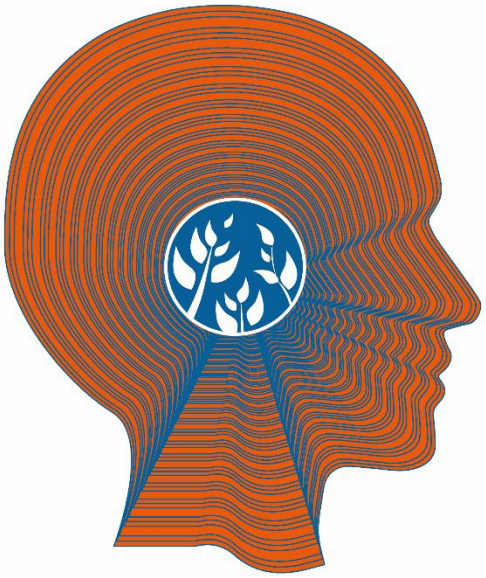

Machine Intelligence for Society and for all Sciences

GYA Annual General Meeting and International Conference of Young Scientists

Bremen, Germany

30 June - 3 July 2026

GLOBAL YOUNG ACADEMY | 25 YEARS CONSTRUCTOR UNIVERSITY

Member Research Talks

Book of Abstracts

01 July 2026, 04:00 - 05:30 PM
Three parallel sessions

Seminar Rooms I - III

Research Talks Session One - *Artificial Intelligence*

Seminar-Room I , 01 July 2026, 04:00 - 05:30 PM

Moderator: Antonia Morita Saktiawati

Anina Schwarzenbach	How Democracy Debates AI and Why It Matters
Melina Florez-Cuadros	Integration of AI and Space Sciences to Analyze the Effects of Microgravity Environments on Embryonic Development and Adult Formation in *Drosophila melanogaster*
Nourhan Hassan	From Bench to Bedside, Faster: AI's Role in Drug Discovery for Women's Health
Santosh Sridhar Mysore	Machine Learning–Driven Design of Selective Metal-doped Graphene Sensor Array for Societal Safety
Wilson Alavia Medina	Comparison of Machine Learning and Physics-Informed Machine Learning Models for Carbon Dioxide Solubility in Saline Solution
Rishemjit Kaur	Found in Translation: LLMs and NLP for Low-Resource Languages
Deniz Sarikaya	Philosophical Investigations into AI Alignment: A Wittgensteinian Framework
Marta Caviglia	Bridging Data Gaps in Emergency Care: The NIGHTINGALE Project and the Future of AI in Mass Casualty Management
Rita Esuru Okoroafor	Building Trust in CO_2 Storage: Machine Learning for Predicting and Preventing Subsurface Integrity Risks
Mohammad Hosseini	AI Agents and the Transformation of Research: Integrity, Trust, and the Future of Professional Research
Jose Luis Flores Guerrero	AI and Cardiometabolic Risk Prediction: Toward Scalable and Democratized Personalized Medicine
Martin Schletterer	Use of AI for Camera Monitoring of Fishways - State of the Art & Outlook
Yalinu Poya	Pollutant Survey and AI-Driven Decision Support for Brownfield Remediation in Boston: A One Health Perspective
Nefin Shalalfeh	Breaking the Loss of Care: AI for Diabetes in Crisis Settings
Pooja Devi	AI-Guided Design of 2D Materials for Catalytic Hydrogen Generation
Diego Martinez-Castro	The Moving Target: Digital Inequalities from the Digital Divide to Artificial Intelligence
Hanjo Hamann	The Copyright Law of Generative AI
Antonia Morita Saktiawati	TBScreen.AI: Inclusive AI-Based Chest X-Ray Screening System for Tuberculosis in Remote Areas of Indonesia

Research Talks Session Two

Seminar-Room II, 01 July 2026, 04:00 - 05:30 PM

Moderator: Ovie Edegbene

Amarjargal Dagvadorj	Public Health in Environmental Negotiations
Waheba Mohamed	When DNA Repair Fails: From Cancer to Brain Disease
Phivos Phylactou	The eyes as the window to the brain
Natalia Montellano Duran	Exploring Antioxidant Potential in Bolivian Ethnobotanical Resources
Kok Sin Woon	Driving Climate Ambition through Sustainable Solid Waste Solutions
Needa Brown	Design of Controlled Release Drug Delivery Systems
Keith Phiri	Political Ecology of Food Resilience: Smallholder Farmers' Agro-Ecology in Chimanimani District, Zimbabwe
Christian Nkanga	Nanocarrier Delivery of a Plant-Derived Antimicrobial to Fight Multidrug-Resistant Bovine Mastitis
Xavier Chiriboga Morales	Empowering Insect Science for Global Cha(lle)nges
Carina Geldhauser	Atmospheric Modelling Techniques That Enable Regional Climate Actions
Luisa Cortesi	Learning to Live in Disastrous Waters
João Borges	Chemically Programmable and Dynamic Supramolecular Biomaterials to Guide Cell Fate
Éva Dékány	The Linguist's Toolkit: How To Study Languages Without Speaking Them
Tariq Khan	Biomolecule Functionalized Silver Nanoparticles as a Novel Strategy to Combat Antimicrobial Resistance in *Escherichia coli*
Nichole Lighthall	Decision Making in Aging and ADRD Across Traditional and Technology-Mediated Context
Mojtaba Abdi Jalebi	Powering the Planet by Turning Carbon Emissions into Renewable Liquid Energy
Borgar Aamaas	Greenhouse Gas Emissions from Soccer, Cross-Country Skiing, and Motocross in Norway

Research Talks Session Three

Seminar-Room III, 01 July 2026, 04:00 - 05:30 PM

Moderator: Natisha Dukhi

Fun Man Fung	GAELIC MENTORS: A Peer Mentorship Model to Advance Gender Equality in Introductory Chemistry
Alexia Nunez-Parra	Social Interaction in a Mouse Model of Neurodevelopmental Disorder: From Behavior to Circuits
Solange Paredes Moscosso	Inflammation, Ancestry, and Risk: Leveraging Genomic Diversity to Decode Breast Cancer Risk in Latin America
Mohamed Alimohamed	If Your DNA Is Missing, Can Medicine Still Understand You?
Praveen Kumar	Harnessing Spin-Dependent Catalysis in 2D Materials
Noor Shaila Sarmin	Assessment of Seaweed Extract and Salicylic Acid for Mitigating Drought Stress in Barley Using UAV-Based Remote Sensing and Field Trials
Ganbaatar Khurelbaatar	UFZ's Knowledge Transfer for Sustainable Water Management
Mujtaba Ali Isani	Trust in Domestic Political Institutions Among European Muslims: The Significance of Discrimination
Emelda Chukwu	Exploring Undergraduate Student's Attitude, Concerns and Support Needs Concerning Antibiotic Use
Wasim Sajjad	Diketopiperazines (DKPs) as Quorum-Sensing Inhibitors: Biosynthetic Dark Matter and the "Unknown Unknowns" in Natural Product Discovery
Rima-Maria Rahal	Cognitive Processes of Normative Decision Making: Webcam-based Eye-tracking Analysis in 8 Societies
Branislav Pantovic	Scientific Diasporas as Strategic Actors: Rethinking Knowledge Mobility in a Transnational World
Peter Gan Kim Soon	Reimagining Healthcare to Address Stunting
Ankit Agarwal	Pioneering Methods for Understanding and Forecasting Hydro-Climate Extremes
Lahcen EL Youssfi	Water Food Energy Nexus: Potential Uses of IoT and New Technologies Towards Sustainability of Agroecosystems in Africa
Natisha Dukhi	Designing with Adolescents: Translating Co-Creation into Digital Innovation for Obesity Prevention

Amarjargal Dagvadorj

Parliament of Mongolia

Public health in environmental negotiations

This study examines how public health issues were discussed within environmental negotiations at the UN Convention to Combat Desertification's COP meetings. Focusing on the host country context, it analyzes how local ecological conditions and infrastructure constraints informed references to public health in policy debates. Using selected negotiation sessions and policy documents, the study compares scientific, bureaucratic, and indigenous perspectives on health and the environment. The analysis shows that these perspectives were often misaligned, shaping how health issues were framed and limited within the negotiations.

Anki Agarwal

Indian Institute of Technology Roorkee, India

Pioneering Methods for Understanding and Forecasting Hydro-Climate Extremes: From Complex Climate Dynamics to Operational Solutions in India

This study presents advanced analytical frameworks to enhance the understanding and prediction of hydro-climate extremes in India such as Extremely heavy rainfall (Cloudburst) and Compound Dry and Hot Extremes (CDHE). Addressing the challenges posed by rising temperatures and altered precipitation patterns, the research integrates methodological innovations, physical process understanding, and operational tools. Methodological advancements include wavelet analysis, network theory, and event coincidence analysis to unravel complex climate dynamics. Physical insights are drawn from detailed investigations of extremely heavy precipitation (cloudburst) such as the transient merging of western disturbances and monsoonal systems, and forensic analyses of catastrophic floods in Himachal Pradesh (2023) and Uttarkashi (2025) and Compound Dry Hot Extremes (CDHE). The work also redefines cloudburst characterization and examines the changing frequency and spatial extent of compound dry and hot extremes, with implications for food security. Leveraging a complex network-based approach, the study identifies key global climate drivers and develops a season-ahead operational forecasting model for CDHE extremes. The outcomes provide a robust foundation for early warning systems, risk assessment, and climate adaptation strategies, supporting sustainable water and disaster management in a warming world.

Anina Schwarzenbach

University of Bern, Switzerland

How Democracy Debates AI and Why It Matters

Artificial intelligence is becoming a major question of public governance because it affects fundamental rights, markets, public services, security, and democratic accountability. Decisions about AI are therefore not just technical matters. They are political choices about which risks societies want to prevent, which benefits they want to encourage, and which values they want to protect. In parliament, these choices are debated through competing arguments about fairness, innovation, safety, responsibility, and the role of law.

Existing tools for analyzing parliamentary speech can show who supports or opposes an issue, but they are less able to capture how politicians justify their positions and how those arguments relate to what parliament actually does. In this talk, I present a reproducible natural language processing pipeline that analyzes the reasoning behind AI governance debates. Applied to Swiss parliamentary speech from 2000 to 2025 and linked to voting records, the project identifies when AI is being discussed, how it is framed, and which ethical and legal arguments are used. The broader aim is to show how democratic institutions make sense of emerging technologies, and how political arguments shape legislative outcomes.

Antonia Morita Iswari Saktiawati

Universitas Gadjah Mada, Indonesia

TBScreen.AI: Inclusive AI-Based Chest X-Ray Screening System for Tuberculosis in Remote Areas of Indonesia

Indonesia ranks second in tuberculosis (TB) burden globally and continues to face a significant diagnosis gap, particularly in remote areas with limited access to radiologists. Approximately 14% of new TB cases are left undetected by TB services. Utilizing artificial intelligence-based computer-aided detection (AI-CAD) applied to chest X-ray (CXR) imaging offers a potential solution to improve TB screening. However, AI systems may exacerbate existing inequities if they are developed and implemented without consideration of gender, age, disability, ethnicity, and socioeconomic barriers to care. This research aims to develop and train an AI-CAD model that considers the balance of gender, age, ethnicity, and disability status. The study will validate an AI-CAD model for TB screening among different socio-cultural and disability status groups. Additionally, it will assess barriers to TB services and inclusive strategies for AI-CAD implementation in remote areas of Indonesia.

This mixed-methods study comprises three integrated components. Part I focuses on the development of TBScreen.AI, an AI-CAD model trained on gender-, age-, ethnicity-, and disability-balanced CXR data from hospitals in Java and Papua. Part II uses a prospective cross-sectional design to evaluate the diagnostic accuracy of TBScreen.AI among individuals with presumptive TB attending four health facilities in Indonesia. AI-generated interpretations are compared with radiologist readings and the final patient diagnosis established by site physicians, based on comprehensive examinations, including anamnesis, physical examination, laboratory investigations, and follow-up assessments. Part III integrates quantitative and qualitative methods to assess access to TB services and to identify inclusive implementation strategies that support equitable deployment of AI-assisted screening.

Borgar Aamaas

CICERO Center for International Climate Research, Norway

Greenhouse gas emissions from soccer, cross-country skiing, and motocross in Norway

Climate change is a pressing global challenge, and greenhouse gas emissions must be reduced across all sectors to avoid the most severe climate impacts. Sport also has a role and responsibility in the transition to a low-emission society, as the climate footprint of sporting activities is considerable. At the same time, sport is of major social importance: in Norway, 93 per cent of young people have participated in organized sport at some point. Travel is often identified

as the main contributor to emissions from sports, a finding our study confirms, while other emission sources have received less attention in previous research.

I will present a study of three sports—soccer, cross-country skiing, and motocross—in which we estimate emissions over one season from training and competition. The analysis includes emissions related to transport, sport facilities, and equipment. While existing research has largely focused on elite professional sport, our study addresses grassroots sport and includes participants and teams from the professional to the amateur level, age groups from 10 years and upwards, and gender differences. The study integrates a wide range of data sources, practitioner input, and emission calculations based on life cycle assessment.

The emission profiles and mitigation challenges differ across the sports. Motocross is unique in that it generates direct emissions from the sporting activity itself, which could be substantially reduced through the adoption of electric bikes. Soccer involves a large number of matches, with travel to away games contributing heavily to the overall footprint. In cross-country skiing, emissions are partly dominated by travel related to training, primarily due to its high frequency relative to the limited number of competitions. In addition, sport facilities may constitute a significant emission source, particularly when they involve land use in forested or bogland areas.

Branislav Pantovic

DiploCientifica, Serbia / Argentina

Scientific Diasporas as Strategic Actors: Rethinking Knowledge Mobility in a Transnational World

Scientific diasporas are often framed as a story of loss: talented people leave, and countries fall behind. This research asks a different question: can scientists living abroad still contribute to national development, even without returning permanently to their country of origin? Based on the project The Venezuelan Scientific Diaspora: Potential for Collaboration and Engagement in the Development of Scientific Ecosystems in the Latin American and Caribbean Region, this talk examines how scientific diasporas can serve as bridges of knowledge, collaboration, and international connection. The Venezuelan case is especially significant given the scale of displacement and the wider institutional and geopolitical pressures shaping the country's scientific system.

The talk argues that scientific diasporas should be understood not as lost talent to be recovered, but as transnational actors who can strengthen scientific capacity, connect local and global agendas, and expand countries' possibilities. Comparative findings suggest that the most effective engagement models move beyond repatriation and rely instead on flexible and hybrid forms of participation, including remote collaboration, short-term exchanges, mentoring, and networked partnerships. They also demonstrate that success depends less on patriotic rhetoric than on institutions, including trust, continuity, coordination, and clear mechanisms for engagement. In this sense, scientific diasporas can become integral to a country's scientific infrastructure and a strategic resource for capacity building, development, and science diplomacy actions. While this is especially relevant for countries facing crisis, fragmentation, or structural inequality, it also points to a broader global question: how should we govern knowledge in a world where scientific talent is increasingly mobile?

Carina Geldhauser

ETH Zurich, Switzerland

Atmospheric modelling techniques that enable regional climate actions

Atmospheric modelling is reshaping climate research by enabling high-resolution, data-driven insight into CO_2 dynamics. We present a framework that integrates satellite retrievals from OCO-2/3, in situ observations from ICOS, and meteorological fields from ERA5 to estimate ground-level CO_2 concentrations at fine spatial scales.

Moving beyond conventional downscaling of national inventories, our approach leverages multimodal data fusion with weighted K-nearest neighbor interpolation and neural networks to infer surface concentrations directly from satellite measurements. The model achieves a Root Mean Squared Error of 3.58 ppm, demonstrating strong agreement with ground observations while preserving local variability.

This level of granularity is critical for advancing atmospheric transport modelling and improving source attribution. By resolving sub-national emission patterns, the framework supports more accurate verification of emission inventories and enhances the detection of localized anthropogenic signals.

For climate policy, such high-resolution atmospheric modelling provides a quantitative basis for targeted mitigation strategies and robust monitoring, reporting, and verification (MRV) systems. It enables policymakers to assess interventions at the scale of implementation and adapt measures based on near real-time feedback.

Overall, this work illustrates how integrating heterogeneous observational data within advanced atmospheric modelling frameworks can bridge the gap between large-scale measurements and local climate action.

Christian Nkanga

University of Kinshasa, Democratic Republic of the Congo

Nanocarrier Delivery of a Plant-Derived Antimicrobial to Fight Multidrug-Resistant Bovine Mastitis

Bovine mastitis is a major infectious disease affecting dairy cattle and causes a significant economic burden for the livestock sector. The disease is commonly treated through intramammary administration of antibiotics (AB); however, extensive and repeated AB use has contributed to the emergence and spread of antimicrobial resistance (AMR), particularly among multidrug-resistant (MDR) Staphylococcus aureus.

Here, we investigated the potential of plant-derived nanotherapeutics as an alternative antimicrobial strategy for mastitis. Specifically, we explored the use of nanoparticles (NPs) loaded with Commiphora swynnertonii resin, a natural product known for its antimicrobial and anti-inflammatory properties. We compared 5 different NPs: liposomes, alginate-based nanoparticles, chitosan-based nanoparticles (ChN), solid lipid NPs (SLN) and nanostructured lipid carriers (NLC). We investigated NPs with/without a hyaluronic acid–stearylamine conjugate (HAC). Antimicrobial activity was assessed against 13 MDR S. aureus strains isolated from cows with mastitis.

Marked differences in antimicrobial performance were observed among the tested nanocarriers. Based on minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) assays, the platforms ranked in ascending order of antimicrobial coverage as follows: liposomes (0% inhibitory and bactericidal activity), ChN (15.4% inhibitory; 0% bactericidal), NLC (23%

inhibitory; 7.6% bactericidal), SLN (69% inhibitory; 46.2% bactericidal), and alginate nanoparticles (100% inhibitory; 53% bactericidal). HAC-functionalized alginate nanoparticles demonstrated the strongest activity, with MIC values ranging from 26–417 µg/mL and MBC values from 35–417 µg/mL.

Overall, this study highlights the potential of alginate–HAC nanoparticles as a promising platform for delivering C. swynnertonii resin, and provides a novel nanotechnology-based strategy to combat MDR mastitis pathogens.

Deniz Sarikaya

Universität zu Lübeck, Germany

Philosophical Investigations into AI Alignment: A Wittgensteinian Framework

We argue that the later Wittgenstein's philosophy of language and mathematics, substantially focused on rule-following, is relevant to understand and improve on the Artificial Intelligence (AI) alignment problem: his discussions on the categories that influence alignment between humans can inform about the categories that should be controlled to improve on the alignment problem when creating large data sets to be used by supervised and unsupervised learning algorithms, as well as when introducing hard coded guardrails for AI models. We cast these considerations in a model of human–human and human–machine alignment and sketch basic alignment strategies based on these categories and further reflections on rule-following like the notion of meaning as use.

To sustain the validity of these considerations, we also show that successful techniques employed by AI safety researchers to better align new AI systems with our human goals are congruent with the stipulations that we derive from the later Wittgenstein's philosophy. We further reflect on past paradigms that were connected to the idea of formal verification of code and the idea of the full mathematization of formal tools. However, their application may benefit from the added specificities and stipulations of our framework: it extends on the current efforts and provides further, specific AI alignment techniques. Thus, we argue that the categories of the model and the core alignment strategies presented in this work can inform further AI alignment techniques.

Diego Martínez-Castro

Universidad Autonoma de Bucaramanga - UNAB, Colombia

The Moving Target: Digital Inequalities from the Digital Divide to Artificial Intelligence

Research on digital inequalities has evolved rapidly over the last three decades. However, it has not evolved as quickly as the inequalities themselves. Initially, the phenomenon was framed with the term 'digital divide,' a concept borrowed from the idea of 'haves' and 'have-nots,' which reduced the problem to the possession of devices such as computers or televisions.

The expansion of the Internet (e.g., at work and in households) brought new challenges: the quality of devices mattered, and people needed to know how to use them. Hence, scholars distinguished between first-level and second-level digital divides. This second level focused not only on knowledge and skills, but also on the actual usage opportunities afforded by the environment. More recently, the literature has explored a third level of digital inequality: the real-

life implications of differentiated use. How does converting usage opportunities into practice lead to healthier lives? How do digital skills help people save money or work more efficiently? How is the Internet enabling easier access to education?

Research has shown that digital inequalities are deeply shaped by pre-existing structural and historical conditions. There is consistent evidence that privileged social groups and regions are more likely to benefit from the advantages that emerging technologies offer, meaning that digital inequalities both draw on and reinforce prior structural inequalities. The rise of Artificial Intelligence (AI) in everyday life has introduced yet another challenge. While AI promises to transform societies for the better, it has also brought manifold risks and harms, particularly for vulnerable social groups. In this context, how should digital inequalities be reconceived in the age of AI? In what ways will vulnerable groups and communities in the Global South face a higher exposure to AI-related risks and harms? And how can AI be transformed to empower marginalised groups and improve their living conditions?

Edmond Sanganyado

University of Saskatchewan, Canada

Chemical pollution in the age of complex mixtures

Chemicals have played an important role in improving life on Earth by increasing agricultural productivity, protecting human and wildlife health, and improving quality of life. To date, there are more than 350,000 chemicals in use, most of which end up in the environment were they can cause great harm to non-target species, including humans. Unfortunately, the amount of chemicals that are discharged into the environment each year now far exceeds the ability of the Earth, and our ability to remove the chemicals. Thus, humans and wildlife are not exposed to single chemicals, as assumed by traditional chemical monitoring frameworks, but a potpourri of diverse chemical mixtures sequentially or simultaneously throughout their lifetime. Hence, there is an urgent need for developing tools that characterize the movement and uptake of complex chemical mixtures in the environment. My work proposes using aggregate exposure pathways as a way of organizing, synthesizing, and examining disparate exposure data to better understand the environmental behavior of complex chemical mixtures. Through this work, a potency flux, measured as biological response to a specific toxicity endpoint was used to measure how the magnitude and nature of toxicity of the complex chemical mixtures changed with space and time. Such an approach will be useful to identify chemical pollution hotspots, develop mitigation strategies, and prioritizing chemicals that pose greater risk to humans and wildlife.

Emelda Chukwu

Nigerian Institute of Medical Research, Nigeria

Exploring undergraduate student's attitude, concerns and support needs concerning antibiotic use

The resistance of bacteria to commonly-used antibiotics has been increasing at an alarming rate, and resistance patterns vary across different settings. Improper utilization of antimicrobial agents, especially in high disease-burden settings like Nigeria, results in drug selection pressure that allows the emergence of resistant strains. There is need to understand behavioural factors predisposing to antibiotics use among university students, articulate their concerns and support needs in other to better tailor interventions. This is a cross-sectional explorative qualitative design

that used in-depth interview methodology to investigate behaviours that impact antibiotic use for perceived infections among undergraduate students in Nigerian.

The study findings highlighted the central role of pharmacies and chemist shops as the first point of healthcare contact for students often bypassing diagnostic evaluation. Convenience, proximity, affordability, and avoidance of hospital bureaucracy strongly influenced this preference. While some students expressed concern about antimicrobial resistance as a growing public health threat, others exhibited complacency with little or no self-perceived vulnerability to the risk despite widespread misuse. Our findings revealed high levels of antibiotic consumption, self-medication, habitual use, and poor adherence to dosage and duration. Despite widespread misuse, many students expressed concerns about side effects, drug reactions, and long-term health impacts of antibiotics. The demand for reminder tools to improve adherence highlights opportunities for digital health interventions tailored to this young population. The findings from this study reveal a complex interplay of behavioral, economic, and systemic factors that shape how students access healthcare and use antibiotics, with important implications for antibiotic stewardship in low- and middle-income country settings, particularly Nigeria.

Esuru Okoroafor

Texas A&M University, United States

Building Trust in CO_2 Storage: Machine Learning for Predicting and Preventing Subsurface Integrity Risks

The success of carbon capture and storage (CCS), a climate mitigation strategy that supports a sustainable and reliable energy future, relies on maintaining subsurface integrity during CO_2 injection. Undetected fracture development can lead to leakage risks with significant health, safety, and environmental consequences, while also undermining public confidence in large-scale CO_2 storage. Despite these risks, most monitoring, measurement, and verification (MMV) approaches remain reactive, identifying integrity issues only after they occur. High-fidelity numerical models, though accurate, are too computationally intensive for real-time decision-making.

This talk presents a hybrid machine-learning (ML) predictive tool that enables proactive fracture-risk assessment during CO_2 injection. A high-fidelity numerical simulator was used to generate a dataset across diverse geological and operational conditions. Latin Hypercube Sampling ensures broad parameter coverage. A combined classification model and a deep learning Long Short-Term Memory (LSTM) network were trained to capture both fracture occurrence and the time-dependent evolution of subsurface parameters.

The resulting framework mimics the integration of real-time measurement, monitoring, and verification (MMV) data, including pressure and temperature signals, to continuously update fracture-likelihood predictions. The model identifies early precursors to failure, enabling operators to anticipate integrity risks before fracture onset and implement corrective actions such as adjusting injection rates.

This work demonstrates a shift from reactive monitoring to predictive prevention, thus enhancing the safety, reliability, and public acceptance of CO_2 storage. The approach also demonstrates how AI can bridge physics-based understanding and real-time operations, offering a scalable framework applicable to broader subsurface energy systems.

Éva Dékány

ELTE Research Institute for Linguistics, Hungary

The Linguist's Toolkit: How To Study Languages Without Speaking Them

In this talk, I discuss how linguists describe the sentence structure of a language to an audience — whether colleagues or the general public — that does not speak it, and how these methods allow me to study features of languages I do not know firsthand. Analyzing the sentence structure of a language requires knowing two things: which words are used and how they are ordered. Simply comparing a sentence in the original language with its English translation reveals neither of these. For instance, the Hungarian "Semmit sem akarok csinálni" and the English "I do not want to do anything" do not even contain the same number of words. To address this problem, linguists supplement the translation with a so-called gloss, a word-by-word rendering of the original sentence.

Semmit sem akarok csinálni.

nothing neither want.I do.to

"I do not want to do anything."

The gloss for our example shows that the Hungarian sentence lacks both an independent subject ("I") and an explicit sentence level negator ("not"). At the same time, compared to English, it contains an additional negative element ("neither"), and its word order differs from that of its English counterpart. The gloss and the translation are only informative when taken together. In the Shona (Bantu) example below, the gloss alone does not show whether the meaning is "three hundred" or "one hundred and three."

mazana matatu

hundred three

"three hundred" (Hurford 2003)

At the end of the talk, I show how I have used glossing in my own work to explore the structure of complex numerals across languages, and I demonstrate that human languages can express the same numerical ideas in remarkably different ways. For instance, the strategies to express "19" include "ten nine", "ten and nine", "ten with nine", "nine on ten", "nine exceed ten", as well as the much more rarely used strategies "one from twenty", "nine from ten", and "nine toward twenty".

Faham Khamesipour

Food and Drug Administration, Ministry of Health and Medical Education, Tehran, Iran, Iran

Invisible Threats, Real Impact: Tackling Zoonotic Diseases in High-Risk Communities

Zoonotic diseases are among the most overlooked drivers of health inequality, silently affecting millions in underserved communities while remaining underprioritized in global health agendas. Diseases such as brucellosis, leishmaniasis, toxoplasmosis, and echinococcosis persist at the human–animal interface, where limited diagnostics, fragmented surveillance, and weak integration between sectors allow transmission to continue unchecked.

In this talk, I present a One Health framework that connects parasitology, epidemiology, and policy to address these "invisible threats" with real-world impact. Drawing on my interdisciplinary background and field experience, I combine molecular diagnostics, spatial mapping, and field

epidemiology to uncover transmission patterns and identify critical gaps in current control strategies.

Beyond research, my work actively bridges science and policy. I have contributed to national treatment guidelines and collaborate with regulatory and public health bodies to translate evidence into actionable strategies for disease prevention and control. This ensures that research does not remain confined to academia but directly improves health outcomes in high-risk populations.

By reframing zoonotic diseases as both scientific and societal challenges, this talk demonstrates how locally grounded, interdisciplinary approaches can generate scalable, globally relevant solutions. Addressing these threats requires not only innovation in science, but also integration across sectors, cultural contexts, and policy systems—advancing a more equitable and effective global health response.

Fun Man Fung

University College Dublin, Ireland

GAELIC MENTORS: A Peer Mentorship Model to Advance Gender Equality in Introductory Chemistry

Chemistry is a vital gateway to STEM careers including medicine and dentistry, yet women and gender-marginalized students encounter persistent barriers to retention and belonging in introductory courses. Funded by the Irish Higher Education Authority (HEA) Equality, Diversity and Inclusion Enhancement Fund, the GAELIC MENTORS project (Gender Accessible & Equitable Learning in Introductory Chemistry – MENTORS) adapts Stanford University's proven STEMentors peer-mentorship model for three Irish institutions: University College Dublin (lead, led by Dr. FM Fung), Atlantic Technological University, and Trinity College Dublin. This training-and-capacity-building initiative directly addresses Ireland's gender gaps while aligning with the National Access Plan 2022–2028, the HEA Gender Equality Framework, the Programme for Government 2025, and EU She Figures 2024. Senior chemistry students are recruited, trained, and compensated as near-peer mentors to deliver academic, social support, and wellness resources tailored to first-year learners. Early design already suggests scalable, evidence-based strategies to boost inclusion and persistence. GAELIC MENTORS offers a practical Irish-led model with global relevance. I invite GYA colleagues working in STEM education, gender equity, or mentorship to explore cross-cultural adaptations and joint research after this talk.

João Borges

University of Aveiro, Portugal

Chemically programmable and dynamic supramolecular biomaterials to guide cell fate

Nature provides us with a fascinating toolbox of building blocks that inspire the creation of artificial biofunctional systems to recreate living systems. One of the most prominent biological systems that has been gathering immense attention among the biomaterials community is the native extracellular matrix (ECM) – a dynamic supramolecular landscape formed through the highly orchestrated non-covalent self-assembly and reciprocal molecular recognition of mainly proteins and glycosaminoglycans. Despite the progress, the synthetic biomaterial architectures developed to date do not fully emulate the complex biomolecular composition, nanostructural

elegance, and dynamic mechanical profile of the native ECM, thus limiting their potential as advanced therapies in regenerative medicine strategies.

In this talk emphasis will be given to the synergistic interplay between naturally sourced macromolecules and synthetic supramolecular building blocks towards supramolecularly engineering hybrid cell-instructive biomaterials to better emulate the native ECM features. We will discuss bottom-up nano/microtechnologies, including molecular self-assembly, 3D (bio)printing, or layer-by-layer assembly technology to assemble chemically programmable and dynamic biomaterials for directing cell functions, while also elucidating cell–material reciprocal interactions. Their potential to act as advanced platforms for the encapsulation and on-demand controlled release of drugs, therapeutics and even cells, and as bioinstructive matrices to guide cell fate in advanced regenerative medicine strategies will also be discussed.

Jose Luis Flores Guerrero

Autonomous University of Puebla, Mexico

AI and Cardiometabolic Risk prediction: Toward Scalable and Democratized Personalized Medicine

Cardiometabolic diseases, including cardiovascular disease, type 2 diabetes, and metabolic syndrome, remain leading causes of morbidity and mortality worldwide, disproportionately affecting populations with limited access to preventive care. Recent advances in artificial intelligence (AI) offer a transformative approach to the analysis of biomarkers for early prediction, risk stratification, and intervention. By integrating heterogeneous data sources, such as genomic, proteomic, metabolomic, clinical, and lifestyle data. AI models can identify complex, non-linear patterns that traditional statistical methods often fail to capture.

Machine learning and deep learning algorithms enable the discovery of novel biomarker signatures and improve the predictive power of existing ones, facilitating earlier detection of cardiometabolic risk. AI-driven platforms also support the transition from population-based medicine to individualized risk profiling, allowing clinicians to tailor prevention and treatment strategies to each patient's unique biological and environmental context.

A critical dimension of this technological shift is its potential to democratize personalized medicine. Cloud-based AI tools, integration with low-cost diagnostic technologies, and deployment through mobile health applications make advanced biomarker analysis increasingly accessible beyond specialized centers. This is particularly relevant in low- and middle-income regions, where healthcare resources are constrained but the burden of cardiometabolic disease is rapidly rising. By reducing reliance on expensive infrastructure and enabling remote risk assessment, AI can help bridge gaps in healthcare access and equity.

Keith Phiri

National University of Science and Technology, Zimbabwe

Political Ecology of Food Resilience: Smallholder Farmers' Agro-ecology in Chimanimani District, Zimbabwe

This chapter investigates food resilience of smallholder farmers in Chimanimani District of Zimbabwe. It uses political ecology and a decolonial lens to contend that modern food insecurity in rural communities of Zimbabwe must be traced back to colonial land deprivation, postcolonial agricultural policy unfairness and continued neoliberal agricultural approaches that exclude local knowledge processes. The chapter taps into a 2023 mixed-method baseline study done across six wards, combining quantitative household survey data and participatory rural appraisal approaches to capture context-based realities of food insecurity, ecosystem degradation, and climate vulnerability. Results show that the district suffers from substantial food insecurity, low dietary diversity, land fragmentation, limited irrigation access, weak institutional support, and heavy dependence on rain-fed maize monoculture. Still, farmers show notable adaptive capacity through agro-ecological practices such as intercropping, small grain cultivation, livestock integration, soil management innovations, and collective coping systems. Such practices challenge dominant modern agricultural methods that contextualise smallholder farmers as dormant receivers of foreign expertise. Agro ecology is reimagined as a platform for external knowledge resistance where local farmer experimentation, biodiversity-based systems, and local institutions are strengthened. Participatory methodologies are further interrogated as spaces of struggle where attempts toward decolonizing research exist side by side with foreign driven approaches. Finally, the Chimanimani project demonstrates that improving food resilience requires reconfiguring knowledge systems, correcting institutional wrongs, and repositioning smallholder farmers as co-creators of agricultural knowledge systems

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Kok Sin Woon

The Hong Kong University of Science and Technology (Guangzhou), China

Driving Climate Ambition through Sustainable Solid Waste Solutions

Human activities have led to a global surface temperature rise of 1.1°C compared to preindustrial levels as of the end of 2020. As one of the greenhouse gases, methane reached 1911.8 parts per billion in 2022, more than double preindustrial levels. Due to its short atmospheric lifetime, methane emerged as a key topic at COP26 for its ability to rapidly mitigate global warming. The solid waste industry, a significant source of methane, could reduce its emissions by 90% by 2050 through currently available technologies. This talk addresses a gap in global analysis by exploring how improved solid waste management can mitigate warming and help achieve the Paris Agreement's 1.5° and 2°C targets, as well as the commitments outlined in the Global Methane Pledge. With global solid waste generation expected to reach 2.56 to 3.33 billion tonnes by 2050, the greenhouse gas emissions from the global municipal solid waste system are forecasted under a business-as-usual scenario using Bayesian-optimized artificial neural networks, and their reduction potential is assessed. Abrupt technical and behavioral changes could lead to a net-zero warming solid waste system, resulting in 11 to 27 billion tonnes of carbon dioxide warming-equivalent emissions within the temperature limits. However, these changes necessitate rapid adoption within 9 to 17 years to align with the Global Methane Pledge.

Lahcen EL Youssfi

National Superior School of Chemistry of Kenitra, Ibn Tofail University, Morocco

Water food energy Nexus: potential uses of IoT and New Technologies toward sustainability of agroecosystems in Africa

African agroecosystems face growing pressure from climate change, water scarcity, energy insecurity, biodiversity degradation, and rising food demand. In this context, the Water-Food-Energy (WFE) nexus provides an integrated framework for understanding the interconnections among these resources and for developing more sustainable responses. This communication examines how the Internet of Things (IoT) and other emerging technologies can support the transition toward more resilient and efficient agro-ecosystems in Africa.

It highlights the contribution of smart sensors, connected monitoring systems, remote sensing, precision irrigation, data analytics, and simulation tools, and new models in improving the management of water, energy, and agricultural inputs. These technologies enable real-time observation of soil, crops, climate, and water conditions, while supporting better decisions on irrigation, fertilization, and energy use. Their application can enhance productivity, reduce resource losses, strengthen climate adaptation, and improve the overall sustainability of farming systems. in fact, food production improvement with lead to strenghten food security pillars.

Drawing on African perspectives, including examples relevant to Morocco and South Africa, the talk argues that digital innovation should not be viewed as a purely technical solution. Its effectiveness depends on its integration into interdisciplinary research, local realities, governance, and innovative policies . The presentation will stress the importance of linking technological innovation with biodiversity conservation, ecosystem services, and nature-based solutions. A nexus-based approach combining science, technology, and governance can help build more inclusive, adaptive, and sustainable agroecosystems across Africa. A case study will be shared to illustrate those aspects.

Marta Caviglia

Università del Piemonte Orientale, Italy

Bridging Data Gaps in Emergency Care: The NIGHTINGALE Project and the Future of AI in Mass Casualty Management

In the context of mass casualty incident (MCI) management, artificial intelligence (AI) represents a promising future, offering potential improvements in processes such as triage, decision support, and resource optimization. However, the effectiveness of AI is heavily reliant on the availability of quality data. Currently, MCI data are scarce and difficult to obtain, as critical information regarding patient demographics, vital signs, and treatment responses is often missing or incomplete, particularly in the prehospital setting. Although the NIGHTINGALE (Novel Integrated Toolkit for Enhanced Pre-Hospital Life Support and Triage in Challenging and Large Emergencies) project is actively addressing these challenges by developing a comprehensive toolkit designed to support first responders and enhance data collection during MCIs, significant work remains to ensure the tools are fully operational and can effectively integrate continuous monitoring and data management. To further advance these efforts, we provide a series of recommendation, advocating for increased European Union funding to facilitate the generation of diverse and high-quality datasets essential for training AI models, including the application of transfer learning and the development of tools supporting data collection during MCIs, while fostering continuous

collaboration between end users and technical developers. By securing these resources, we can enhance the efficiency and adaptability of AI applications in emergency care, bridging the current data gaps and ultimately improving outcomes during critical situations.

Martin Schletterer

Tiroler Wasserkraft AG & BOKU University, Austria

Use of AI for Camera Monitoring of Fishways – State of the Art & Outlook

Fishways are often the only route for migratory fish to pass dams and other river barriers. Camera monitoring helps us understand whether these structures function, how different species move through them across seasons, and whether fishways also create pathways for invasive species. However, the video data are still often assessed through slow and subjective manual review.

This Research Talk summarizes how artificial intelligence can support more reliable fishway monitoring. AI can turn camera footage into consistent indicators of passage, including counts, timing, movement direction, and, in some cases, species or size classes, while flagging uncertain cases for quick human checks. This makes monitoring faster, more transparent, and easier to compare across sites.

We also outline what is needed for practical use in the next five years: models that remain robust across sites and seasons, self-supervised learning from large volumes of unlabeled underwater video, multi-sensor fusion with environmental data, edge AI for quick real-time analysis, and open benchmarks that allow methods to be compared fairly. These tools could help assess native fish passage, guide adaptive fishway management, and support the control of invasive fish by identifying when and where non-native species use passage routes and by informing selective management responses. Overall, AI should not replace ecological expertise, but can make environmental evidence more timely and useful for decisions about rivers, biodiversity, and infrastructure management.

Mbuzeleni Hlongwa

Human Sciences Research Council, South Africa

Why are men dying at high rates by suicide? A call for gendered mental health interventions

Suicide is a major global public health challenge and a leading cause of premature mortality, with men disproportionately affected across most regions. Despite reporting lower rates of diagnosed depression and mental health service use than women, men experience significantly higher suicide mortality. This disparity reflects the interaction of social, psychological, cultural, and biological factors, including restrictive gender norms that discourage emotional expression and help-seeking, often resulting in delayed care and more lethal suicide attempts. This paper examines key risk factors for suicide among men, with a particular focus on low- and middle-income countries (LMICs), where social inequality, economic insecurity, and limited mental health infrastructure may heighten vulnerability. We synthesize current evidence on male suicide trends across age groups and settings, highlighting the roles of depression, harmful alcohol use, unemployment, financial stress, adverse life events, relationship breakdown, and exposure to violence. The paper further explores gendered barriers to mental health care and discusses

gender-responsive, community-based, and preventative strategies to reduce suicide risk among men in LMIC settings.

Melina Florez-Cuadros

Universidad del Valle, Argentina

Integration of artificial intelligence and space sciences to analyze the effects of microgravity environments on embryonic development and adult formation in Drosophila melanogaster (AI-GraviFly)

The AI-GraviFly project aims to investigate how microgravity influences embryonic development and adult formation in the fruit fly (Drosophila melanogaster). This research area is of significant importance, as it contributes to a deeper understanding of how microgravity environments affect living organisms—knowledge that is essential for future long-duration space missions and extraterrestrial habitation. To achieve this, the project integrates artificial intelligence (AI) with advanced image processing techniques to analyze experimental data obtained under simulated microgravity conditions. These conditions are generated using acoustic radiation force (ARF), an innovative approach that, to our knowledge, has not been extensively explored as a tool for simulating microgravity in biological systems. AI-driven methods will be employed to identify developmental patterns, define stages, and generate predictive models. The methodological framework includes the development of machine learning and deep learning algorithms to process longitudinal imaging data of organismal development, alongside experiments using airborne ultrasonic levitators operating at different frequencies to replicate microgravity-like conditions. This combined approach enables high-resolution, non-invasive observation of developmental processes. Key expected outcomes include a detailed characterization of how ARF-simulated microgravity affects embryonic development in Drosophila melanogaster, including morphological, physiological, and genetic alterations. Additionally, the study will examine the impact of microgravity on adult traits such as behavior, longevity, and reproductive capacity. The results will be compared with findings obtained through other microgravity simulation techniques, including magnetic levitation systems, random positioning machines, clinostats, and available data from experiments conducted aboard the International Space Station.

Mohamed Alimohamed

Muhimbili University of Health and Allied Sciences, Tanzania

If Your DNA Is Missing, Can Medicine Still Understand You?

If your DNA has never been studied, can medicine still claim to understand you?

This is the reality for many populations across Africa. Most genomic data used in medicine today comes from outside these settings, yet we are increasingly expected to use it to diagnose and treat patients locally.

In Tanzania, I work where this gap becomes visible. We are building genomics systems from the ground up, including diagnostic pathways for rare diseases using trio-based exome sequencing, training clinicians and scientists, and developing national strategies for genomic medicine.

But the challenge is not only about infrastructure. It is about interpretation.

When we identify a genetic variant in a patient, its meaning often depends on global reference datasets that do not reflect the populations we serve. Sometimes, we find variants that cannot be confidently interpreted, not because they are rare, but because they have never been studied in these contexts.

This reveals a deeper issue. Genomics presents itself as a universal science, but in practice, it reflects where data has been collected. As artificial intelligence becomes more integrated into genomic analysis, it risks reinforcing these gaps unless we change how data is generated and used.

My work addresses both levels of this problem: building local capacity to generate genomic data, and challenging how genomic knowledge is defined globally.

Because the goal is not just to include Africa in genomics, but to ensure that genomics is accurate for everyone.

Mohammad Hosseini

Northwestern University, United States

AI Agents and the Transformation of Research: Integrity, Trust, and the Future of Professional Research

Artificial intelligence (AI) agents are capable of active participation and making autonomous decisions in research and can be connected to external resources like datasets, robots and laboratory systems. AI agents used in scientific research are rapidly becoming more competent, and able to independently design, execute, and interpret research tasks. While AI agents offer efficiency gains, they also fundamentally affect the research ecosystem. In this talk, I will discuss the implications of AI agents for research integrity and trust in science.

I will focus on how the growing role and sophistication of AI agents will challenge core ethical norms of research, and will highlight what is required to preserve confidence in scientific processes and outputs. Discussed ethical issues include: 1) Immoral research and harming humans and other forms of life; 2) Biased, inaccurate or undeclared deception; 3) Privacy and confidentiality; 4) Impacts of overreliance on machines; 5) Diffusion of responsibility and accountability; 6) Deskilling; 7) Job losses; 8) science that is incomprehensible for humans; and 9) loss of trust. For each of the challenges identified, some solutions will be proposed. I will briefly discuss some potential solutions to address these issues to protect the integrity and trustworthiness of research and minimize risks to the future of science as a human activity.

This presentation is based on my two in-press publications due to be published in Feb/2026: 1) Benefits and Risks of Using AI Agents in Research (Hastings Center Report Journal); 2) Autonomous Artificial Intelligence, Scientific Research, and Human Values (AI and Ethics journal).

Mojtaba Abdi Jalebi

University College London, United Kingdom

Powering the Planet by Turning Carbon Emissions into Renewable Liquid Energy

To combat the climate crisis, we must address the 80% of global energy demand that cannot be easily electrified, such as long-haul shipping, aviation, and heavy industry. My research focuses on "Solar Fuels"—a technology that mimics natural photosynthesis to transform captured carbon

dioxide and water into high-energy, renewable liquid fuels. This process offers a way to turn an environmental liability into a sustainable resource, creating a circular carbon economy.

The heart of this system is a high-performance "engine": a novel solar cell that I have engineered at the atomic level. By using specialized chemical coatings—or "passivation"—to heal tiny defects in materials like halide perovskites, we have created solar devices that are significantly more efficient at harvesting sunlight. This clean energy is then used to drive an electrochemical system that breaks chemical bonds and rearranges them into green fuels. To overcome the traditional bottlenecks of stability and efficiency, my work incorporates advanced nanomaterials like MXene-supported catalysts to ensure these reactors can run reliably over long periods.

Furthermore, the field of materials science is currently being revolutionized by Artificial Intelligence (AI). By leveraging computational models and machine learning to predict how new materials will behave before they are even synthesized in the lab, researchers can dramatically accelerate the discovery of even more powerful catalysts. This talk will demonstrate how the synergy between cutting-edge solar cell engineering and modern materials discovery is providing a scalable, sunlight-driven solution to replace fossil fuels and power a greener planet.

Mujtaba Ali Isani

Quaid-e-Azam University, Pakistan

Trust in Domestic Political Institutions Among European Muslims: The Significance of Discrimination

Regardless of their individual backgrounds, Muslims across Europe face marginalization and exclusion based on being seen as an out-group with a different culture, religion, or race as well as restrictions in accessing economic and political opportunities. While previous research has shown European Muslims to be more trusting toward European institutions than other groups, we hypothesize that experiencing discrimination from the host society should reduce European Muslims' trust in domestic institutions. Experiencing discrimination might make them more skeptical of the political context they are living in and the political institutions of this context which are seemingly unable to prevent or protect them from discrimination. To test our hypotheses, we use pooled data from the European Social Survey from 2002 to 2018, which includes questions on trust in institutions as well as experiences of discrimination. Our preliminary results show that feelings of discrimination are negatively and significantly related to trust in domestic political institutions like the police, judiciary and the national parliament. The results evidence that long-term integration – that also reaches out to identity- and discrimination-related problems of immigrants – is strongly needed to sustain higher levels of institutional trust.

Mutshidzi Mulondo

University of the Free State, South Africa

Effect of Climate Change on children and their families' nutritional status

Background: Children's health and nutritional status has rarely been researched on in the global south. The impact of climate change on children's health generally falls under 4 intertwined sustainable development goals, namely SDG 1 (poverty), SDG 2 (hunger), SDG 3 (health) and SDG 13 (climate change). **Aim**: A scoping review was conducted looking at the impact of climate change on children in Africa. **Methodology**: The review was conducted according to the PRISMA-

ScR. Three electronic databases were searched in collaboration with a librarian. There were two main reviewers who went through the selected articles to ensure they fit the inclusion criteria. **Results**: The review found that the main health conditions associated with climate change are malnutrition, infectious diseases, respiratory diseases in children and adults, adverse pregnancy and birth outcomes, high child and maternal morbidity and mortality, and mental health problems.

Natalia Montellano Duran

Universidad Católica Boliviana San Pablo, Bolivia

Exploring Antioxidant Potential in Bolivian Ethnobotanical Resources

Bolivia hosts an extraordinary diversity of plant species, many of which are traditionally used in local medicine and nutrition but remain scientifically underexplored. This study focuses on the evaluation of antioxidant potential in selected fruits and vegetables derived from Bolivian ethnobotanical knowledge, aiming to bridge ancestral practices with modern biotechnological approaches.

Plant materials were selected based on their reported use in traditional medicine or unknown bioactivity across different ecological regions, including the Amazon, Chiquitania, and Andean valleys. Extracts were obtained using optimized solvent systems, and their antioxidant capacity was assessed through established in vitro assays, such as DPPH, ABTS, and total phenolic content. Preliminary results reveal significant variability in antioxidant activity among species, with several native fruits exhibiting high levels of phenolic compounds and strong radical scavenging capacity.

These findings highlight the relevance of Bolivian biodiversity as a valuable source of bioactive compounds with potential applications in health, nutrition, and the development of functional foods. Furthermore, this research underscores the importance of integrating traditional knowledge systems into scientific research frameworks, promoting culturally informed innovation and sustainable use of natural resources.

By linking ethnobotanical insights with biochemical characterization, this work contributes to the growing field of bioeconomy in developing countries, supporting the valorization of local resources and fostering opportunities for scientific advancement, technology transfer, and community engagement. Ultimately, this study advocates for a multidisciplinary approach to unlock the potential of underutilized plant species, positioning Bolivia as a key contributor to global research on natural antioxidants.

Natisha Dukhi

Human Sciences Research Council, South Africa

Designing with Adolescents: Translating Co-Creation into Digital Innovation for Obesity Prevention

Adolescent obesity is rising across geographic and economic contexts, underscoring the urgent need for prevention strategies that are both scalable and responsive to young peoples lived realities. While digital platforms offer unprecedented reach, many interventions continue to underperform, often because adolescents are positioned as end-users rather than contributors to design.

The FASTA study advances a co-creation framework that reframes adolescents as partners in the development of a school-based mobile health intervention targeting diet and physical activity behaviours in South Africa. Through structured focus group discussions with Grade 5 learners, participants directly shaped the intervention architecture, influencing behavioural features, motivational strategies, interface preferences, and culturally grounded nutrition content.

Critically, these insights were translated into a functional prototype, demonstrating the feasibility of embedding adolescent voice into early-stage digital development. Participants consistently prioritised practicality, achievable behaviour change, and supportive guidance over entertainment-driven features, challenging dominant assumptions surrounding youth engagement in digital health.

By moving beyond consultation toward tangible design outputs, this work positions co-creation not merely as an engagement strategy, but as a translational pathway capable of strengthening intervention relevance, acceptability, and future uptake. This approach may be particularly consequential for low- and middle-income settings seeking cost-effective and scalable prevention models.

As this research progresses toward feasibility testing and implementation, it signals a broader scientific shift: the effectiveness of next-generation health interventions may depend less on technological sophistication than on who is invited to shape them.

Needa Brown

University of Central Florida, United States

Design of controlled release drug delivery systems

We know that nanoscale materials take on unique, size-dependent characteristics that differ from their bulk counterparts, however, given the complexity of parameters within the nanoscale (e.g. size, shape), very little is known about how modulating these factors can alter their biological interactions. A common challenge with translation of nanoparticles is the discrepancy between the predicted response and the experimental outcome. Rational design of next-generation drug delivery systems relies on understanding the dynamic forces and molecular components that alter the physiochemical identity of our biomaterial. This talk will be centered around understanding and leveraging inherent material-biological interactions to design next-generation biomaterial systems, specifically looking at shifts in tumor immunogenicity, combination efficacies, and drug distribution toxicology.

Neema Mduma

Nelson Mandela African Institution of Science and Technology, Tanzania

KilimoAI for crop disease detection

Agricultural productivity is heavily threatened by crop diseases, particularly for smallholder farmers who lack timely access to diagnostic services and expert support. Delayed or inaccurate identification of plant diseases often leads to significant yield losses, excessive pesticide use and economic instability.

My research focuses on the development of kilimoAI, a mobile application that uses Artificial Intelligence (AI) to enable early crop disease detection through smartphone-based image analysis. Farmers capture images of affected leaves, and a trained convolutional neural network (CNN)

model analyzes visual symptoms such as lesions, discoloration and abnormal patterns. The system then identifies likely diseases and provides practical, evidence-based treatment recommendations. By combining machine learning, computer vision and an accessible mobile interface, kilimoAI bridges the gap between advanced agricultural diagnostics and farmers in resource-limited settings. The app is designed to function in low-connectivity environments and prioritizes usability for non-technical users. This work demonstrates how AI can strengthen agricultural resilience, reduce unnecessary chemical use and improve decision-making at the farm level. Beyond technical performance, the project examines ethical AI deployment in agriculture, including model bias, data representativeness and equitable access to digital tools. kilimoAI illustrates the broader role of AI in transforming agriculture into a more precise, sustainable and farmer-centered system, contributing to food security and climate adaptation in vulnerable regions.

Nefin Shalalfeh

Palestine Polytechnic University, Palestine

Breaking the Loss of Care: AI for Diabetes in Crisis Settings

In crisis-affected settings, healthcare systems collapse, but the most critical loss is not infrastructure—it is continuity of care. Diabetes, a condition that requires constant monitoring, follow-up, and adjustment, becomes life-threatening when this continuity is disrupted. Patients are not lost because treatment is unknown, but because systems fail to sustain engagement. This creates a silent global health crisis, particularly affecting vulnerable populations.

This project introduces an AI-driven model called DAP, designed to replace the missing continuity of care. Unlike traditional health technologies that depend on stable systems, this approach follows the patient rather than the institution. Using minimal inputs—such as symptoms, glucose levels, behavior patterns, and carbohydrate intake (picture of food)—the AI predicts risks, supports real-time decision-making, and guides patients in managing their condition independently.

Embedded within the Disease Awareness and Prevention (DAP) framework, the model integrates clinical care, behavioural support, and mental health considerations, recognising that wellbeing is a critical component of disease management in crisis contexts. It addresses not only physiological risk but also emotional and psychosocial burdens that influence adherence and outcomes.

This solution represents a shift from system-dependent healthcare to patient-centered intelligence. It is designed to function in low-resource and unstable environments, making it scalable across conflict zones, disaster settings, and fragile health systems globally.

By sustaining care where systems fail, this model protects lives, preserves knowledge, and redefines how chronic diseases are managed in a world increasingly shaped by crisis.

Nichole Lighthall

University of Central Florida, United States

Decision making in aging and ADRD across traditional and technology-mediated contexts

From everyday choices about food and socializing, to major decisions in domains such as health, career, family, and finances — value-based decision making shapes the direction and quality of our lives across the lifespan. In this context, determining age-related vulnerabilities and pathways

to successful aging requires research that can clarify when and why age differences in value-based decision making occur. My talk will feature work from my lab that addresses these questions through research on mechanisms of decision processing in healthy cognitive aging and Alzheimer's disease and related dementias (ADRD) across both traditional and novel, technology-mediated contexts (e.g., AI-generated faces, videochat platforms). I will discuss findings that identify decision-processing subcomponents that drive age differences in decision making, including learning and memory, affective processes, and social factors – and to what degree these alterations can be attributed to age-related changes in brain function. Finally, my talk will discuss how decision behavior may be impacted by the introduction of novel technologies and modes of communication in normal cognitive aging and ADRD.

Noor Shaila Sarmin

Gazipur Agricultural University, Bangladesh

Assessment of Seaweed Extract and Salicylic Acid for Mitigating Drought Stress in Barley Using UAV-Based Remote Sensing and Field Trials

The objectives of the study are:

1. To assess the physiological and growth responses of barley to the foliar application of seaweed extract under drought stress conditions.

2.To utilize UAV-based multispectral imaging for the early detection and monitoring of drought stress in barley.

3. To correlate UAV-derived vegetation indices with ground-based physiological and yield parameters in order to validate the remote sensing data. The experiment will be conducted at the research field of the Agroforestry and Environment research field of Gazipur Agricultural University, Gazipur. The field trial will follow a RCBD with 6 replications. The project will utilize a range of advanced sensor technologies to enable precise monitoring of drought stress in barley. Soil moisture sensors will be deployed to assess in situ water availability, while soil temperature sensors will provide thermal profiling of the root zone to understand heat dynamics under stress conditions. Chlorophyll meters will be used for rapid, non-destructive estimation of leaf chlorophyll content, indicating photosynthetic efficiency. Plant wood moisture meters will help determine the water retention capacity within plant tissues. A DJI Inspire 2 UAV, equipped with the MicaSense Altum multispectral and thermal sensor, will be employed for aerial imaging to generate high-resolution spatial data on crop health. The expected outcomes of this project include the generation of quantitative data on the effectiveness of seaweed extract and salicylic acid in enhancing drought tolerance in barley under field conditions. Through UAV-based multispectral imaging, the study aims to produce high-resolution stress maps that illustrate the spatial variability of drought impact across the experimental plots. Furthermore, the research will establish validated correlations between UAV-derived vegetation indices and ground-based physiological and yield measurements, ensuring the reliability of remote sensing data.

Nourhan Hassan

Biotechnology Department, Faculty of Science, Cairo University, Egypt

From Bench to Bedside, Faster: AI's Role in Drug Discovery for Women's Health

Despite significant advances, diseases predominantly affecting women, such as specific subtypes of breast cancer, continue to face a critical gap in therapeutic innovation. The traditional drug discovery pipeline is notoriously slow and expensive, often taking over a decade and billions of

dollars to bring a new treatment to market. This lengthy process represents a major bottleneck in our ability to address the urgent health needs of millions of women worldwide.

Artificial Intelligence (AI) is emerging as a transformative force to shatter this paradigm. By leveraging computational power to analyze vast biological datasets, AI can dramatically accelerate the initial phases of drug discovery. As a principal investigator in a new interdisciplinary drug discovery program, my work focuses on harnessing AI to identify novel therapeutic targets and design next-generation treatments for aggressive breast cancers.

Our approach integrates multi-omics data with advanced machine learning models to build predictive maps of disease pathways. This allows us to rapidly identify promising molecular targets and perform large-scale virtual screening of potential drug candidates, significantly reducing the time and cost associated with preclinical research. This talk will explore how AI is revolutionizing our strategy for developing targeted therapies, moving us closer to a future of personalized medicine for women's health. It will highlight the potential of this synergy between computational and biological science to deliver effective treatments from the laboratory bench to the patient's bedside, faster than ever before.

Peter Gan Kim Soon

Ministry of Health, Malaysia

Reimaging Healthcare to Address Stunting

Malaysia has universal health coverage and strong maternal and child health services. Yet 21.2% of children under five remain stunted, and in some indigenous communities, rates exceed 40%. After more than a decade, progress has stalled. The economic toll is staggering, amounting to an estimated 2-3% of annual GDP. The problem is not the absence of services. It is the failure to translate infrastructure into equitable outcomes.

Led by the Ministry of Health through the Health Transformation Office, we are piloting a community-based First 1000 Days initiative that shifts the centre of gravity from facilities to households and communities. Unlike traditional grants, we transition to outcome-linked financing where payments depend on verified performance in service coverage and health markers.

Our model consolidates maternal health, breastfeeding and complementary feeding, growth monitoring, as well as oral and mental health into a unified delivery platform. Trained community health workers provide structured home visits and behavioural support. Formal referral pathways connect families with health care and social protection, ensuring risk identification triggers immediate clinical or welfare action.

Equity is the core mandate. This pilot prioritises lower socioeconomic and indigenous communities, where fragmented access to services perpetuates undernutrition. Drawing on implementation science and lessons from other countries, we've embedded a rigorous mixed-methods evaluation. We combine quantitative impact assessments with ethnographic exploration of community experiences.

This initiative aims to generate policy-relevant evidence for national-scale up and to contribute to global discourse on how upper-middle-income countries can tackle persistent stunting through integrated delivery, financing reform, and community partnerships.

Pooja Devi

CSIR-Central Scientific Instruments Organisation, India

AI-Guided Design of 2D Materials for Catalytic Hydrogen Generation

The transition to sustainable energy systems requires efficient, low-cost catalysts for hydrogen production through electrochemical water splitting. Two-dimensional (2D) materials, including transition metal dichalcogenides, MXenes, layered oxides, and emerging heterostructures, have shown significant promise due to their high surface area, tunable electronic properties, and abundant active sites. However, conventional trial-and-error approaches for catalyst discovery remain slow and resource intensive. This project proposes an artificial intelligence (AI)-guided framework to accelerate the rational design, optimization, and deployment of advanced 2D catalytic materials for hydrogen evolution reaction (HER) and related electrochemical processes. The study integrates experimental synthesis, advanced characterization, density functional theory simulations, and machine learning models to establish structure–property–performance correlations. AI algorithms will be used to predict catalytic activity, stability, and electronic behavior based on compositional, structural, and defect-engineering parameters. Special emphasis will be placed on high-entropy 2D systems, heterostructure engineering, and defect modulation to maximize active site exposure and catalytic efficiency. Experimental validation will include scalable synthesis routes, electrochemical performance testing in relevant electrolytes, and durability assessments under practical operating conditions. The anticipated outcomes include accelerated discovery of robust, earth-abundant hydrogen evolution catalysts, predictive models for catalyst design, and scalable material processing strategies. This approach aims to bridge the gap between computational prediction and experimental realization, enabling faster translation of laboratory findings to electrolyzer technologies. Ultimately, the work supports the development of cost-effective green hydrogen production systems, contributing to energy security.

Pradeep Kumar

University of the Witwatersrand, Johannesburg, South Africa

Mathematical Modelling for Antimicrobial Therapy Optimization in African Neonatal Sepsis

Optimizing empirical antimicrobial therapy for neonatal sepsis in African settings requires reconciling pathogen dynamics, antimicrobial resistance (AMR) trends, and severe resource constraints. An integrated mathematical modelling framework composed of three computational layers was developed across heterogeneous clinical and infrastructural environments. The epidemiological–resistance layer implemented a probabilistic pathogen distribution model using categorical prevalence inputs and drug specific resistance probabilities, structured as a Bayesian network to enable dynamic updating with new surveillance data. The outcome simulation layer employed Markov decision processes to represent clinical state transitions—treatment, recovery, and mortality—parameterized by pathogen–drug interactions and resistance conditioned mortality differentials. Finally, the optimization layer jointly minimized expected mortality and penalizes regimens based on drug cost and availability, solved through constrained multi objective linear programming. The various scenario analyses compared first line (Gentamicin + Ampicillin), second line (Cefotaxime), and escalation therapies (Vancomycin, Meropenem) as per the optimization. The data generated showed that although carbapenems achieve the lowest expected mortality, first line therapies consistently maximize utility in resource poor environments due to significantly lower access and cost penalties. A focused simulation of hospital acquired Acinetobacter sepsis demonstrated that Gentamicin + Ampicillin remains the highest utility empirical choice despite high resistance associated mortality (≈30.4%), whereas Meropenem—while clinically superior—incurs prohibitive utility penalties driven by availability scores as low as 0.3. An empirically calibrated drug escalation decision tree further enabled context aware AMR stewardship and

providing a foundation for integration into digital clinical decision support systems in African neonatal units.

Praveen Kumar

Plaksha University, Mohali, Punjab, India

Harnessing Spin-Dependent Catalysis in 2D Materials

In this talk, I will present my research on advancing spin-dependent catalysis through engineered two-dimensional (2D) materials, with a focus on fundamental mechanisms and their potential for transformative applications. I will first discuss the role of spin-orbit coupling in Janus MoSSe, where an external magnetic field modulates its catalytic activity, enabling spin-dependent electrocatalysis. By integrating delaminated Mo_2C-Tx MXene with MoSSe/SiNW photocathodes, we achieve a 52% enhancement in photocurrent under a 0.4 T field at zero bias, demonstrating a novel route for efficient photoelectrochemical (PEC) water splitting. Additionally, I will highlight magnetically induced hydrogen evolution in quasi-2D $MnSe_2$, showcasing the potential of asymmetric 2D materials for next-generation catalytic systems.

Rima-Maria Rahal

WU Vienna University of Economics and Business, Austria

Cognitive Processes of Normative Decision Making: Webcam-based Eye-tracking Analysis in 8 Societies

How humans decide to play by the rules or to violate them is an age-old question. In this project, I leverage webcam-based eye-tracking to study cultural variations of cognitive processes underlying norm compliance and violation. Participants from 8 societies made decisions in two repeated, incentivized games while eye-gaze was recorded. In a neutral decision task imposing an arbitrary rule, as well as a decomposed dictator game task imposing a social norm, I demonstrate that social norm espousal predicts compliance, and that compliance rates differ between societies. Moreover, I show that attention allocation predicts compliance, but that there is substantial society-level heterogeneity in the directionality of these effects. I discuss the results in the light of aiming to understand heterogeneous processes of higher-order cognition stemming from individual and cultural variation.

Rishemjit Kaur

CSIR-Central Scientific Instruments Organisation, India

Found in Translation: LLMs and NLP for low-resource languages

This talk focuses on Natural Language Processing (NLP) and Large Language Models (LLMs) for multicultural and multilingual low-resource scenarios. Most NLP models primarily cater to high-resource languages such as English and French; however, low-resource languages such as Punjabi and Assamese remain significantly underrepresented. This imbalance leads to disparities in access to technology, particularly for already marginalized and underrepresented communities, limiting their ability to benefit from recent advances in AI.

This talk provides an overview of models and datasets developed for low-resource languages, especially Indic languages, along with the key challenges associated with their development, including data scarcity, lack of standard benchmarks, and linguistic diversity. The talk also highlights key applications of these technologies in domains such as agriculture and education, including agent-driven multilingual agricultural advisories, farmer-centric decision support systems, and language-accessible learning platforms for school kids designed to improve inclusivity and accessibility

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Rocio Alejandra Chavez Santoscoy

Tecnologico de Monterrey, Mexico

Obesity and Diabetes Management Through Microbiota Modulation: An Animal Study of a Multi-Organ and Multi-Omic Assessment of a Probiotic-Enriched Beverage

Obesity is characterized by gut microbiota dysbiosis, systemic inflammation, and multi-organ dysfunction. This study evaluated a Bacillus licheniformis-based probiotic beverage in high-fat diet (HFD)-induced obese mice. Male C57BL/6 mice received standard diet or HFD, with or without probiotic supplementation, for 21 weeks. Probiotic-treated HFD mice exhibited significantly reduced weight gain, visceral fat, hepatic steatosis, renal injury, and splenic hematopoietic stress. Glucose tolerance improved, and serum cholesterol decreased. Gut microbiota analysis revealed increased α-diversity, partial restoration of the Firmicutes/Bacteroidetes ratio, and enrichment of short-chain fatty acid-producing taxa. Liver transcriptomics showed downregulation of interferon and antigen presentation pathways, and upregulation of genes involved in tissue regeneration and lipid metabolism. These integrated physiological, microbial, and transcriptomic changes suggest systemic protection by Bacillus licheniformis probiotic beverage against HFD-induced damage. Our findings support its potential as a non-dairy functional intervention to modulate the gut–organ axis and restore metabolic balance in obesogenic diets.

Rubén Costa

Technical University of Munich, Germany

Protein materials in energy technologies

Fluorescent proteins have been traditionally designed for bioimaging, but we will show that these types of materials can also be of interest for technological applications. In short, we will show our recent work on developing protein-hybrids that combine the best of the photophysical features of the fluorescent proteins with the versatile processability of polymers, nanoparticles and crystals. This will be flanked by proof-of-concept applications for photon down-conversion applied to lighting and photovoltaics, as well as for photon-to-heat conversion in photothermoelectrics. Hence, we will discuss the strategies, challenges, and opportunities towards the biologization of the technology as a fundamental step towards a truly sustainable society.

Santosh Sridhar Mysore

CSIR - CIMFR, India

Machine Learning–Driven Design of Selective Metal-doped Graphene Sensor Array for Societal Safety

Reliable detection of hazardous gases in complex environments remains a critical challenge for societal safety, particularly in mining, industrial, and environmental settings where multicomponent gas mixtures complicate selective sensing. This work presents a machine intelligence–driven framework for the rational design of selective metal-doped graphene sensor arrays. By integrating high-throughput density functional theory (DFT) simulations with data-driven machine learning models, we systematically screen 91 metal–gas combinations across 13 dopants and 7 target gases relevant to safety-critical applications. Quantum-derived descriptors, including adsorption energy, charge transfer, work function modulation, and electronic density of states perturbations, are mapped to predicted resistance responses using a random forest regression model, achieving 94% predictive accuracy. The framework enables virtual exploration of chemical space beyond explicitly computed systems, significantly accelerating materials selection. Selectivity coefficients exceeding 150:1 are identified for optimized dopant–gas pairs such as Pt–CO and Au–H2S. Beyond single-sensor optimisation, machine intelligence guided assembly of a 21-element sensor array that achieves >95% discrimination accuracy in multigas mixtures through pattern recognition techniques are demonstrated. Robustness analyses confirm tolerance to signal drift and partial sensor failure, highlighting the adaptive capability of the proposed architecture. By bridging quantum-level modelling and artificial intelligence, this work establishes a scalable paradigm for designing intelligent material systems that enhance public safety. The approach is transferable across scientific domains, offering a general framework for machine intelligence–enabled materials discovery and deployment in environmental monitoring, industrial process control, and health diagnostics.

Shankar Kausley

TCS Research, Tata consultancy services Ltd., India

River Digital Twin: Multi-modelling Approach for Predicting River Water Quality

The river ecosystem is an intricate interaction of inflow and outflow streams and diverse physical processes, influenced by environmental factors and human activities, all significantly impacting river water quality. The current study develops a predictive model for river water quality in varying ecosystems. Utilizing a multi-modeling approach, incorporating agent-based, data-based, and physics-based models, the work explores the dynamics of a river ecosystem its effects on water quality and evaluates the efficacy of interventions, contributing to the prediction and maintenance of river water quality. Agent-based modeling captures the relationships and interdependencies among different factors of a large complex river ecosystem with enhanced simulation efficiency. Concurrently data-based models establish the relations between different agents. Additionally, physics-based models, incorporating transport and reaction equations, are synergistically employed to represent the river system's physics, flow dynamics, and temporal changes in quality parameters resulting from transport and reactions. The integrated approach successfully constructs a river digital twin capable of simulating and assessing the river's quality parameters under various scenarios for large stretches of river spanning hundreds of kilometers with small computational time. The developed digital twin is generalizable and can be easily applied to new river systems with minimum effort.

Shymaa Enany

Suez Canal University, Egypt

What Gut Microbes Are Doing in Colorectal Cancer as Shown by Metaproteomic Evidence from Egypt

Colorectal cancer is rising rapidly in low- and middle-income countries, yet most microbiome research still comes from high-income settings and focuses on who is there, not what they are doing. In this talk, I present a functional snapshot of the gut microbiome in colorectal cancer using fecal metaproteomics from an Egyptian patient cohort. We analyzed stool samples from colorectal cancer patients and matched healthy controls using high-resolution mass spectrometry, capturing the proteins actively expressed by gut microbes. Rather than global microbial disruption, we observed selective functional reprogramming. Core metabolic activities, including carbohydrate utilization, amino acid metabolism, and anaerobic energy pathways, were reshaped in cancer patients. Two findings stood out. First, microbial DPP4 like enzymes were consistently upregulated, raising the hypothesis that gut bacteria may influence metabolic and immune signaling pathways implicated in colorectal cancer. Second, proteins from Segatella copri, a common gut commensal, were broadly suppressed across multiple functional classes, suggesting species-specific adaptation or exclusion within the tumor-associated gut environment. Importantly, all detected proteins were microbial, indicating that these signals reflect luminal microbial activity, not host protein leakage or translocation. While this study is exploratory and limited in size, it demonstrates how metaproteomics can move microbiome research beyond taxonomy to function, especially in underrepresented populations. Understanding what microbes are doing, rather than simply who they are, is essential for translating microbiome research into meaningful cancer biology and global health insights.

Solange Paredes Moscosso

Universidad Peruana de Ciencias Aplicadas, Peru

Inflammation, Ancestry, and Risk: Leveraging Genomic Diversity to Decode Breast Cancer Risk in Latin America

Breast cancer genetics is entering a new era, one defined not only by scale, but by inclusion. The Latin America Genomics of Breast Cancer Consortium (LAGENO-BC) was created to address a critical blind spot in genomic research: the underrepresentation of Latin American populations. By integrating data from over 60,000 individuals across more than a dozen countries in the Latam region, LAGENO-BC is building a uniquely diverse genomic resource to uncover ancestry-specific risk, prognosis, and treatment-response loci.

This effort is tightly connected to the CONFLUENCE Project, a large-scale initiative led by the U.S. National Cancer Institute that aggregates genome-wide association data from more than 400,000 cases and 1.6 million controls worldwide. By dramatically increasing sample size and diversity, CONFLUENCE is redefining the architecture of breast cancer as a highly polygenic disease, where thousands of variants of small effect collectively shape risk, subtype heterogeneity, and clinical outcomes.

Within this landscape, LAGENO-BC is not merely a contributor but a transformative research platform. It enables rigorous investigation of the admixed genetic architecture of Latin American populations, while also supporting the study of biological processes underlying breast cancer initiation, progression, and therapeutic response.

In our study, we focus on chronic inflammation, a well-established hallmark of cancer. We'll evaluate whether variation in immune and inflammatory pathways, at the germline level, is associated with breast cancer risk. Understanding how these pathways contribute to disease risk may inform therapeutic strategies, particularly in the context of immunotherapy and precision oncology. Ultimately, our goal is to build an inflammation-informed polygenic risk score (PRS) that integrates variants across immune-related pathways. Such a tool could support more personalised, population-relevant cancer prevention strategies in Latin America.

Tariq Khan

University of Malakand, Pakistan

Biomolecule Functionalized Silver Nanoparticles as a Novel Strategy to Combat Antimicrobial Resistance in Escherichia coli

Antimicrobial resistance (AMR) is one of the most pressing global health threats, with multidrug-resistant Escherichia coli posing a significant challenge to conventional antibiotic therapies. Green nanotechnology offers a promising alternative, and our research focuses on the synthesis, characterization, and antimicrobial evaluation of bio-functionalized silver nanoparticles (bio-AgnPs) as a targeted strategy against resistant E. coli strains.

Bio-AgnPs were synthesized using an eco-friendly approach and characterized via UV-Vis spectroscopy, TEM, XRD, and FTIR analysis. The biomolecule surface functionalization enhances nanoparticle stability and facilitates targeted delivery by exploiting folate receptors overexpressed on bacterial membranes. Antimicrobial activity was assessed using minimum inhibitory concentration (MIC) assays, disk diffusion, and biofilm inhibition studies against clinical and laboratory E. coli isolates, including AMR strains.

Our findings demonstrate that biosynthesized AgNPs exhibit significantly enhanced bactericidal activity compared to non-functionalized AgNPs, disrupting bacterial membrane integrity and inhibiting biofilm formation at sub-MIC concentrations. These nanoparticles also show a synergistic effect when combined with conventional antibiotics, offering a potential strategy to restore antibiotic efficacy.

This research highlights the potential of biosynthesized AgNPs as a cost-effective, scalable nanomedicine platform to address the AMR crisis, with implications for infectious disease management in low- and middle-income countries.

Tomislav Meštrović

University North, Croatia / University of Washington School of Medicine, USA

Infectious Diseases in an Unequal World: Pathogens, Vulnerability and Global Health Equity

Infectious diseases remain among the most powerful indicators of global inequality. Although major advances in vaccination, sanitation, diagnostics and treatment have reduced mortality over recent decades, the burden of infectious diseases continues to disproportionately affect low- and middle-income countries (LMICs), older adults, children, and populations living in conditions of structural vulnerability. Using large-scale datasets spanning 204 countries and territories from 1990-2023, advanced statistical modelling and big data analytics were employed to quantify mortality associated with 101 pathogens and identify global patterns, disparities and emerging trends.

In 2023 alone, we have estimated that 101 pathogens were associated with 18.3 million deaths globally, accounting for nearly one quarter of all deaths worldwide. More than 61% of infectious deaths (and over 90% of infectious deaths among neonates) occur in LMICs, despite these countries account for less than half of the global population. Vaccine-preventable pathogens collectively declined from 9.61 million deaths in 1990 to 5.41 million deaths in 2023, representing a 43.7% reduction globally. In contrast, pathogens without effective vaccines increased from 11.0 million to 11.9 million deaths during the same period.

In 2023, Staphylococcus aureus was associated with 1.56 million deaths globally, followed by tuberculosis with 1.16 million deaths and HIV/AIDS with 942,000 deaths. Meanwhile, climate-sensitive and antimicrobial-resistant pathogens are rising in prominence – including Legionnaires' disease, fungal infections caused by Candida species, and resistant Gram-negative bacteria. The burden of pathogens such as malaria, measles and HIV remains heavily concentrated in sub-Saharan Africa, illustrating persistent inequities in prevention and care.

Addressing these threats requires integrated One Health approaches, stronger public health infrastructure, equitable access to vaccines and diagnostic solutions, as well as sustained international scientific collaboration. There is also the responsibility of young scientists to bridge research, policy and advocacy.

Waheba Mohamed

Zewail City of Science & Technology, Egypt

When DNA Repair Fails: From Cancer to Brain Disease

Every day, each of your cells suffers thousands of DNA breaks. Most of the time, sophisticated repair machinery fixes them silently. But what happens when that machinery fails?

My research explores this question across two seemingly unrelated diseases, cancer and neurodegeneration. In cancer, I study how defects in managing DNA topological stress, the physical tension that builds up when DNA is copied or read, lead to genome instability that drives tumor evolution and resistance to therapy. In Huntington's disease, I investigate how faulty DNA repair allows unstable repetitive sequences to expand over time, progressively destroying neurons.

These two disease contexts look very different on the surface. But at the molecular level, they share a common vulnerability: when the genome cannot maintain itself, cells either become cancerous or die when they shouldn't.

By combining molecular experiments with genome-wide and computational approaches, my work aims to identify the key points of failure in DNA repair and turn them into therapeutic targets. The ultimate goal is precision medicine strategies that work for both oncology and neurodegeneration, guided by a single unifying principle: genome integrity is not just about preventing cancer. It is fundamental to keeping the brain alive.

Wasim Sajjad

National University of Medical Sciences Pakistan, Pakistan

Diketopiperazines (DKPs) as Quorum-Sensing Inhibitors: Biosynthetic Dark Matter and the “Unknown Unknowns” in Natural Product Discovery

Antibiotics are losing their power, and one major reason is that bacteria don’t live only as single, free-floating cells. They often form biofilms—a slimy “bacterial city” with protective walls that block antibiotics and even the immune system. Two common culprits, Staphylococcus aureus and Pseudomonas aeruginosa, are notorious for these stubborn infections. Instead of trying to kill bacteria directly—which can increase selection pressure and speed up resistance—this work explores a different strategy: silencing bacterial communication. Bacteria coordinate their behavior through chemical signals in a process called quorum sensing, like a group chat that switches on genes for biofilm formation, toxins, & other harmful traits once enough cells are present. If we block that conversation, we can potentially disarm pathogens rather than destroy them, reducing their ability to cause damage. To find such “anti-virulence” molecules, we investigated marine sponges from the Karachi coast, which host diverse microbes that produce unusual chemicals to compete and survive. From sponge-associated microbes, we isolated Planococcus and prepared ethyl acetate extracts, then asked three questions: do they slow growth, prevent biofilms, & block communication? Using Chromobacterium violaceum (a reporter bacterium), we observed strong signal reduction—evidence of quorum-sensing inhibition—alongside up to ~70% reduction in growth/biofilm and MICs around 32–64 µg/mL. To identify what was responsible, we combined whole-genome sequencing, LC–MS/MS, and molecular networking, revealing diketopiperazines (DKPs) such as cyclo-(Ile-Pro), cyclo-(Phe-Pro), and hydroxylated derivatives, plus “biosynthetic dark matter” (cryptic gene regions) suggesting more hidden chemistry. Overall, this highlights Planococcus as an overlooked source of non-traditional antibiofilm agents—an encouraging direction when AMR demands strategies beyond conventional antibiotics.

Wilson Alavia Medina

Disruptive Sustainable Technologies for Positive Change SpA, Chile

Comparison of Machine Learning and Physics-Informed Machine Learning Models for Carbon Dioxide Solubility in Saline Solutions

Carbon dioxide (CO_2) is the primary greenhouse gas driving global warming, therefore reducing its emissions is essential to mitigate climate impacts. A promising strategy is CO_2 capture and storage, where the solubility of the gas in media such as saline solutions is a key parameter for determining capture capacity, selectivity, storage, and operating conditions. This work addresses modeling CO_2 solubility in saline solutions using machine learning (ML) and Physics Informed Machine Learning (PIMM) models, aiming to compare their predictability, robustness, and consistency.

Yalinu Poya

Wentworth Institute of Technology, United States

Pollutant Survey and AI-Driven Decision Support for Brownfield Remediation in Boston: A One Health Perspective

Boston's legacy of industrial activity has left numerous brownfield sites that pose environmental, health, and socioeconomic challenges, particularly in historically underserved neighborhoods. This presentation outlines a planned two-phase methodology to address these challenges. In the first phase, comprehensive pollutant surveys will be conducted to characterize soil and groundwater contamination, focusing on heavy metals, hydrocarbons, and PFAS. These high-resolution datasets will form the foundation for the second phase: applying machine intelligence to enhance remediation strategies. Predictive modeling will leverage survey data to forecast contaminant behavior and optimize cleanup plans. Remote sensing and computer vision will analyze satellite and drone imagery to identify contamination hotspots and monitor ecological recovery. Natural language processing will extract insights from regulatory documents and scientific literature, enabling evidence-based prioritization of sites based on health risk and environmental justice considerations. By framing remediation within the One Health paradigm, this planned approach aims to accelerate site assessment, reduce remediation costs, and promote sustainable redevelopment, demonstrating how pollutant surveys combined with AI can serve both society and science in addressing Boston's complex environmental challenges.