rheology. In addition, he is the author and co-author of several individual and collective works including scientific articles in his field of specialization, published in international indexed journals, and specialized communications in major international conferences.

Prof. Fassi-Fehri is a Member of the Higher Council of Education, Training and Scientific Research, a Member of the National Coordination Commission for Higher Education (Morocco), and a Foreign Fellow of the Academy of Science and Technologies of Senegal (since 2002). He is also Member of several boards in Morocco including National Center for Scientific and Technical Research Board, National Agency for Evaluation and Quality Assurance of Higher Education and Scientific Research Board and Euro-Mediterranean University of Fès Board.

He contributed in different societal instances: he was President of the Organizing Committee of the 1st, 2nd and 3rd International Congresses of Mechanics in Morocco; Founder and Honorary President of the Moroccan Society of Mechanical Sciences (since 1998); organizing member of the Assizes on Training in Applied Sciences and Techniques.

He was awarded Knight of the Order of the Throne of the Kingdom of Morocco and Officer of the Order of the Academic Palms (France).

Mostapha Bousmina

Chancellor

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Professor Bousmina's background is in Physics, Physical Chemistry and Nanoscience. He got his Engineering diploma from École des Hauts Polymères of Strasbourg, France and MSc. from Louis Pasteur University-France. He then got a Ph.D. from Louis-Pasteur University-France in collaboration with the University of Illinois in Chicago, USA and then a Post-Doc at École Polytechnique of Montreal, Canada. He is presently the Chancellor of the Hassan II Academy of Science and Technology, Morocco, President of the Euromed University of Fes, Morocco, President of ASRIC (African Science, Research & Innovation Council) of the African Union. He is Member of WAAS (World Academy of Art and Science), of TWAS (The World Academy of Sciences), of AAS (African Academy of Sciences), Member at large of Polymer Processing Society (PPS), Co-Editor of the Journal of Polymer Engineering, Associate Editor for the Journal of Nanoscience and Nanotechnology, Regional Editor of Recent Patents in Nanotechnology and Member of the Editorial Board of J. of Polymer Processing. He was President of NASAC (Network of African Science Academies), Senior Canada Research Chair on Polymer Physics and Nanomaterials at Laval University, Canada, Co-Founder and Director General of MASciR (Moroccan Advanced Science, Innovation and Research Foundation). President of Quebec Society of Polymers, Director of Canada SPE (Society of Plastic Engineers), Vice-President of the Canadian Society of Rheology, Member of the Canada Team for Aerospace, Member of the Executive Board of IAP (InterAcademy Partnership), Member the board of Trustees of PSL University (Paris Sciences et Lettres, France) and of Shenkar University in Israel. His contributions in science & Engineering are in rheology of multiphase systems and in nanoscience and nanotechnology, with more than 220 publications, 9 patents and an H-index of 56 in Scopus and 62 in Google Scholar. He was Ranked in 2021 and in 2023 among the top 2% of scientific researchers in the world by Stanford Group. He got the Cross of the Order of Civil Merit of Spain in 2022, the Grand Prize on Innovation in Scientific Research from the Ministry of Higher Education, Morocco in 2009, the STEACIE fellowship from NSERC (Natural Science and Engineering Research Council of Canada) in 2004, Canada's Top Twenty Researchers Prize from CIAR (Canada Institute for Advanced Science) in 2002, the International Morand Lambla Award from the Polymer Processing Society in 2000, the Innovation Award from the Ministry of Industry, Canada in 1999 and the Louis-Pasteur Award, France in 1994.

Driss Ouazar

Professor of Computational Civil Engineering and Water Resources

Mohamed V University, Ecole Mohammadia d'Ingénieurs

Rabat, Morocco

Driss Ouazar is Professor of Computational Civil Engineering and Water Resources. (Mohammed V University, Ecole Mohammadia d'Ingénieurs, Rabat). He is a Resident Member of Hassan II Academy of Science and Technology since its creation in 2006, He is the National Representative of the International Association of Hydrological Sciences (IAHS), member of High Water and Climate Council, Founder of Adaptation Metrics and Techniques Cluster Water, Agriculture and Cities, Former President of UM6P University and Former Director of School of Engineering (Mines Rabat), Former member of Scientific Committee of COP22 and Scientific Board of the National Research Council of Morocco, Former Member of the Higher Council of Education, Training and Scientific Research and the Scientific Research Commission (Morocco). He is the Scientific committee of AAA (Adaptation Agriculture Africa- Moroccan Initiative). He was African Scientific Research and Innovation Council (ASRIC) Vice Chair and represents ASRIC as a co-Founder of the International Platform of Adaptation Metrics hosted by Africa Agriculture Adaptation (AAA) and currently the chair of IPAM Water. He was Jury Chair of 2019 African Union Kwame Nkrumah Awards for Scientific Excellence (AUKNASE), the African Union, Addis Ababa. He is also the Director of the College (Science and Technology for Environment, Earth and Sea), Associate Editor and Executive Director of Frontiers in Science and Engineering International Journal of the AH2ST.

Lalla Btissam Drissi

Full Professor, Mohammed V University in Rabat

Member, Hassan II Academy of Science and Technology in Morocco

Lalla Btissam Drissi is a Moroccan full Professor at the Faculty of Sciences Mohammed V University in Rabat, specializing in quantum science. Her primary research focus lies in modeling and engineering emergent materials for advanced applications in energy, environment, spintronics, sensing and health. She is also a corresponding member of the Chemical and Physical Sciences College at the prestigious Hassan II Academy of Science and Technology in Morocco. Prior to this, Dr Drissi held a permanent position as a Dr Researcher at INANOTECH (Institut des Nanosciences et des Nanotechnologies).

Since 2018, she has served as the head of the Falling Walls laboratory in Morocco, and organizing an interdisciplinary forum for exceptional Moroccan talent and innovative thinkers. From 2018 to 2022, she chaired the African Network for Advanced Two-dimensional Materials for Nanotechnology, comprising research groups from 12 African countries. Since 2022, Prof Drissi has been the Moroccan representative of the African Strategy for Fundamental and Applied Physics, leading efforts to reform basic physics research and higher education across Africa. Additionally, she serves as the convener for the ASFAP Condensed Matter & Materials Physics Working group.

Prof. Drissi also oversees Bachelor's degrees programs in environmental sciences and in optics and nanophotonics, and coordinates the ICTP Physics Without Frontiers programme for selected classes of Moroccan master's students. Actively involved in organizing international scientific events, she also chairs various National Meetings, annual conferences, workshops and advanced schools for PhD students and young researchers. Driven by cutting-edge research projects, she collaborates with Moroccan institutions and international partners.

Throughout her career, Professor DRISSI has been recognized for her contributions to scientific research and education. She has published over 140 research articles in international journals, and has supervised numerous Master's and doctoral students. Additionally, she has published books and book chapters, and has handled in several scientific editorial boards. Her research work has been honoured with national and international awards, including membership at the International Centre of Theoretical Physics in Italy, membership in the Arab-German Young Academy of Sciences and Humanities in Germany, the Georg Forster Research award by the Alexander von Humboldt Foundation, and the Guardian of Sciences award for a research security tour with Harvard University.

Rachid Benmokhtar Benabdellah

Member, Hassan II Academy of Science and Technology in Morocco

Rachid Benmokhtar Benabdellah started his career with IBM France in 1967. In 1973 he founded with 6 other engineers the first Moroccan consulting company in information technology. IIn 1978 he founded with Parsons&Brickenhoff (New York) a subsidiary in Morocco, today CID, one of the most important engineering firms in Africa. In 1977 he was selected by the Club Of Rome as contributor to the project " No Limits to Learning "; Between 1973 and1990 he taught as a visiting professor at Mohammedia School Of Engineering and contributed to the creation of the departments of computer sciences and industrial engineering.

Between January 1995 and March 1998 he served as Minister of Education. In June 1998 he was appointed by His Majesty King Hassan II President of Al Akhawayn University (AUI) a newly founded higher education institution now the only non-American university accredited in the US. In 2003 he was appointed by His Majesty KIng Mohammed VI Chairperson of The scientific commission in charge of the 50 Years Of Independence Development Report (RDH50) and in 2006 Chairperson of the board and President of the National Observatory of Human Development. In October 2013 KING Mohammed VI appointed him Minister Of Education And Vocational Training. After retiring in 2017 he served 3 years as an expert to UNDP as a member of the Evaluation Advisory Panel of the Independent Evaluation Panel of the Independent Evaluation Office till 2020.

His present activities are shared between the Hassan II Academy of Science and Techniques as resident member, The board of the Foundation of the 3 Cultures of the Mediterranean (Spain) and the board of the Project Aladin Foundation (Paris).

He also served as a member of the Advisory Board of the World Bank Institute (1998-2001) member of the Committee of Experts in Public Administration (2001-2009), one of the 15 experts invited by the Director General of UNESCO to review the exact and social sciences of the institution (2006-2008). Awards and Acknowledgements include: Chevalier de l`ordre du Trône of Kingdom of Morocco; Officier de la Légion d`Honneur of the France Republic; Cross of the Merit of the Albert Einstein Academy Foundation; The United Nations Certificate of Recognition of the United Nations. Rachid Benmokhtar Benabdellah is a Higher Institute of Aeronautic and Space (ISAE) Engineer and an International Institute for Management Development (IMD Lausanne, Switzerland) alumnus.

Mohamed Essaaidi

Chief of Party, Interactive Digital Center Morocco

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Mohamed Essaaidi is General Manager of Moroccan School of Engineering Sciences Group (Since Jan. 2023), Chief of Party of Interactive Digital Center Morocco (since Nov. 2020) and a Professor and past Dean of ENSIAS School of Computer Science of Mohammed V University, Rabat, Morocco (since 2011), past Director of International Cooperation at the Ministry of General Affairs & Governance, Morocco (2019), and past faculty member (Professor & Assistant Professor) at the Faculty of Science of Abdelmalek Essaadi University, Tetuan, Morocco (1993-2011). He is IEEE Global Cities Alliance, MEA Chairman (2021-2022), IEEE Humanitarian Activities Committee (HAC) Assessment Committee Member (2021-2022), IEEE EAB Teaching Excellence Editorial Hub, Member (2021-2022), and IEEE Public SafetyTechnology, Education Chair (2022). He is also the founder and past Chairman of the IEEE Morocco Section (2005-2016), co-founder and chair of IEEE Morocco APS/MTT-S joint Chapter (2005-2010), IEEE Communications / Computer Society Chapter (2006-2008) and IEEE Education Society Morocco Chapter chair from 2007 to 2009. He has been a member of the Committee of Global Accreditation activities of IEEE Education Activities Board (2017-2018). He has also been the Director of the Morocco Office of Arab Science and Technology Foundation, ASTF (2006-2009) and the Coordinator of ASTF RD&I Network of Electro-Technology (2006 – 2008). He has authored and co-authored 10 books and more than 200 papers in international refereed journals and conferences in the field of Electrical and Computer engineering and its diverse applications. He has been Guest Editor of several international journals. He is also an active member of the editorial boards of several international journals in the same fields mentioned above.

Furthermore, Prof. Essaaidi is the founder and the General Chair / co-chair of several IEEE technically sponsored international conferences such as Information and Communication Technologies International Symposium (2005, 2007), NATO Advanced Research Workshop on Information Security Assurance (2005), International Conference of Multimedia Computing and Systems series (2009-2016). He also co-organized and co-chaired IEEE Smart Cities Summit in May 2020, the US National Academies 5th Arab American Science, Engineering and Medicine Frontiers Symposium in November 2017, Rabat, Morocco and US NSF sponsored workshop on Smart Cities in January 2016 in Rabat, Morocco. He has also served in the Organizing committees and TPC and presented keynote talks at many other international conferences worldwide. Prof. Essaaidi holds 10 patents in the field ICT. Some of these patents received several international innovation awards. He was also a member of the IEEE 802.16 Sponsor Ballot Pool of IEEE Standard Association that defined the technical specifications for WiMAX, and of that of IEEE P2784 - Smart City Planning and Technology Guide Work Group (2020-2021) that cover several aspects related to Smart Cities. He has supervised several Masters and PhDs theses and has been the principal investigator and the project manager for several research projects in the framework of national and international programs dealing with several research issues related to cybersecurity and privacy. Moreover, in the framework of his position as the director of International Cooperation in the Ministry of General Affairs and Governance (Morocco), he was involved in the coordination of the World Bank Group Morocco Country Partnership Framework (2019-2024) and OECD Morocco Country Program (2019-2021) among other international cooperation programs.

Abdelaziz Sefiani

Professor of Medical Genetics

Faculty of Medicine and Pharmacy, Mohammed V University Rabat

Professor Abdelaziz Sefiani studied medicine at the Mohammed V University in Rabat where he was awarded MD in 1984. He obtained his PhD in human genetics at the University Paris VII in 1989. After completing his training in medical genetics at U-12 National Institute of Health and Medical Research (INSERM) in Paris and after his return to Morocco, he started to applied genetics as a new science in medical practice. He introduced for the first time in the Moroccan public health care system, genetic testing to improve diagnosis and prediction of hereditary diseases. Abdelaziz Sefiani is presently professor of genetics at the Faculty of Medicine and Pharmacy of Rabat, and the head of the Department of Medical Genetics; he set up in 1990 at the National Institute of Health in Rabat. This department was the first integrated Center of Genomic Medicine in Morocco that offers various services such as genetic counselling, cytogenetic and molecular testing. Professor Sefiani dedicated his career to improving the diagnosis and prevention of genetic diseases and to advancing the knowledge and understanding of the genetic diversity in the Moroccan population. With regard to research, the he has being co-director of the International Associated INSERM Laboratory on child genetics disabilities (2008-2014). His research team, accredited by the Mohammed V University, contributed to the discovery of several new genes and mutations associated with genetic disorders. Professor Sefiani is the co-author of 175 peer reviewed papers published in International Journals, (Complete list on Scopus, h-index: 30). Among his academic accomplishments, Professor Sefiani has initiated a graduate training programme in medical genetics for young physicians and was a founding member and first president of the Moroccan Society of Medical Genetics. Professor Sefiani is a resident member of Academy Hassan II of Science and Technology.

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Professor Mahfoud Ziyad received his PhD from the National Polytechnic Institute of Lorraine (INPL, France) in 1976. The same year he was appointed as professor of physical chemistry at the University Mohammed V (Rabat), where he taught kinetics, thermodynamics, heterogeneous catalysis and conducted research. He setup the first laboratory of heterogeneous catalysis in Morocco and he was fortunate to be funded by several Moroccan companies including the phosphate mining company (OCP). The principal topic explored were the investigation of dynamic systems in heterogeneous catalysis which exhibit an oscillatory phenomenon. In addition, he also studied the dehydrogenation of alkanes using modified phosphates as the catalysts. In that perspective, he showed that the oxidation of butan-2-ol displays in particular conditions an oscillatory behaviour over a palladium catalyst. That system can enter a chaotic regime under certain conditions. He is also owns a patent on the decolourisation of sugar syrups using natural phosphates. M. Ziyad has published over 120 articles in international revues and supervised 30 PhDs of students in catalysis. From 1994-95, he was Research Director at the Institute of Research in Catalysis (CNRS) in Lyon. He has been also invited as guest researcher in several universities in Europe. Actual he is the chair of the global council of the Science Education Program (SEP) at InterAcademy Partnership (IAP) and a resident member the Hassan II Academy of Science and Technology.

The help provided by the staff
of the Hassan II Academy of Science and Technology is highly acknowledged

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