RESEARCH INSTITUTE
NYU ABU DHABI

Impact Report 2025













جامعة نيويورك أبوظبي
NYU ABU DHABI

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Impact Report 2025

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Welcome Message Impact Report 2025

Research at NYU Abu Dhabi has never been a solitary pursuit. Positioned within this global campus rooted in the heart of the Middle East, the Research Institute serves as a bridge: connecting world-class inquiry with the real-world needs of the country, region, and beyond. This year's Impact Report highlights how that bridge has become a bustling corridor of innovation, anchored by our specialized research centers and organized across NYUAD's strategic research themes.

While our inaugural report celebrated our evolution into an R&D powerhouse, this edition focuses on our integration. We have moved beyond building the foundation to cultivating ecosystem of impact. By aligning our 18 centers under eight cohesive themes—from the frontiers of quantum science to the preservation of heritage—we ensure that our academic depth is matched by its societal relevance. This thematic approach allows us to be agile, responding to the UAE's national vision while contributing to the global body of knowledge.

NYUAD's strength lies in its ability to be both "of the world" and "for the region." Our researchers do not work in isolation; they lead international consortia that bring global perspectives to Abu Dhabi, while simultaneously exporting "Made in the UAE" solutions to the rest of the world. Whether we are addressing the complexities of climate change in arid climates or pioneering new paradigms in global health, the 18 centers featured in these pages represent the innumerable and distinct ways we are delivering on our promise to be a transformative force.

As you explore this report, you will see that NYUAD's eight research themes are more than just categories—they are our commitments. They represent the areas where we believe NYUAD can make the most significant difference. This clarity of purpose allows our Research Institute Centers to thrive as hubs of interdisciplinary excellence, attracting the brightest minds and fostering the next generation of leaders within the UAE's knowledge economy.

None of this would be possible without the unwavering support of our partners and the relentless curiosity of our faculty and staff. Your contributions turn our "global campus" from a concept into a catalyst for progress.

I invite you to witness the tangible outcomes of this connectivity. This is research without borders, designed for lasting impact.

Prof. Sehamuddin Galadari
Professor of Biology, Managing Director,
Research Institute, NYU Abu Dhabi





















The Research Institute: Driving Discovery Through Convergence

Since its inception, the NYUAD Research Institute (RI) has served as a catalyst for discovery, helping transform Abu Dhabi into a global hub for pioneering scholarship and research excellence.

The work of the Research Institute's Centers is organized around eight signature themes that span the spectrum of human knowledge: Bio-Innovation and Health, Culture and Heritage, Economic and Social Development, Environmental Sustainability, Space Science, Technology and Information, The Arts, and Urban Systems. The RI does more than support individual Centers; it curates a dynamic ecosystem where Thematic Research Areas converge to address some of the world's most complex challenges. By anchoring research initiatives in these strategic clusters, the RI ensures that every inquiry—whether decoding the fundamental building blocks of life or reimagining the future of our cities—leverages the full strength of NYU Abu Dhabi's intellectual capital. This thematic framework enables NYU Abu Dhabi to build critical mass in areas of vital importance, ensuring that the work of RI Centers is not only academically rigorous but also economically and socially transformative.

Whether Research Institute scholars are harnessing cutting-edge bioengineering to improve human health, preserving the intricate tapestry of humanity's shared heritage, or pushing the boundaries of space exploration, they are supported by an infrastructure designed to turn ambitious questions into meaningful outcomes. The RI actively embraces an interconnected research landscape, bridging regional relevance with global significance. Its Centers operate as a unified force for global impact—from climate change and resource sustainability to the ethical implications of artificial intelligence—with depth, scale, and continuity. The Research Institute continues to evolve while safeguarding a core culture where scientists, artists, engineers, and policy experts collaborate freely, collectively shaping the solutions that will define our shared future.



Research Institute Team

Managing Director
- Sehamuddin Galadari

Director for Strategy and Public Engagement:
- Cira-Cinzia Mathis

Associate Director, Administration and Operations
- Abdulla Jamal

Assistant Director of Operations
- Hardeep Birring

Reporting and Data Analysis Manager
- Christina Johnson

Research Outreach Specialist
- Lolowa AlKindi

Program Administrative Coordinator
- Athari Mesmar

Program Assistant
- Salma Alhajeri

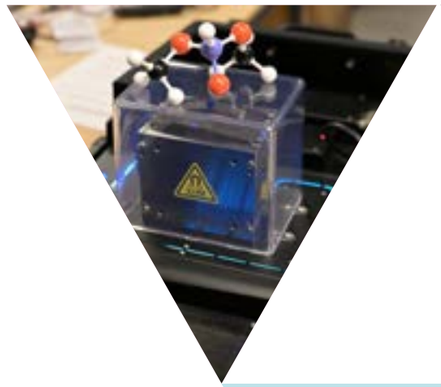
Grant Award and Administration Cycle



Strategic Alignment: Research Impact Areas











Culture & Heritage
HRF
LAL
al Mawrid Arab Art Center

The Arts

Space Science
CASS

Economic & Social Development
CBID

Bio-Innovation & Health
CGSB
PHRC
CBH
CENTMED

Tech & Information
CAIR
CQTS
CIDSAI
CCS
WIRELESS

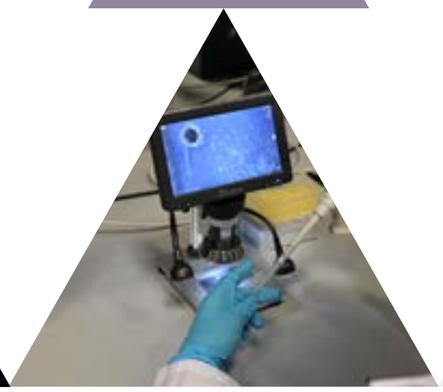
Urban Systems
CITIES
SITE
CSEM
SHORES

Environmental Sustainability
Mubadala ACCESS
WRC

HRF: Humanities Research Fellowship for the Study of the Arab World
LAL: Library of Arabic Literature
al Mawrid: al Mawrid Arab Center for the Study of Art
CASS: Center for Astrophysics and Space Science
CBID: Center for Behavioral Institutional Design
CGSB: Center for Genomics and Systems Biology
PHRC: Public Health Research Center
CBH: Center for Brain and Health
CENTMED: Center for Translational Medical Devices
CAIR: Center for Artificial Intelligence and Robotics
CQTS: Center for Quantum and Topological Systems
CIDSAI: Center of Interdisciplinary Data Science and Artificial Intelligence
CCS: Center for Cyber Security
WIRELESS: NYUAD Wireless Research Center
CITIES: Center for Interacting Urban Networks
SITE: Center on Stability, Instability and Turbulence
CSEM: Center for Smart Engineering Materials
SHORES: Sand Hazards and Opportunities for Resilience, Energy, and Sustainability
Mubadala ACCESS: Mubadala Arabian Center for Climate and Environmental Sciences
WRC: Water Research Center







Spotlights: April 2024 - March 2025

The Research Institute's achievements for AY 2024- 25 reflect the collective excellence and dedication of all it's centers. Through pioneering research, impactful collaborations, and meaningful societal contributions, each center has advanced knowledge and innovation in various fields. These spotlight metrics capture the scale, quality, and influence of the Institute's work over the past academic year.



Technologies
36

CENTMED has advanced its innovation portfolio with several patent filings, including novel systems for improved drainage and ingestible gastrointestinal sampling. Its breakthrough "off-the-jaw" sensing design separates sensors from surgical tools, simplifying integration with laparoscopic devices while reducing wiring complexity, contamination risks, and sterilization challenges offering a scalable, cost-effective solution for modern surgical applications.



Collaborating Institutions
390

CGSB in collaboration with Hoshida lab at UTSouthwest to expand the findings made in zebrafish model of liver cancer to human samples, enabling identification of unique subclasses of human tumors that are defined by the discoveries in UHRF1-induced gene signatures in zebrafish.



External Funding
$7.3m

Mubadala ACCESS secured a grant of $5 million over a period of 5 years from the Mubadala Foundation to support research on preserving vital natural environments in the UAE and surrounding regions. Through multidisciplinary approaches, combining climate monitoring, biodiversity conservation, and sustainable development, the initiative aims to address environmental threats and strengthen long-term ecosystem resilience.



Students
322

CCS led the development of "ICSQuartz: Scan Cycle-Aware and Vendor-Agnostic Fuzzing for Industrial Control Systems (ICS)," presented at NDSS 2025. The work introduced the first method to detect vulnerabilities in ICS source code, led by a NYUAD undergraduate first author who later received a UC Berkeley PhD fellowship.



Awards & Honors
172

CBH received a prestigious award from the Department of Health's Innovation Health Challenge for Project AREA, recognizing ARIAH-AI's potential to advance AI-driven healthcare solutions in Abu Dhabi. The award highlights its clinical relevance and innovation in improving neuroimaging analysis, diagnostics, and patient care through artificial intelligence.



Media Features
552

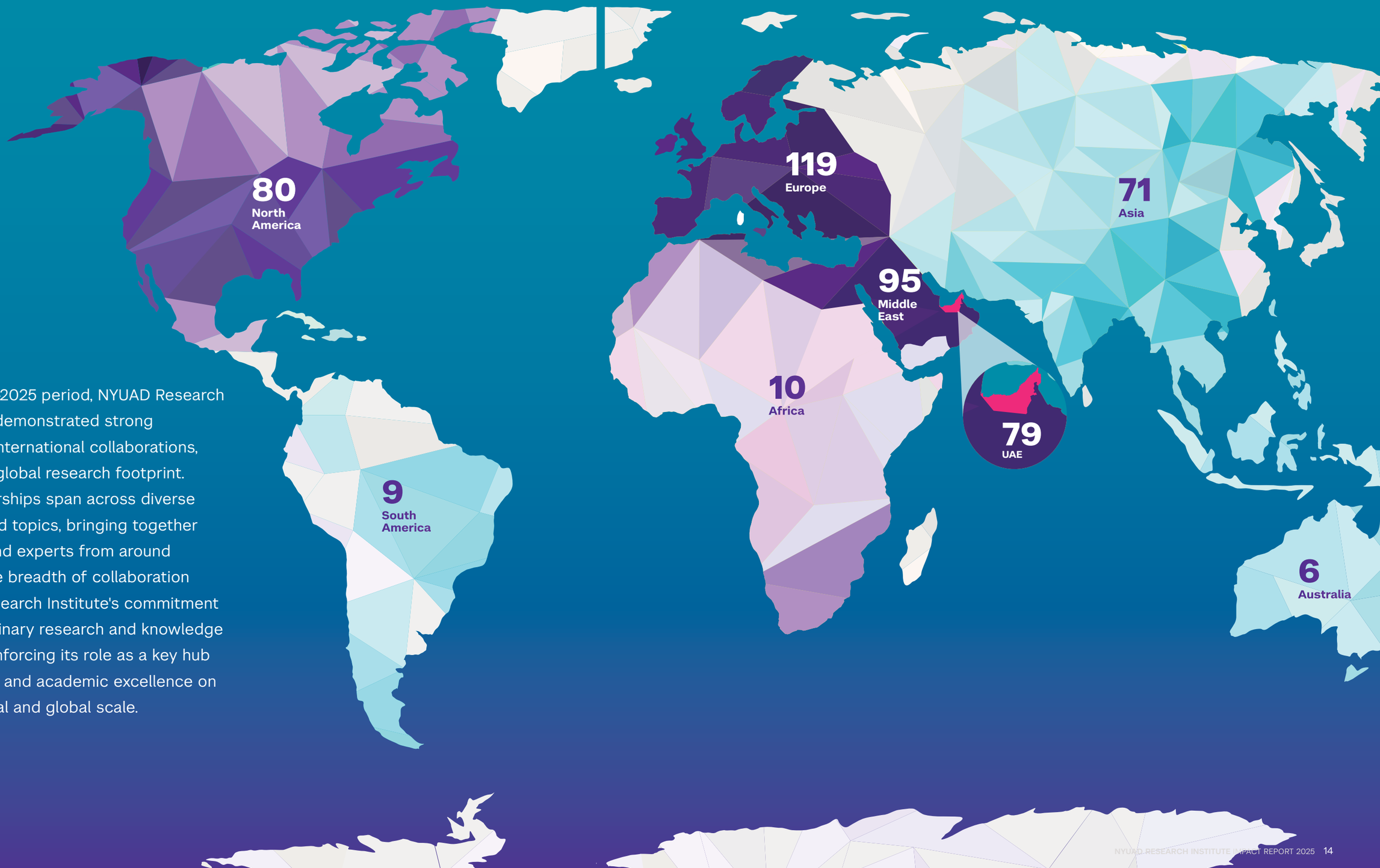
al Mawrid's work has received wide media coverage across major UAE outlets, highlighting its role in preserving and sharing Arab cultural heritage globally. The Center digitized over 5,000 images from key collections, including Hussein Sharif's, through a 40-step process. With 16,878 views, this effort advances open access to art history and supports scholarly research worldwide.



Research Output
877

CASS has produced 34 publications in Nature journals, underscoring its global research impact. A Nature Astronomy paper on exoplanet WASP-43b, based on James Webb Space Telescope observations, received widespread media coverage from NYUAD, SpaceDaily, GulfDaily, and WAM, highlighting strong international interest in the Center's discoveries.

Collaborators



For the 2024–2025 period, NYUAD Research Institute has demonstrated strong national and international collaborations, reflecting its global research footprint. These partnerships span across diverse disciplines and topics, bringing together institutions and experts from around the world. The breadth of collaboration highlights Research Institute's commitment to interdisciplinary research and knowledge exchange, reinforcing its role as a key hub for innovation and academic excellence on both a regional and global scale.

Research Institute Day, 2025



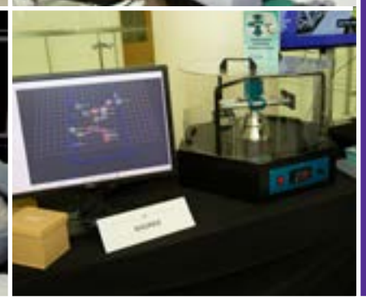












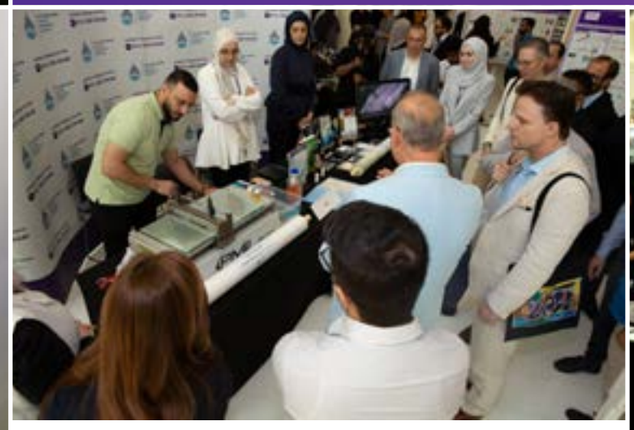






Research Institute Day transformed the NYU Abu Dhabi campus into a vibrant arena of discovery, presenting a vivid cross-section of scholarship propelling our mission ahead. More than a traditional exhibition, the event became an interactive forum where leadership and key stakeholders engaged directly with breakthroughs emerging across Research Institute (RI) Centers. Through immersive demonstrations and thoughtful dialogues, the day showcased the tangible impact of the RI ecosystem. It stood as a powerful reminder of the shared curiosity that defines us, revealing how our varied disciplines converge to address complex global challenges today together.







Center for Research Computing

Infrastructure

The Center for Research Computing **(CRC)** is a multidisciplinary hub that empowers data-intensive research across the sciences, social sciences, engineering, and humanities. By providing state-of-the-art computational infrastructure, scalable workflows, and expert support in high-performance computing (HPC) and advanced analytics, the CRC enables researchers to turn complex data into rigorous, reproducible insight. Partnering with domain experts, core facilities, and international collaborators, the CRC advances discovery in areas ranging from genomic and immunological variation, through artificial intelligence and environmental systems, to biomedical imaging and neuroscience.

Through collaborative problem-solving and computational innovation, the CRC accelerates research productivity and publishes widely in top-tier journals. Its support enhances the impact of projects that integrate machine learning, single-cell genomics, large-scale simulations, and multimodal data integration. By anchoring research computing excellence on campus, the CRC not only facilitates high-impact scholarly output, but also supports training and capacity building across disciplines. Its work reinforces NYU Abu Dhabi's reputation as a global research leader in computational science and data-driven discovery.





HPC has been essential in enabling both the NIHAO simulations and HELLO simulations. These simulation suits are at the core of 30+ papers, and over 6,000 citations since 2016. The availability of large-scale computational resources at NYUAD has made it possible to run high-resolution, computationally intensive simulations that capture the complex interplay between dark matter, baryons, and stellar dynamics across cosmic time.

-Andrea V. Macciò,
Center for Astrophysics and Space Science









CRC

Innovating Across Scales and Domains From Immune Variation to Smart AI and Brain Analytics

Single-Cell Transcriptomics Reveals Inter-Ethnic Variation in Immune Response to Plasmodium falciparum

Malaria remains one of the world's most devastating infectious diseases and has disproportionately impacted African populations over millennia. Yet, despite Africa's genetic richness and complex population structures, individuals of African descent have been strikingly underrepresented in genomic datasets, making up roughly only 0.2% of global genomic data. This underrepresentation creates a significant gap in understanding how genetic diversity shapes disease susceptibility and treatment response.

To address this gap, a collaborative team led by the Idaghdour Lab in NYUAD's Department of Biology partnered with the Centre National de Recherche et de Formation sur le Paludisme and the Institut de Recherche en Sciences de la Santé in Burkina Faso. The project focused on two ethnically distinct groups of children, the Mossi and the Fulani, the latter of whom are known to exhibit lower susceptibility to malaria infection.

Using NYUAD's Core Technologies Platform for single-cell RNA sequencing and leveraging high-throughput bioinformatics workflows developed by the Core Bioinformatics team (CGSB/CRC) on the Jubail HPC cluster, researchers generated and analyzed single-cell transcriptomic data from 126 participants. This approach enabled unprecedented resolution in profiling the cellular and molecular dynamics of immune response to Plasmodium falciparum infection.

Analysis revealed strong ethnicity-dependent differences in immune cell populations and transcriptional programs. Monocytes, in particular, displayed distinct expression patterns between groups, suggesting fundamental variation in innate immune sensing and response. Fulani participants exhibited a unique balance of immune responses: subdued pro-inflammatory profiles in certain monocyte and T-cell subtypes alongside heightened activation in select B-cell subsets. These differences suggest that Fulani individuals may coordinate innate and adaptive immunity in ways that reduce parasite burden more effectively.

Further investigation pointed to ethnicity-specific regulatory variants that may underlie the observed transcriptional signatures, emphasizing the contribution of host genetic variation to immune architecture and disease susceptibility. The study's datasets now serve as a valuable resource for identifying biomarkers of resistance or vulnerability to malaria and may guide the development of vaccines or therapeutics that are effective across genetically diverse populations.

Published in the American Journal of Human Genetics, this work not only deepens scientific understanding of host–pathogen interactions but also reinforces the importance of including diverse populations in genomic research, contributing to more equitable global health solutions.

The Data Science Core as an Innovation Catalyst

The Data Science Team at NYUAD functions as an intellectual engine that translates complex data into meaningful discovery. Operating at the intersection of machine learning, advanced analytics, and domain expertise, the team breaks through traditional barriers, whether

they stem from limited data, noisy environments, or unconventional research questions. Their interdisciplinary impact spans engineering, environmental science, social science, and beyond.

AI Advancements in Construction Engineering

Tackling Small Data with Deep Learning:

In construction material classification, the team confronted the classic challenge of "small data." With only 208 labeled images, they combined transfer learning (Inception V3) with texture analysis via Gray-Level Co-Occurrence Matrix (GLCM). Despite the limited dataset, this hybrid approach achieved 95% classification accuracy, a testament to how modern ML can overcome data scarcity without performance trade-offs. These findings have already been cited widely and demonstrate scalable strategies for similar constrained datasets.

Smart Audio for Activity Recognition:

Construction sites are acoustically complex. To extract useful signals from noisy backgrounds, the team collaborated with external partners to develop a hybrid CNN-LSTM model that merges Mel spectrogram representations with temporal sequence learning. This system distinguishes machinery sounds with 91% precision, surpassing benchmarks in the field and showing how acoustic data can augment visual monitoring in safety and automation.

Active Learning for Efficient Labeling (WATLAS):

Manual annotation often bottlenecks machine learning workflows. The team's WATLAS framework applies weighted active learning to prioritize informative samples, drastically reducing labeling costs while maintaining high detection accuracy. The result: a model that achieves 97% accuracy and retains 90% performance even when using only 5% of labeled data, a leap forward in sustainable ML for real-world applications.

AI for Environmental Resilience: Coral Bleaching Insights

Expanding beyond engineered systems, the Data Science Team applied explainable AI to 40 years of climate data to illuminate drivers of coral bleaching in the Arabian Gulf, a region acutely affected by marine heatwaves. Using XGBoost models paired with SHAP (SHapley Additive exPlanations) analysis, the team identified key meteorological variables such as wind speed and dew point as critical modulators of thermal stress on reefs. Unlike opaque "black box" models, this approach quantified the influence of specific factors, offering actionable forecasts for conservationists and local stakeholders. This research not only supports regional marine resilience planning but sets a precedent for interpretable machine learning in environmental systems.

Frontiers in Social Science: Art Valuation and Emotional Markets

The team is also innovating in areas where data is abstract and subjective:

- Art Market Prediction: By combining global trend analysis with localized market behavior, the team explored predictive frameworks for art pricing, a domain traditionally resistant to quantitative modeling. They are developing a "Visual Valuation" methodology that teaches algorithms to assess aesthetic attributes and market value, bridging art theory and computational economics.

- Emotional Drivers of Financial Markets: In collaboration with behavioral science experts, the team is modeling cryptocurrency volatility through the lens of sentiment and psychological response. By integrating natural language analysis of news with price and volume metrics, this work probes how human emotion shapes financial dynamics.

Across these domains, the Data Science Team has shifted from a supporting role to a driving force in research output. With publications in top-tier journals and partnerships across faculties, the team proves that whether the challenge is a sound wave, satellite data, or auction price, disciplined data science delivers clarity and insight.

BRAIMCORE — HPC-Enabled Analysis for Multimodal MRI

In 2024–2025, CRC and the Biomedical Imaging team deployed BRAIMCORE, a scalable platform for large-scale and multimodal neuroimaging analysis. BRAIMCORE seamlessly integrates with central imaging repositories and provides a reproducible processing framework that abstracts software setup and manual data handling, enabling researchers to focus on scientific questions rather than computational logistics.

Key achievements include:

- **Massive Data Throughput**: Using the Jubail HPC cluster, BRAIMCORE processed hundreds of terabytes of structural MRI datasets from both local cohorts and external benchmarks like the Human Connectome Project.

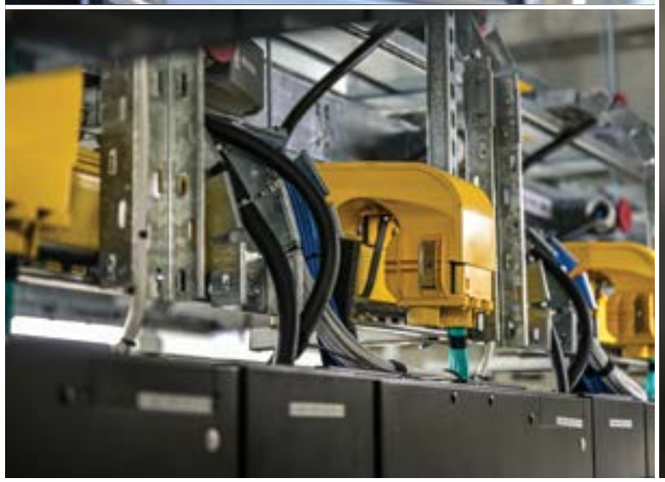
- **Population-Level Analyses:** The system produced normative curves for brain measures across the lifespan, supporting conference presentations, peer-reviewed publications, and successful grant proposals.

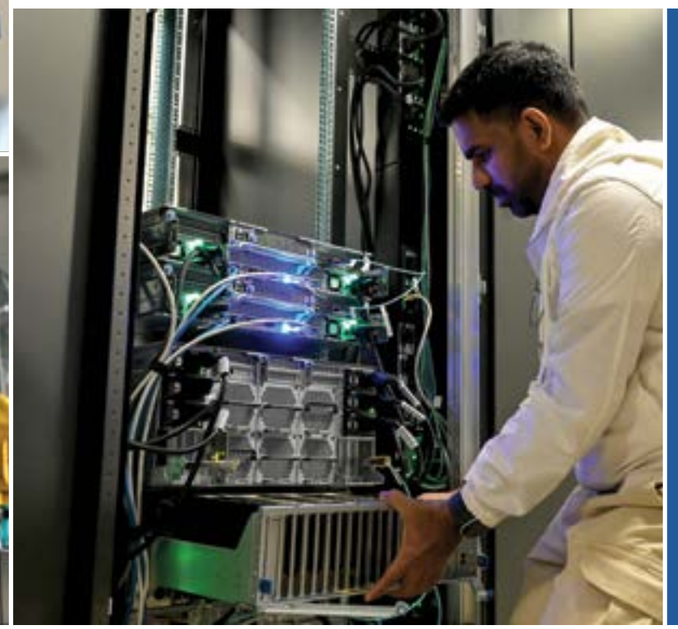
- **Reproducibility and Scalability:** Standardized workflows and a central data store reduce redundancy and ensure that analyses are repeatable, robust, and shareable, core principles of modern scientific computing.

Importantly, BRAIMCORE is expanding beyond MRI to include MEG and EEG processing, laying the foundation for truly multimodal pipelines that integrate fast neural dynamics with anatomical structure. This expansion positions NYUAD at the forefront of computational neuroscience and demonstrates how infrastructure-enabled workflows can accelerate discovery across neuroimaging and public health research domains.

CENTER FOR RESEARCH COMPUTING







> *CRC supported ACCESS with high-performance computing and technical expertise for large-scale simulations and data analysis, enabling key studies on the April 2024 UAE extreme rainstorm and Arabian Gulf sea temperature links to global climate patterns.*
>
> **-Francesco Paparella, Mubadala Arabian Center for Climate and Environmental Sciences**

Spotlights

April 2024
March 2025

525
Publications Citing use of Jubail

37
Faculty & Researchers Supported

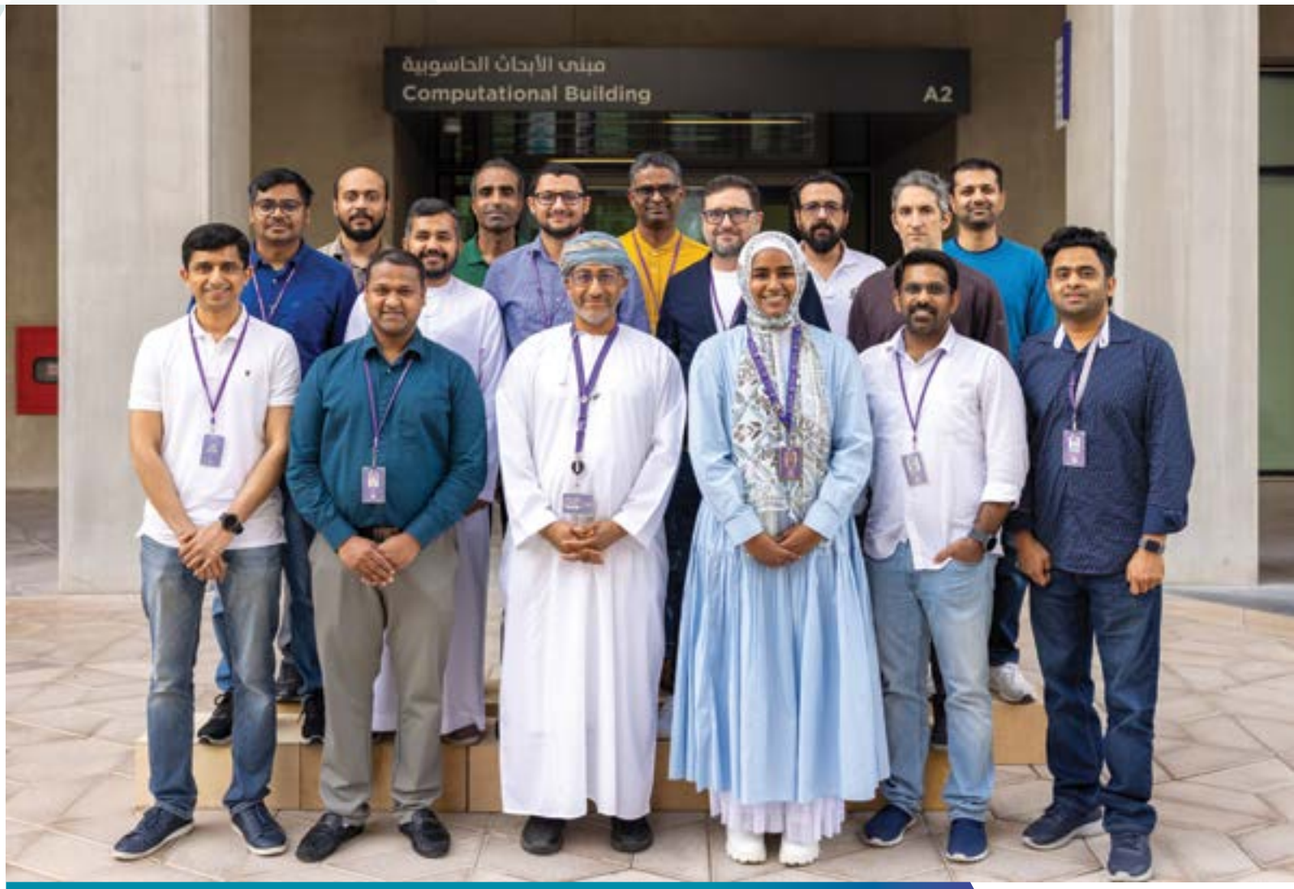
62
External Collaborations Supported

661
Active Users

270
Student Users

*The Jubail cluster delivered **188 million hours** of supercomputing power. To put that in perspective, a standard laptop (8 CPU) would have to operate 24/7 for more than 21,000 years to process the same volume of data.*

-Muataz Al Barwani
Senior Director, CRC



Center Leadership and Research Team

Senior Director
- Muataz Al Barwani

HPC Application and Computational Specialists
- Vineet Deepak More
- Jorge Naranjo
- Ahmed Mahany Omar
- Mennatallah Samier Saleh
- Waqqas Zia

HPC System Administrators
- Simon Johny
- Fayizal Kunhi
- Abhishek Kumar Sharma

Data Science & AI
- Dhanu Jhala
- Karunakar Reddy Mannem

Bioinformatics
- Muhammad Arshad
- Nizar Drou
- Jayaram Radhakrishnan
- Nabil Rahiman
- Giuseppe-Antonio Saldi

Culture & Heritage

HRF

LAL

Humanities Research Fellowship for the Study of the Arab World

In January 2014, the NYU Abu Dhabi Institute launched a multi-year Humanities Research Fellowship (**HRF**) program aimed at strengthening and diversifying the humanities research ecosystem. The program establishes focused thematic areas of scholarly inquiry, fostering a sustained and interdisciplinary research environment on campus. Over the past decade, the HRF has developed into a leading international platform for research on the intellectual, cultural, and social histories of the Arab world, encompassing both historical and contemporary perspectives. Grounded in NYUAD's geographic and institutional context, the program has contributed to a globally recognized humanities research profile while advancing institutional infrastructures that support scholarly innovation, collaboration, and knowledge dissemination in and about the region.

Since its inception, the HRF has hosted 22 senior fellows, 29 postdoctoral fellows, and 6 PhD students through one- and two-year residential fellowships. Fellows actively engage with the university's intellectual community by conducting original research and participating in seminars, workshops, and presentations of work in progress with NYUAD faculty and students. The program's scholarship is closely aligned with faculty research in Arts and Humanities at NYUAD, related departments and centers at NYU New York, and NYUAD's broader outreach initiatives in the UAE.



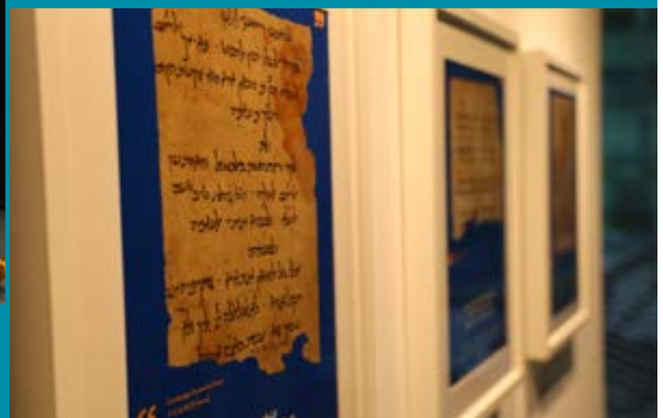






By prioritizing collaboration, mentorship, and protected research time, HRF has articulated a scalable model for impactful humanities research-one that positions the program as a dynamic hub for scholarship on the Arab world.

-Nathalie Peutz,
Center Director, HRF



Time and Space: Optimizing the Conditions for Impactful Scholarship in Humanities

A Dynamic Evolution: Rethinking the Fellowship

Academic Year 2024–25 marked a pivotal period for the Humanities Research Fellowship for the Study of the Arab World (HRF). The HRP joined into the university's Arts and Humanities Research Platform, and the program entered a period of strategic evolution. Embracing an agile and experimental approach, HRF reimagined conventional fellowship models to focus on flexibility, targeted interventions, and intensified faculty engagement.

This dynamic shift resulted in a year of programmatic innovation that successfully expanded research participation, strengthened scholarly networks, and reinforced HRF's role as a vital catalyst for interdisciplinary humanities research within and beyond NYUAD.

A central priority in this period was expanding research impact and broadening the program's scholarly reach. To achieve this, HRF introduced shorter, high-impact scholarly workshops and writing-focused interventions designed to maximize productivity while fostering rich intellectual exchange.

These new initiatives emphasized depth of engagement, mentorship, and cross-disciplinary dialogue, aligning seamlessly with NYUAD's faculty research priorities and robust global academic networks. By diversifying the fellowship experience, HRF created new avenues for connection and sustained scholarly excellence.

Winter Writing Residency: An Intensive Model for Global Scholarly Exchange

A cornerstone of this reimagined approach was the inaugural Winter Writing Residency, held from January 6–24, 2025. Conceived as an intensive, research-driven engagement, the residency brought together eight senior scholars selected from a highly competitive pool of applicants. Participants represented a wide range of disciplines and institutions, unified by their focus on the Arab world and its global entanglements.

The residency supported sustained work on book manuscripts, journal articles, and major research projects, while embedding scholars within NYUAD's intellectual ecosystem. Participants included:

- James Allinson (University of Edinburgh), *The Making of Fossil Sovereignty*
- Sebastian Günther (University of Göttingen), *Legacies of Early Islamic Educational Thought (8th–11th Century CE)*
- Magdalena Moorthy-Kloss (Leibniz-Zentrum Moderner Orient / Austrian Academy of Sciences), *Famines, Slavery, and Plantation Labor in 1940s South Yemen*
- Mohammed Muharram (University of Bremen), *Yemen–Gulf Maritime Connections from a Blue Humanities Perspective*
- Mona Oraby (Howard University), *Back to Kemet: Black America and the Allure of Afrocentrism*
- Vaughn Rasberry (Stanford University), *The African Mediterranean: Language, Diaspora, and the Literary Imagination*
- Zekeria Ahmed Salem (Northwestern University), *Islamic Knowledge Unbound: Mauritania and the Making of Islamic Knowledge Authority*
- Nükhet Varlık (Rutgers University–Newark), *From Pluralism to Professionalism in Ottoman Medicine, 1350–1650*







Each scholar was paired with at least one NYUAD faculty member based on shared research interests, enabling focused mentorship and collaboration. The program combined structured writing time with faculty meetings, welcome and social dinners, and a concluding panel in which participants presented their research progress. HRF's administrative flexibility allowed two scholars to extend their stays under education visas, demonstrating responsiveness to diverse scholarly needs.

Beyond individual research outputs, the Winter Writing Residency functioned as a laboratory for intellectual exchange. Cross-disciplinary conversations emerged organically, linking history, literary studies, political theory, and environmental humanities. These interactions laid the groundwork for ongoing collaboration and positioned the workshop as a scalable model for future programming.

Faculty Research Writing Workshops in Oman: Deepening Scholarly Practice

Building on the momentum of the Winter Writing Residency, HRF piloted a second initiative: two Faculty Research Writing Workshops held in the Green Mountains of Oman during summer 2025. These workshops tested a new model of off-campus, immersive research engagement aimed at NYUAD faculty, current and former HRF fellows, and affiliated researchers across the humanities and social sciences.

Each workshop offered 20–24 hours of protected writing time over several days, complemented by structured discussions on research methods, project design, and reflective scholarly practice. This format removed daily institutional pressures, allowing participants to focus intensively on advancing their work.

Participants reported substantial progress on conference papers, journal articles, and book chapters, as well as renewed clarity on long-term research trajectories. Reflections underscore the workshops' impact:

- *"It was a fabulous experience, very inspiring, and just a great way to begin the semester!"* — Rashmi Devi, Associate Arts Professor, Film & New Media
- *"I was able to accomplish a significant amount of writing in just a few days... it helped get a sense for how much can be accomplished under close to ideal circumstances."* — Gabriel Koehler-Derrick, Assistant Professor of Political Science
- *"Excellent initiative... I would recommend more of these workshops to shift the tone back toward research and education."* — Dale Hudson, Associate Professor, Film & New Media
- *"The workshop gave me the time and mental space to focus and get [the paper] out the door... it's just been accepted by a major journal in digital humanities."* — Süphan Kırmızıaltın, Visiting Assistant Professor of Middle Eastern History

The Oman workshops strengthened collegial bonds, facilitated cross-divisional dialogue, and reinforced mentorship between junior and senior scholars. They also demonstrated how relatively modest investments in time and space can yield outsized research outcomes.

Integrating Workshops and Retreats: A Coherent Mentorship Strategy

Taken together, the Winter Writing Residency and the Oman workshops formed a coherent strategy centered on mentorship, collaboration, and sustained scholarly engagement. HRF intentionally linked visiting scholars with NYUAD faculty, creating multiple points of contact across career stages and disciplines. The combination of short-term workshops, structured writing environments, and informal social interaction fostered a supportive research culture that extended beyond the duration of each program.

Looking Ahead: Research Across the Emirates

Building on these successful pilots, HRF plans to launch "Research Across the Emirates," a multi-year initiative comprising interdisciplinary research seminars hosted across the UAE. One seminar will be held in each emirate over the next two to three years, engaging HRF fellows, NYUAD faculty, and partner institutions.

A three-day seminar scheduled in Dubai for January 2026 will convene visiting scholars and NYUAD faculty for sustained collaborative exchange. During this seminar, NYUAD faculty will experience an abridged form of the Winter Writing Residency, together with invited senior scholars selected from a pool of over 200 applicants.

Conclusion: A Model for Adaptive Humanities Research

AY24–25 stands as a case study in adaptive program design within the humanities. Through targeted interventions, flexible workshop models, and a focus on immersive scholarly practice, HRF not only sustained its mission under constraint but expanded its intellectual reach.

By prioritizing collaboration, mentorship, and protected research time, HRF has articulated a scalable model for impactful humanities research, one that positions the program as a dynamic hub for scholarship on the Arab world and a driver of innovation within NYUAD's research ecosystem.

Workshops strengthened collegial bonds, facilitated cross-divisional dialogue, and reinforced mentorship between junior and senior scholars.



Spotlights

April 2024
March 2025

9
Workshops

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Center Leadership and Visiting Researchers

Center Director & Principal Investigator
- Nathalie Peutz

Co-Principal Investigators
- Maya Kesrouany
- Erin Pettigrew

Center Administration
- Sara Alfardan
- Raya Lakova

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- Saleem Al Bahloly
- Alexandra Schultz

Visiting Scholar
- Eli Dollarhide

Library of Arabic Literature

The Library of Arabic Literature **(LAL**) publishes Arabic editions and English translations of major works from Arabic literature, emphasizing texts produced between the seventh and nineteenth centuries. Its scope ranges from the pre-Islamic period to the threshold of modernity and encompasses diverse genres, including poetry, poetics, fiction, religion, philosophy, law, science, travel writing, history, and historiography.

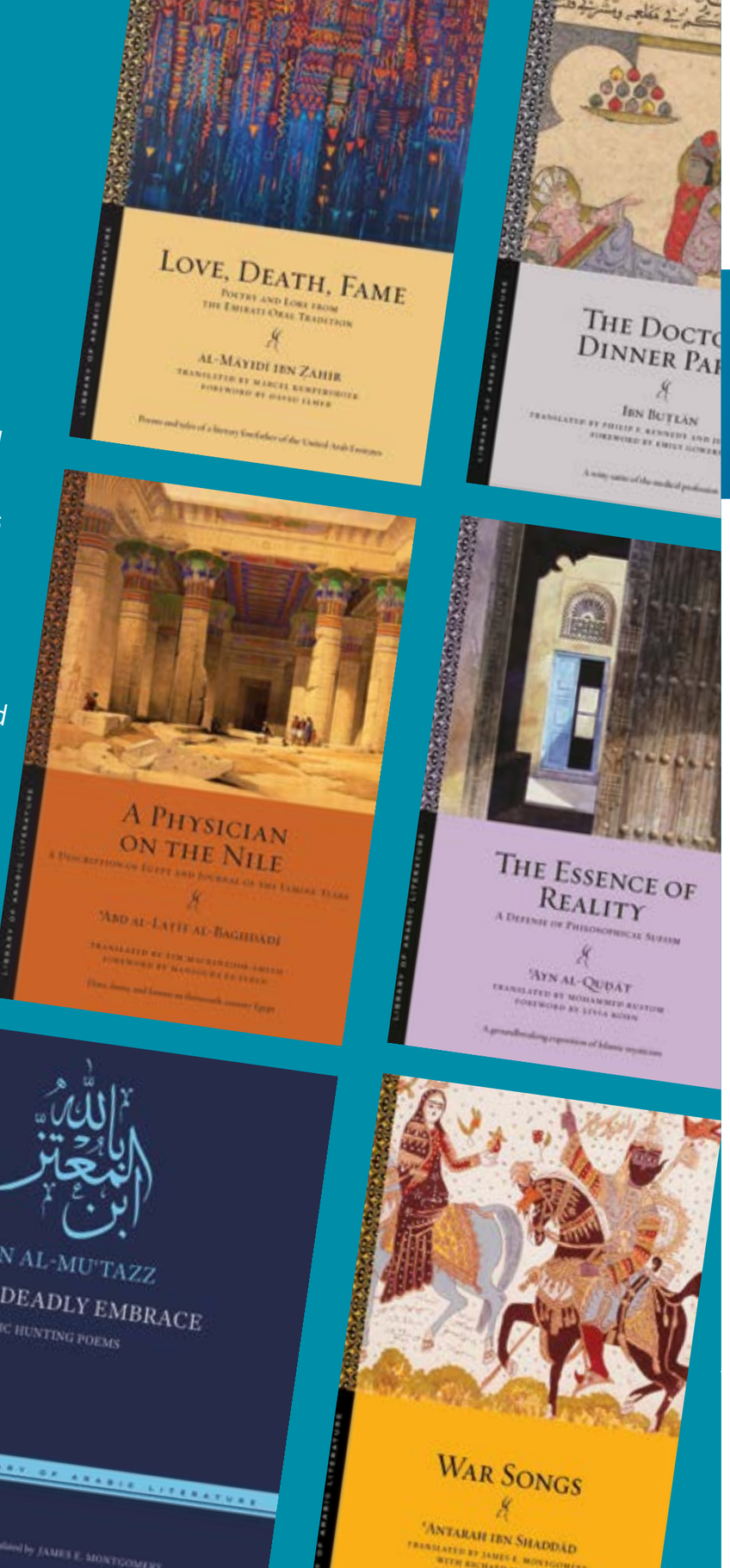
Each volume is edited and translated by internationally recognized scholars and is available in multiple formats: hardcover editions with Arabic and English presented in parallel-text format, English-only paperbacks, and freely downloadable Arabic editions, reflecting LAL's commitment to open access and educational dissemination. Select works also receive standalone scholarly editions with full critical apparatus.

LAL supports the production of authoritative Arabic texts accompanied by clear, contemporary English translations, aiming to make Arabic literary heritage accessible to scholars, students, and general readers.Additionally, LAL offers full-year and semester-long fellowships for scholars and translators of Arabic, fostering a global community of editors and translators dedicated to advancing the study, translation, and dissemination of Arabic literature.



By producing authoritative texts and contemporary English translations, the series ensures that the intellectual achievements of the Arab world continue to inspire and educate audiences worldwide.

-Philip F. Kennedy, Center Director, LAL



Arabic Literature Revealed Through Critical Editions and Accessible English Translations

The Library of Arabic Literature (LAL), based at New York University Abu Dhabi and published in partnership with New York University Press, is an ambitious, internationally recognized initiative dedicated to producing authoritative Arabic editions alongside clear, modern English translations of significant works from the classical Arabic tradition. Founded in 2010, LAL seeks to make the intellectual, literary, and cultural heritage of the Arab world widely accessible to both specialists and general readers. By encompassing a broad spectrum of disciplines, LAL highlights the richness of classical Arabic scholarship and demonstrates its global historical significance across centuries.

Each volume in the Library of Arabic Literature is prepared by leading international scholars who bring rigorous academic expertise to every stage of the editorial process. Arabic texts are carefully established through extensive manuscript research, ensuring the highest standards of textual accuracy and reliability. Each edition is accompanied by detailed annotations and explanatory notes that clarify linguistic, historical, and cultural references, guiding readers through complex material. Comprehensive scholarly introductions situate each work within its intellectual, literary, and historical context, providing both specialists and general audiences with a clear understanding of its broader significance.

Through its publications, LAL has transformed how Arabic literary heritage is encountered in global academia. Arabic classics are increasingly integrated into world literature curricula, supporting comparative humanities research and contributing to cultural diplomacy by showcasing the depth, diversity, and sophistication of Arab intellectual traditions. In doing so, the Library fosters cross-cultural dialogue and positions classical Arabic literature as a vital component of global knowledge.

At its core, LAL reflects NYU Abu Dhabi's mission as a global research university: preserving knowledge traditions, advancing scholarship, and making them accessible across linguistic and geographic boundaries. By producing authoritative texts and contemporary English translations, the series ensures that the intellectual achievements of the Arab world continue to inspire and educate audiences worldwide.

A Demon Spirit: Arabic Hunting Poems

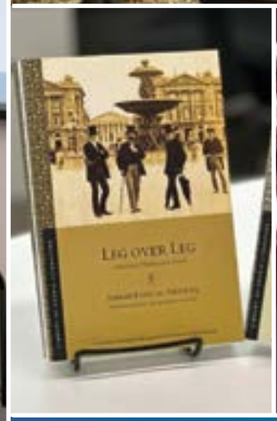
In A Demon Spirit: Arabic Hunting Poems, award-winning poet and translator James E. Montgomery brings together the hunting poetry, or tardiyyat, of Abū Nuwās, rendering these works into vivid, contemporary English for the first time. These poems reveal not only the poet's technical brilliance and stylistic innovation, but also his irreverent worldview, in which desire, danger, wit, and sacred defiance coexist in a dazzling literary display.

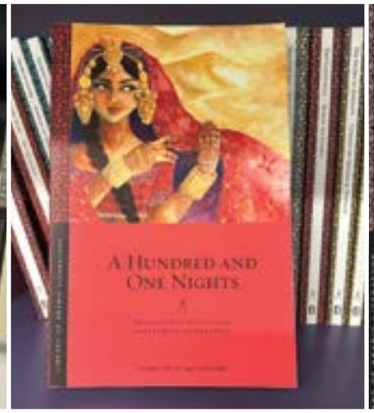
This volume represents the third installment in a striking series dedicated to Arabic hunting poetry, following earlier works acclaimed as essential reading for anyone who loves poetry. A Demon Spirit offers readers a rare encounter with a literary giant whose work continues to unsettle, enchant, and redefine the boundaries of poetic expression. Montgomery's translation captures the immediacy, rhythm, and audacity of Abū Nuwās, bridging the gap between the classical Arabic text and contemporary readers while preserving its linguistic and cultural richness.

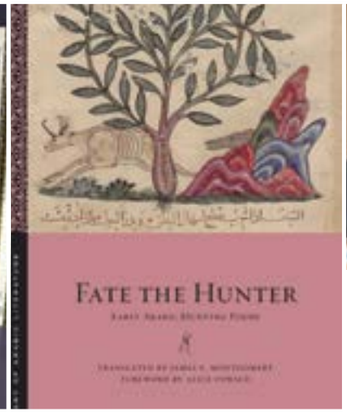














These volumes preserve a living archive of Bedouin memory, where poetry and narrative intertwine to tell the story of a people, their landscape, and a way of life negotiating its place between tradition and transformation.

The Rules of Logic

The Rules of Logic has long been the most widely read introduction to logic in the Arabic-speaking world and likely holds the distinction of being the longest-surviving logic textbook ever written. From the early eighth/fourteenth century to the present, generations of madrasah students have studied its pages, honing their ability to construct sound arguments and articulate precise, unambiguous claims in natural language. Drawing on foundational theories developed by Avicenna, al-Rāzī, and other pioneers of logical thought, al-Kātibī carefully maps the common pitfalls of human reasoning, providing readers with tools to navigate them with clarity and rigor.

The enduring relevance of The Rules of Logic attests to al-Kātibī's intellectual legacy and his influence on formal discourse and argumentation across centuries. This English-only edition, accompanied by an illuminating commentary by translator Tony Street, makes accessible to contemporary readers a text that has shaped scholarly thinking for generations. It offers insight into the development of logical theory and its application in classical Arabic scholarship, reaffirming the work's significance in the global history of logic and philosophy.

Bedouin Poets of the Nafūd Desert

Bedouin Poets of the Nafūd Desert collects the poetry of three remarkable poets from the Ibn Rashīd dynasty: Khalaf Abū Zwayyid, Adwān al-Hirbīd and Ajlān ibn Rmāl. Their lives were rooted in the tribal heartland around Jabal Shammar, a region that, during the nineteenth century, represented the high point of Bedouin culture. This vibrant crossroads saw caravans, pilgrims, tribal shaykhs, European travelers, and poets both illiterate and learned converge, creating a rich literary and cultural environment.

Living at the onset of modernity's encroachment, these poets witnessed profound social and technological changes. Firearms and new tools spread across the desert, while political upheavals, most notably the rise of the House of Saud and the expansion of Wahhabism, reshaped the social and cultural landscape. Their poetry, often humorous and witty yet deeply sentimental and romantic, vividly evokes journeys on camelback, tales of love and marriage, daring raids, and lyrical depictions of desert nature. Alongside accompanying narratives, the collection offers an intimate portrait of Bedouin society as it navigated the tensions between tradition, adaptation, and continuity during times of profound transformation.

Complementing these voices is Arabian Hero, which preserves the surviving corpus of poems attributed to the semi-legendary epic hero Shāyi' al-Amsa, alongside oral narratives of his chivalrous exploits. A revered ancestor of the Shammar tribal confederation spanning the Great Nafūd Desert, Shāyi's stories have been transmitted orally for centuries. Translator Marcel Kurpershoek renders these verses and narratives with vivid clarity, capturing a figure who embodies Bedouin ideals of courage, generosity, cunning, and honor.

Together, these volumes preserve a living archive of Bedouin memory, where poetry and narrative intertwine to tell the story of a people, their landscape, and a way of life negotiating its place between tradition and transformation. They exemplify LAL's commitment to making classical Arabic literature accessible, providing both textual fidelity and cultural context, and bridging centuries of literary and oral tradition for contemporary readers.

LIBRARY OF ARABIC LTERATURE

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- David Larsen
- Tim Mackintosh-Smith
- Chip Rossetti
- Lucie Taylor

Culture & Heritage

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The Arts

al Mawrid

al Mawrid Arab Center for the Study of Art

al Mawrid Arab Center for the Study of Art is an interdisciplinary research center dedicated to advancing the study of visual arts from an intellectual base in the Arab world, while operating within an extensive global network of scholars, archives, and cultural institutions.

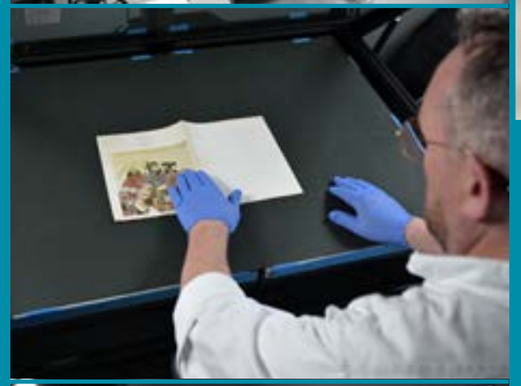
Grounded in principles of critical dialogue and sustained collaboration, the Center systematically examines the concepts, practices, and institutional frameworks of education and exhibition developed by Arab artists in response to profound transformations in the twentieth-century global balance of power. The imperative to address persistent gaps in archival scholarship and heritage management has grown increasingly urgent in the digital era, in which disparities in “findability” play a decisive role in shaping visibility, representation, and historical narrative. Drawing on the deep expertise of its research and archival teams, its rigorous and ethically informed approaches to digital assets, and its strong commitment to public-facing scholarship, the Center constitutes a unique, world-class hub for innovative research in the arts that critically links historical inquiry with future-oriented knowledge production.













Contrary to external perceptions that assumed the absence of a local art scene, sustained and meaningful artistic activity was unfolding through women's unions, informal teaching circles, and community-based initiatives.

Documenting Visual Art Education in the UAE Since the 1960s: The Feryal Matar Collection as Historical Evidence

In the decades preceding the institutionalization of art education in the United Arab Emirates, artistic practice developed largely outside formal academic frameworks. Contrary to external perceptions that assumed the absence of a local art scene, sustained and meaningful artistic activity was unfolding through women's unions, informal teaching circles, and community-based initiatives. It is within this overlooked historical landscape that the life and work of Feryal Matar emerge as both emblematic and foundational, offering critical insight into the early development of visual art practice and education in the Emirates.

Feryal Matar, a Palestinian artist, relocated to Kuwait in 1960, where she established herself as both an educator and exhibiting artist. Her career was shaped by an unusually expansive transnational education: she earned formal qualifications in Arabic calligraphy, pursued art studies in London, and trained in ikebana in Japan. Following her marriage to Dr. Zuhair Abu Kuwaik, whose professional work brought the couple to Sharjah, Matar continued to cultivate her artistic practice while Abu Kuwaik established the first medical clinic in the Emirate. Their settlement coincided with a formative period in the UAE's social and cultural development, during which artistic production remained largely informal yet highly active.

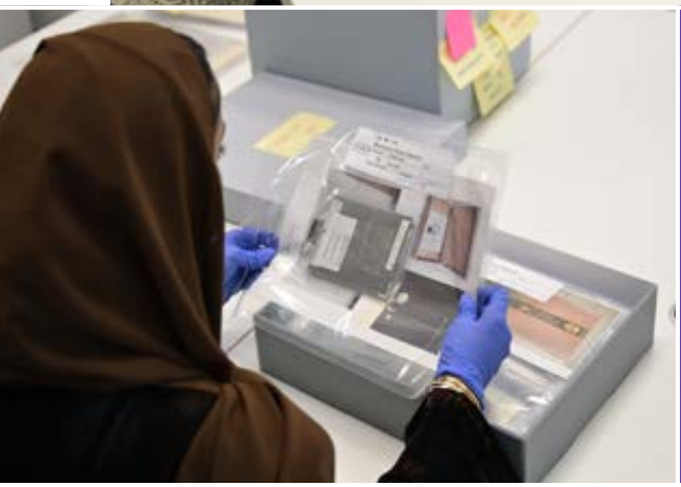
Matar's artistic oeuvre reflects both the breadth of her training and the complexity of her lived experience. Her work includes expressive oil paintings, seascapes and cave landscapes, symbolic depictions of Palestine, folk-inspired compositions, beadwork, and figure studies informed by Japanese aesthetics. Moving fluidly across media and techniques, her practice consistently challenged rigid distinctions between fine and applied arts. This openness not only expanded the aesthetic vocabulary of her work but also enabled it to circulate widely. Over time, Matar developed a significant collector base that included Gulf royalty and prominent dignitaries, positioning her practice within both local and regional cultural networks.

Throughout her career, Matar's art articulated an ongoing dialogue between identity, displacement, and belonging. Her Palestinian heritage remained a central thematic reference, while her long-term residence in the Emirates deeply informed her subject matter, materials, and pedagogical commitments. Beyond her individual artistic production, Matar played a crucial role as an educator at a time when no formal university-level art programs with terminal degrees existed in the UAE. Between the 1960s and 1970s, she led groups of women who met regularly in Abu Dhabi, Sharjah, and Dubai to receive informal instruction in art. These gatherings functioned as alternative learning environments in which skills were transmitted, practices refined, and creative communities sustained.

The historical importance of this informal pedagogical ecosystem forms the basis for al Mawrid Arab Center for the Study of Art's acquisition of the Feryal Matar Collection. Building on the collection, the Center initiated a major research project titled "Visual Art Education in the Emirates, 1960s to the Present," aimed at situating Matar's practice within a broader history of art education in the UAE. The project is led by Professor Tina Sherwell, Co-Director of the Master of Fine Arts program and Associate Arts Professor at NYU Abu Dhabi, with the support of a Kawader Fellow. Together, they seek to examine how early artistic and educational initiatives shaped the foundations of today's art ecosystem.

Spanning more than three years, the research constructs a historical trajectory of visual art practice in the UAE, tracing how informal educational efforts





The findings of this research will serve as a critical resource for the ongoing development of Abu Dhabi's creative sector.

contributed to the country's contemporary engagement with the arts and its significant cultural investment. The study examines the development of visual art education over the past five decades, paying particular attention to the reciprocal relationship between informal and formal modes of learning. Rather than treating these as separate systems, the research analyzes how they intersect within individual artistic careers, across generations, and within national cultural development.

A key component of the study involves mapping informal art instruction programs initiated by institutions, organizations, collectives, and individual artists. These programs are examined in relation to the emergence of formal education in colleges and universities, highlighting points of overlap, mutual influence, and coexistence. Central to this analysis is the role of women, whose sustained engagement in informal teaching practices proved critical to the continuity and transmission of visual art knowledge during periods of limited institutional infrastructure.

Focusing on selected artists and educators, the research investigates how their activities shaped pedagogical methodologies, curricular approaches, and broader educational visions. Beyond documentation, the study critically examines how these initiatives responded to shifting social, political, and historical conditions. It addresses questions of longevity and sustainability, exploring how informal programs were maintained over time, the forms of support they relied upon, and the extent of their cultural impact. Particular attention is given to how these initiatives fostered creative communities and encouraged pathways into advanced art education.

The research also considers the formation of educator cadres in the Emirates, examining their training backgrounds and professional trajectories. It analyzes how these experiences influenced the ethos of art education across different institutional roles and how art education contributed to broader processes of nation building and cultural identity formation.

As the UAE and Abu Dhabi in particular has developed into a global crossroads for creative practitioners, the study situates local art education within a wider context of globalization. It asks how the UAE's position as an international cultural hub has shaped the development of art education locally, and how national ambitions intersect with global artistic flows. In doing so, the UAE is examined as a distinctive case study for understanding the relationship between cultural development, globalization, and state formation.

The findings of this research will serve as a critical resource for the ongoing development of Abu Dhabi's creative sector, with specific relevance to the Miza District and the educational initiatives of the Department of Culture and Tourism. By foregrounding the cumulative history of visual art education in the UAE, the study identifies strengths, gaps, and opportunities for future growth. It distinguishes key pedagogical trends, methodologies, and synergies, while highlighting particularly impactful initiatives that offer models for future development.

Methodology

The study employs a multi-method research design combining archival research, in-depth interviews, focus group discussions, and participatory workshops. Research is conducted across individual and institutional archives to reconstruct historical trajectories and educational practices. Interviews are undertaken with artists, educators, and key stakeholders involved in both informal and formal art education, documenting personal histories, institutional development, and pedagogical approaches.

Focus groups comprising five to ten participants bring together artists, graduates, professors, educators, ministerial and institutional representatives, and current and former leaders. Guided by structured discussion frameworks, these sessions generate qualitative insights into cohort experiences and perceptions of continuity and change within visual art education.

Outcomes

The research will generate new scholarly insights into pedagogical models that integrate formal and informal learning environments in the Emirates within regional and global networks. Its findings will inform the development of undergraduate and graduate programs in art and art history at NYU Abu Dhabi, as well as future creative programs. The study will also illuminate student pathways, prior training contexts, and the role of graduates in sustaining art education across formal and informal sectors.

Final deliverables include three peer-reviewed academic articles analyzing the evolution of art education policies and institutional strategies; the relationship between informal learning and professional artistic development; shifting pedagogical approaches in relation to modern and contemporary art practices; and long-term transformations in the social role of art in the UAE, particularly in relation to citizenship, national identity, and cultural belonging.

AL MAWRID ARAB CENTER FOR THE STUDY OF ART

"The task of redressing gaps in archival scholarship and heritage management has only become more urgent in the digital age, when differences in 'findability' can determine whose stories are told."

-Salwa Mikdadi, Center Director, al Mawrid

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Center Leadership and Research Team

Center Director & Principal Investigator
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- Ala Younis

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- Zuhoor Al Sayegh
- Patrick Kane
- Donata Levi

Space Science

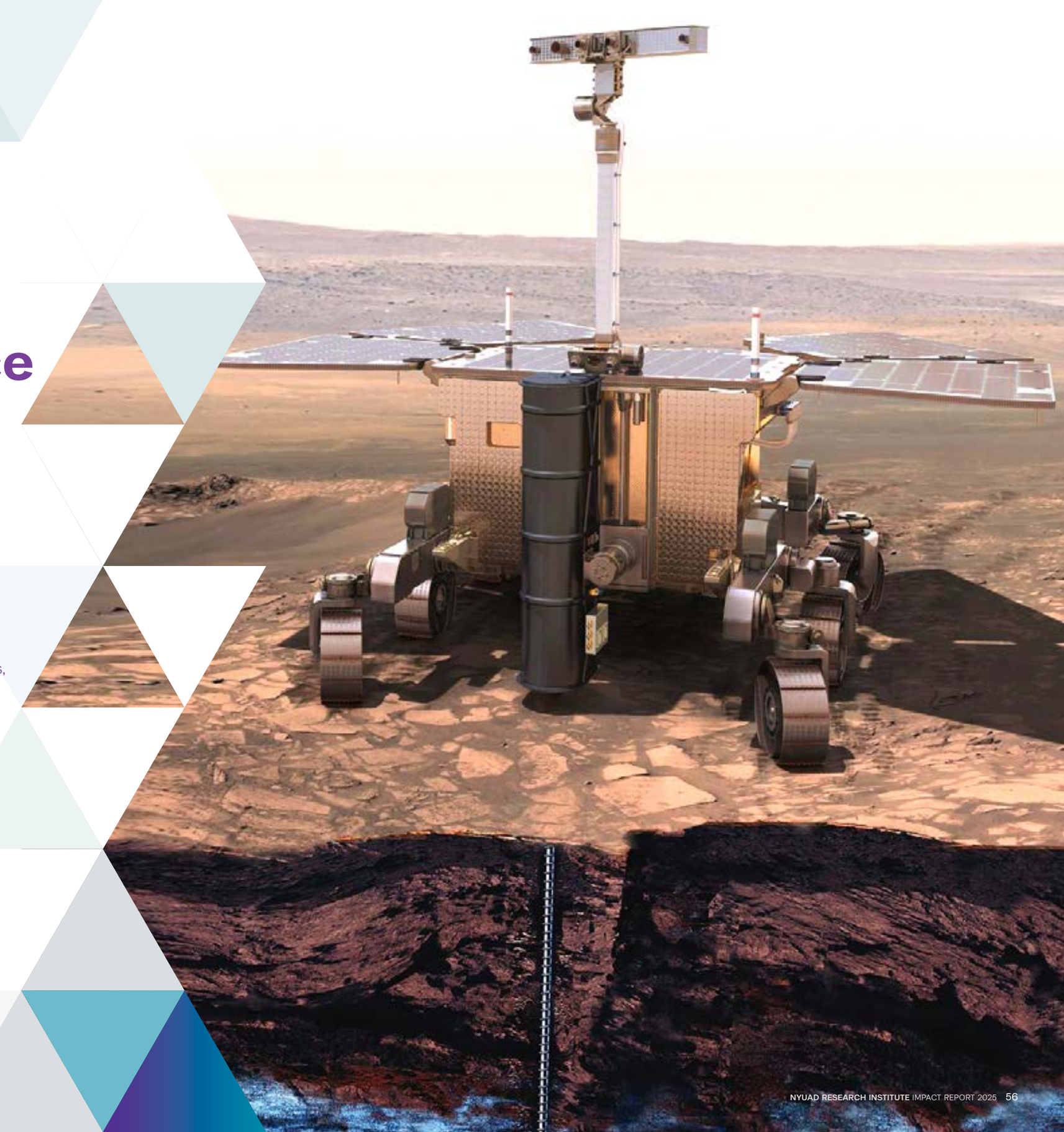
CASS

Center for Astrophysics and Space Science

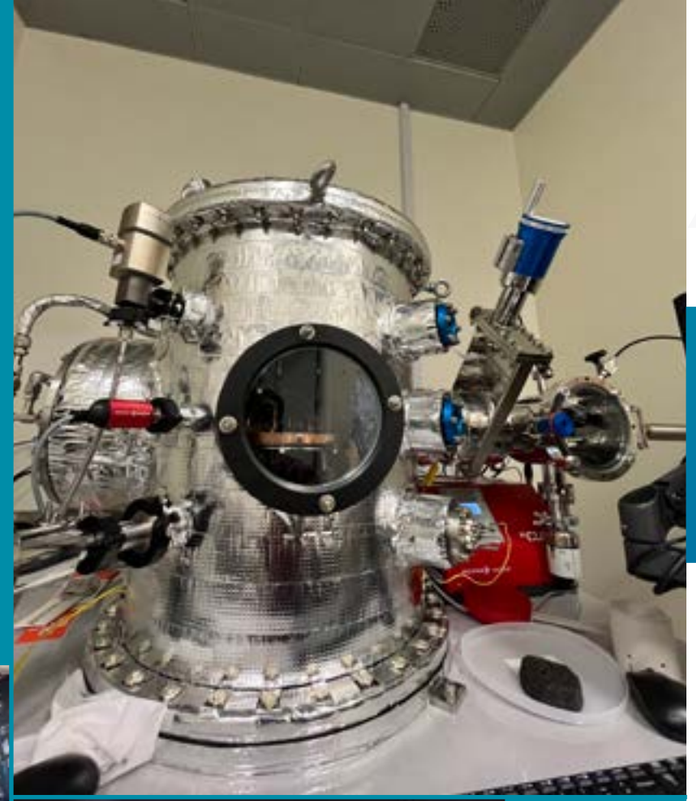
At the Center for Astrophysics and Space Science (**CASS**), our mission is to address the most fundamental questions about the cosmos. CASS is not merely conducting space research; it is assembling a comprehensive narrative of the Universe—one that traces the interplay of physical forces shaping its past and informing the trajectory of humanity's future.

Formed through the merger of the Center for Space Science and the Center for Astro, Particle and Planetary Physics, CASS brings together a distinctive community of theorists, observers, and instrument builders committed to understanding the nature of the cosmos. Our work spans an exceptional range of temporal and spatial scales, from investigations of the Sun and planetary systems to studies of the Universe as a whole.

CASS advances inquiry and discovery across five core research domains: Sun and Stellar Physics, Planetary Science, Galactic Astrophysics, Extragalactic Astrophysics, and Cosmology and Astroparticle Physics. These areas are inherently interdisciplinary and complementary, united by a shared objective—to deepen our understanding of the Universe. Each field approaches key questions from distinct yet synergistic theoretical, computational, and observational perspectives, collectively driving the future of astrophysical research.



CASS research contributed to major telescope-driven discoveries, most notably the identification of a temperate, Earth-sized, tidally heated planet orbiting an M6 star.









CASS

Achieving 80 Publications While Advancing Breakthroughs In Cosmic Origins, Habitability, Solar Physics, And Fundamental Physics

At CASS, our mission is to answer the most fundamental questions about the cosmos. This academic year, the Center reached a landmark milestone that reflects the depth and ambition of our work: 80 high-impact publications in peer-reviewed journals. This achievement represents more than a numerical record; it captures a unified scientific effort–a single, connected narrative that traces the history of the Universe and demonstrates how distant, energetic events have shaped our planet and its future.

This year's breakthrough offers our most comprehensive view yet of how life's essential elements and habitable worlds are forged. The materials that compose everything on Earth–from the iron in our blood to the gold in our jewelry–did not originate here. They were created in extreme cosmic environments. CASS researchers made major advances this year in tracing the origin of these heavy elements, focusing on the most violent events in the Universe.

In the time domain, CASS teams tracked the activity of compact stellar objects, including a specific X-ray binary system. Through coordinated multi-wavelength observing campaigns, we mapped how these compact objects launch and re-activate powerful plasma jets. This work links microphysical plasma processes to the large-scale feedback exerted by compact objects, improving our understanding of how they redistribute energy and matter throughout galaxies.

This destructive power is also essential for creation. On galactic scales, CASS researchers used a sophisticated simulation suite to examine how energy feedback from stars and active galactic nuclei regulates star formation. We traced how these forces sculpt the dark-matter scaffolding of the cosmos and propel galaxies across the "green valley," confirming that the same processes that produce life's building blocks also influence the evolution and fate of entire galaxies.

Understanding the elemental origins of our world allows us to identify where life may emerge elsewhere. This year, CASS expanded the search for habitability in unexpected directions, from neighboring planets to distant exoplanetary systems. Using national Mars Mission data, CASS teams developed deep-learning models to detect and characterize proton auroras on Mars. Together with studies modeling Martian aurorae and climate behavior, this work helps reconstruct the planet's dynamic history and assess the performance of radiation-shielding materials relevant to future astronaut safety.

Beyond our solar system, CASS contributed to major telescope-driven discoveries. Most notably, CASS research enabled the identification of a temperate, Earth-sized, tidally heated planet orbiting an M6 star. This discovery challenges conventional assumptions about habitability by demonstrating that internal heat–not only stellar irradiation–can sustain conditions suitable for liquid water, broadening the range of environments that may support life in the Milky Way.

Our philosophy is to make the Universe accessible.

-Andrea V. Macciò,
Center Director, CASS



CASS is assembling a definitive history of the Universe—one that exposes the interconnected forces that shaped our origins and will guide humanity's future.

Even our own star presents constant risk. CASS research using advanced solar-interior mapping techniques is revealing the structure and dynamics of the Sun's inner layers, including complex supergranular-scale convection and Rossby waves. These findings require a reassessment of energy transport in the solar envelope, an essential step for improving predictions of solar flares that threaten Earth's satellites and power infrastructure.

Progress in cosmic origins and habitability is driven by CASS's commitment to advancing fundamental physics and open science. CASS members contribute to world-leading constraints on unresolved questions, including the search for dark matter through major international collaborations. At the same time, we are developing enabling technologies—such as transition-edge sensors and dark-photon haloscopes—that will power the next generation of rare-event experiments.

Our philosophy is to make the Universe accessible. A multi-messenger astronomy platform now provides citizen scientists with professional-grade data, while high-school students using our public astronomy portal have produced scientifically valid catalogs of blazar candidates, directly contributing to active research.

The collective achievement of 80 publications this year reflects a unified vision: to treat the cosmos as an interconnected system. CASS is dissolving traditional disciplinary boundaries, ensuring that solar-interior mapping informs planetary science and that galaxy simulations directly support observational interpretation. This integrated approach moves beyond correlations to establish causal links, revealing how the activity of black holes, the emergence of planets, and the behavior of dark matter belong to one continuous cosmic story.

CASS is not simply researching space; it is assembling a definitive history of the Universe—one that exposes the interconnected forces that shaped our origins and will guide humanity's future.

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- Benjamin Davis
- Dattaraj Dhuri
- Christopher Hanson
- Dimitrios Kantzas
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- Bhargav Mantravadi
- Ahmad Nemer
- Sergei Nikiforov Yuryevich

Economic & Social Development

C-BID

Center for Behavioral Institutional Design

The Center for Behavioral Institutional Design (**C-BID**) is a globally recognized research hub dedicated to advancing the scientific understanding of human behavioral diversity and its implications for institutional and policy design. Integrating research, education, and outreach, the center generates empirical knowledge and translates it into applications that enhance social and economic welfare across varied contexts. Its mission is to deepen understanding of human behavior and lead the application of behavioral science to evidence-based policymaking. Its vision is to develop empirically grounded models that inform the creation of effective, context-sensitive institutions.

C-BID's research is organized across three interconnected clusters. The Human Behavior cluster examines institutional, social, and biological drivers of behavior across societies. The Behavioral Institutional Design cluster applies these insights to the design of institutions, markets, and policies that improve welfare outcomes. The Behavioral Policy cluster evaluates and refines interventions within specific socioeconomic environments. Drawing on economists, political scientists, psychologists, sociologists, and neuroscientists from the NYU Global Network, the center investigates how preferences, expectations, social norms, and cognitive constraints shape decision-making, translating rigorous behavioral research into practical institutional and policy solutions.







Driven by cutting-edge theory and informed by data, we design transformative practices and institutions to elevate economic and social well-being.

-John Wooders
Principal Investigator, C-BID



Understanding Behavior, to Shape Policy and Society

During the 2024–2025 academic year, the Center for Behavioral Institutional Design (C-BID) at NYU Abu Dhabi advanced its research and policy agenda through three major initiatives: the creation of the World Behaviors and Stereotypes Dataset (WBSD), the organization of Behavioral Exchange™ 2025 (BX2025) in Abu Dhabi, and the expansion of strategic partnerships with UAE government entities, including the General Civil Aviation Authority (GCAA). Together, these milestones strengthened the center's capacity to generate rigorous evidence on human behavior and to apply behavioral insights to institutional and policy design in the UAE and beyond.

The World Behaviors and Stereotypes Dataset represents a major methodological and empirical contribution to the study of beliefs and stereotypes across societies. Developed to address limitations in cross-country research, including reliance on unincentivized surveys and non-comparable measures, the WBSD employs incentivized behavioral tasks conducted under standardized conditions in every participating country. Covering 70 countries and nationally representative samples that encompass nearly 90 percent of the global population, the dataset enables systematic comparison of preferences, expectations, and behavioral patterns across diverse institutional contexts.

The WBSD measures beliefs about traits such as competitiveness, honesty, and cognitive ability across seven demographic dimensions: gender, age, skin color, income, education, employment sector, and religiosity. By combining behavioral decisions with representative sampling, the dataset allows researchers to examine how individuals perceive different social groups and how accurate those perceptions are. Its scale and methodological consistency make it possible to investigate questions that previously lacked reliable empirical grounding. Early analyses explore whether certain groups are systematically perceived as more or less honest or competitive than they are in practice, and how such perceptions relate to broader institutional features, including judicial reliability and social trust. As the dataset expands, it is expected to serve as a long-term resource for comparative research on belief formation, cooperation, and institutional performance, while also strengthening C-BID's global research network.

C-BID also played a central role in organizing Behavioral Exchange™ 2025, held at NYU Abu Dhabi from 30 April to 1 May 2025 under the patronage of His Highness Sheikh Theyab bin Mohamed bin Zayed Al Nahyan. The conference brought together more than 800 participants from academia, government, industry, and civil society, making it the largest behavioral science gathering in the region to date. Structured around the theme "New Frontiers in Behavioural Science," BX2025 examined the application of behavioral insights to digital governance, financial decision-making, public health, climate adaptation, and education. Discussions emphasized how behavioral evidence can inform regulatory frameworks, public-service delivery, and program design.



By combining behavioral decisions with representative sampling, the dataset allows researchers to examine how individuals perceive different social groups and how accurate those perceptions are.



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The conference provided a platform for presenting early findings from the WBSD and for strengthening dialogue between researchers and policymakers. It also marked the launch of a Global Network for Behavioral Science, designed to connect behavioral insight units and academic centers internationally and to promote coordination in research and policy implementation. For C-BID, BX2025 reinforced its role as a regional hub for behavioral science and expanded opportunities for collaboration with public and private sector partners.

Alongside these research and convening activities, C-BID advanced its portfolio of strategic partnerships with UAE institutions. A key development during the year was the expansion of its collaboration with the UAE General Civil Aviation Authority. Building on interest from national leadership in adopting transparent and evidence-based approaches to governing air-transportation rights, C-BID initiated a multi-stage assessment of the institutional framework governing air traffic rights and international air service agreements. The project integrates behavioral and institutional-design analysis to evaluate current mechanisms and to propose improvements aligned with national policy objectives.

This collaboration will culminate in the design of a new national Air Transportation Policy for the UAE, with implications for competition, regulatory transparency, and international connectivity. It reflects the growing role of behavioral science in informing complex policy decisions and demonstrates how C-BID's expertise can be applied to priority sectors within the UAE's economic and governance landscape.

Taken together, these achievements enhanced C-BID's national and international visibility and reinforced its dual role as a center for rigorous behavioral research and for policy-relevant institutional design. By establishing a large-scale global dataset, convening the region's leading behavioral science forum, and deepening partnerships with government stakeholders, the center continued to translate scientific insights into practical applications that support institutional effectiveness and social welfare.

CENTER FOR BEHAVIORAL INSTITUTIONAL DESIGN

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- Ernesto Reuben

Center Administration
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- Sumit Goel
- Moritz Janas
- Lina Lozano
- Davide Marchiori
- Gabriel Møller
- Mayada Oudah
- Hyoeun Park
- Cem Peker
- Ashley Perry
- Yi Sheng
- Robert Stüber
- Yuki Tamura
- Alena Tsiulya
- Jeffrey Zeidel

Bio-Innovation & Health

CBH

CGSB

PHRC

Center for Brain and Health

The Center for Brain and Health (**CBH**) seeks to advance the understanding of brain function in both health and disease, with a particular focus on disorders prevalent in the United Arab Emirates (UAE). The Center fosters interdisciplinary research at the interface of brain science, psychology, engineering, and health, leveraging collaborations with local clinical and industry partners. A significant portion of the Center's research is dedicated to Multiple Sclerosis (MS), a degenerative disease with high regional prevalence, addressing core deficits in perception, cognition, and motor function

A central objective of the Center is the development of a normative brain database comprising 1,000 Emirati and 1,000 non-Emirati UAE residents—the first of its kind in the region. This resource is designed to elucidate the effects of lifestyle, genetics, and environment on brain function and dysfunction within a region-specific context. Insights derived from this database are expected to inform clinical diagnosis and treatment of brain disorders in the UAE and contribute to the country's strategic goal of establishing itself as an international hub for precision medicine.







Conventional MRI sequences highlight inflammatory plaques as hyperintense regions; however, lesion appearance depends on the sequence used and often fails to reflect underlying biological severity or clinical impact.







CBH

Multiple Sclerosis in the UAE: Tract-Based Quantitative MRI for Improved Prediction of Disability and Disease Progression

Multiple sclerosis (MS) is a chronic, inflammation-mediated disorder of the central nervous system and a leading cause of non-traumatic neurological disability among young adults. Patients exhibit highly heterogeneous symptoms, ranging from motor and sensory deficits to cognitive impairment. Clinically, approximately 85% of patients present with relapsing–remitting MS (RRMS), whereas 10–15% exhibit primary progressive MS (PPMS) from onset. Over time, 60–70% of RRMS patients transition to secondary progressive MS (SPMS), characterized by gradual, relapse-independent functional decline. Predicting this progression remains a major unresolved challenge in MS management, particularly in the UAE, where disease prevalence is high.

For decades, magnetic resonance imaging (MRI) has been the primary tool for MS detection and monitoring. Conventional MRI sequences highlight inflammatory plaques as hyperintense regions; however, lesion appearance depends on the sequence used and often fails to reflect underlying biological severity or clinical impact. This discrepancy gives rise to the "clinico-radiological paradox," in which patients with substantial lesion load may remain clinically stable, while others with fewer visible lesions experience significant disability.

Researchers at the NYUAD Center for Brain and Health, led by co-PIs Osama Abdullah, David Melcher, and Bas Rokers, recently developed an innovative approach to address limitations in predicting MS outcomes. They hypothesized that the clinico-radiological paradox arises because conventional analyses overlook two critical factors: the precise anatomical location of lesions and their intrinsic microstructural composition. To address this, the team developed a tract-based quantitative MRI (qMRI) framework that integrates lesion location and microstructural properties to predict disability and disease progression more accurately.

The framework introduces two key innovations:

1. Refining location ("Where"): Rather than grouping lesions by broad anatomical compartments, the approach uses diffusion-based tractography to identify major white-matter pathways (association fibers, projection and brainstem tracts, occipitoparietal bundles, and cerebellar pathways). Lesions are quantified only where they intersect these pathways, under the premise that damage to high-traffic fiber systems is more likely to disrupt clinical function.

2. Refining composition ("What"): To characterize the severity of tissue injury within these pathway-specific lesions, the framework incorporates qMRI measures sensitive to microstructural changes. T1 relaxation and magnetization transfer ratio (MTR) provide information on myelin integrity and macromolecular content, while diffusion-derived measures such as fractional anisotropy (FA) and mean diffusivity (MD) capture microstructural disorganization associated with demyelination, axonal injury, and extracellular water changes. This provides a detailed characterization of lesion pathology beyond visibility alone.

By combining lesion location and microstructural content, the tract-based framework functions as a biologically informed filter that emphasizes pathology most likely to disrupt critical neural circuits.



Our work pushes the boundaries of what MRI can see. We validate and apply these discoveries in a real-world setting with our clinical partners, creating a powerful ecosystem for healthcare innovation...

-Osama Abdullah,
Investigator, CBH

By combining lesion location and microstructural content, the tract-based framework functions as a biologically informed filter that emphasizes pathology most likely to disrupt critical neural circuits. To evaluate its utility, the team analyzed 89 MS patients and 43 healthy controls. Across multiple disability measures, the tract-based approach significantly outperformed conventional region-based metrics, with particularly strong associations for projection/brainstem and occipitoparietal pathways—critical systems for sensorimotor and cognitive function. Furthermore, the framework accurately classified patients into RRMS, PPMS, and SPMS subtypes.





The framework yields several key impacts:

1. Resolving the clinico-radiological paradox: By integrating functional location and internal pathology, the framework provides interpretable biomarkers that more accurately reflect functional disruption.

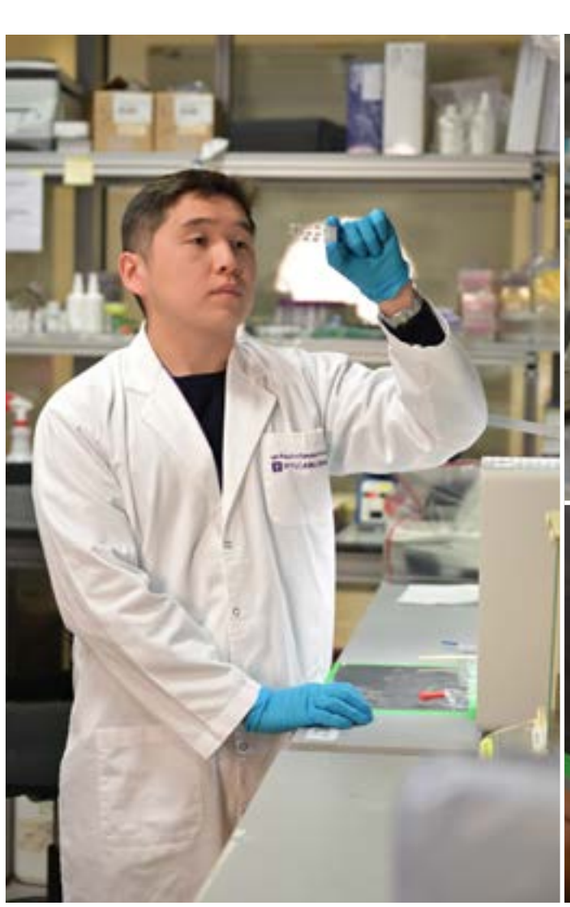
2. Individualized patient care: Enhanced predictive power enables personalized monitoring and therapeutic decision-making, guiding interventions based on damage within functionally critical pathways.

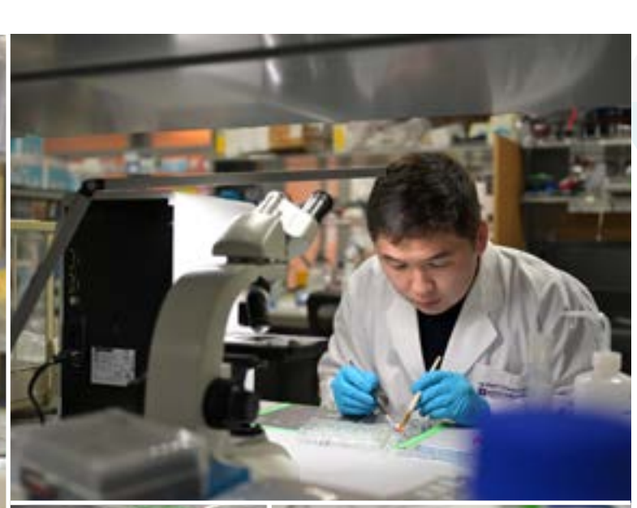
3. Refined disease classification: Tract-based metrics provide clearer separation between MS subtypes, supporting patient stratification and improved clinical trial design.

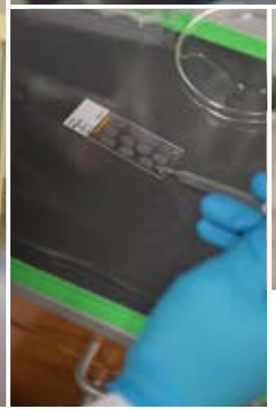
4. Future clinical tools: This methodology has the potential to transform lesion analysis into a functional biomarker. As qMRI technology and computational modeling tools become more accessible, the framework could identify patients at high risk of rapid progression, enabling earlier, tailored interventions.

This work demonstrates the Center's ability to integrate neuroimaging, neuroscience, and regional clinical expertise to address locally relevant health challenges while contributing to global advancements in MS research.

CENTER FOR BRAIN AND HEALTH









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Center Leadership and Research Team

Center Director and Principal Investigator
- Bas Rokers

Co-Principal Investigators
- Dipesh Chaudhury
- Olivia Cheung
- David Melcher
- Kartik Sreenivasan

Investigators
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- Eugene Achi
- Meera Al Kaabi
- Lev Brylev
- Olivia Cheung
- Clayton Curtis
- Mohammad Asif Dogar
- Mohamad Eid
- Luai Eldweik
- Els Fieremans
- Patryk Filipiak
- Daryl Fougnie
- Anu Jacob
- Michael Landy
- Milos Ljubisavljevic
- Abdalla Mohamed
- Dmitry Novikov
- Khalil Ramadi
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- Daya Sharma

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- Aleksandrina Dimova
- Alessio Fracasso
- Aysha Hamkari
- Joseph Hong
- Danielle Laminta
- Abdalla Mohammed
- Soumen Mohanty
- Tarek Nabih
- Prim Phowarasoontorn
- Amal Salah
- Malvika Sharma
- Nikola Stikov
- Antonio Zafarana
- Treedom Zhang

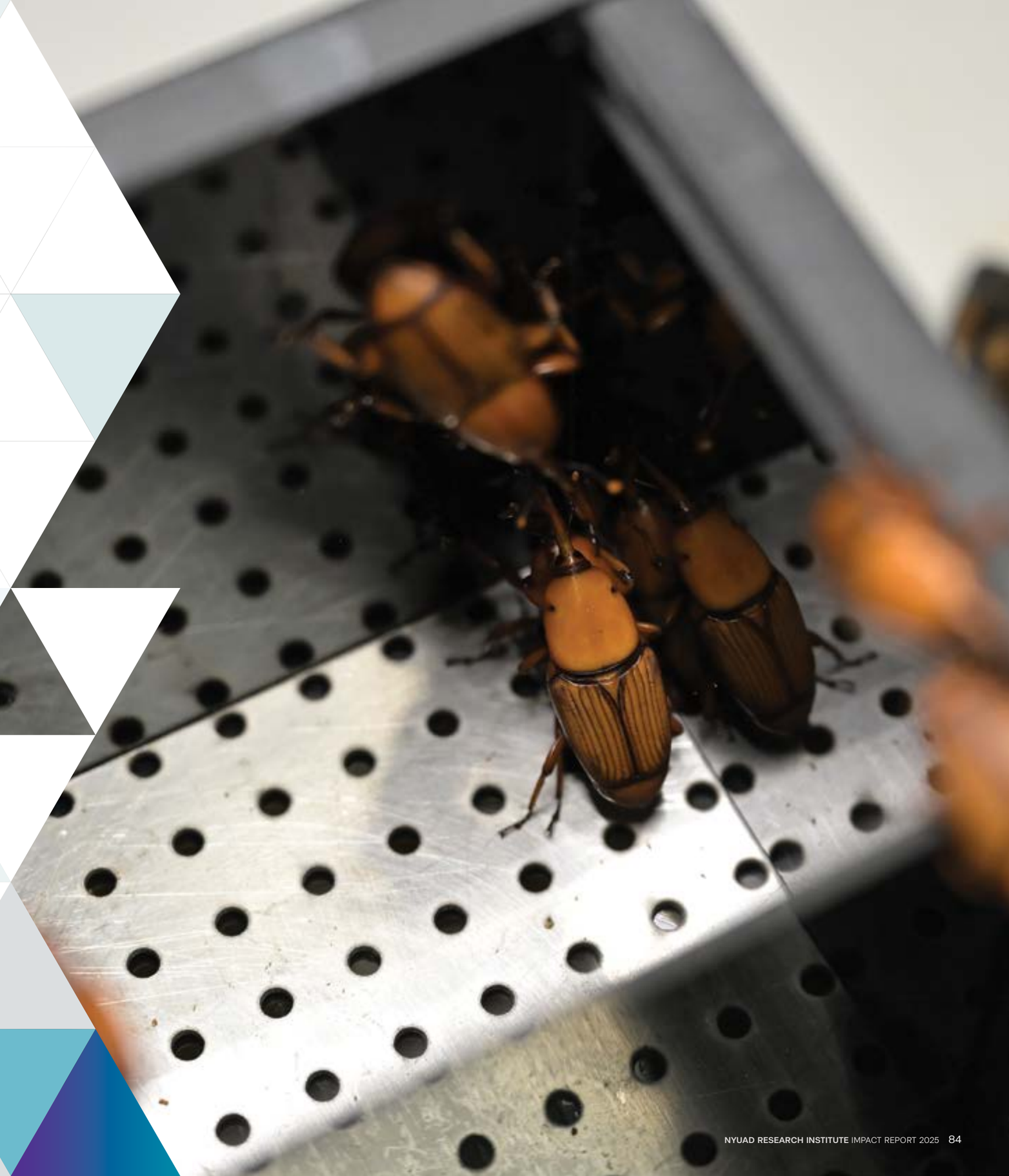
Kawader Fellow
- Dana Al Kalali

Center for Genomics and Systems Biology

The Center for Genomics and Systems Biology (**CGSB**) is a leading research hub driving scientific innovation in areas critical to the UAE's future, including Environmental Adaptation and Sustainability and Biomedicine and Health. Aligned with national priorities such as climate resilience, food security, and public health, the Center produces high-impact research, fosters global collaboration, and develops scientific capacity across the region.

Over the past five years, CGSB researchers have achieved significant advances, generating 144 research outputs, including publications in Nature, Cell, and Nature Communications, along with 477 scientific presentations worldwide. During this period, the Center's innovation ecosystem has produced patents, online resources, public engagement initiatives, and contributed to major national programs, including the Emirati Genome Program.

CGSB's international reach includes 88 active collaborations across 57 countries, while its training initiatives have supported over 130 undergraduate, graduate, and pre-university students and interns in the last five years. Outreach and public engagement programs have involved more than 4,600 community members through school programs, exhibitions, lectures, and science cafés. Its expanding media and digital presence, including a robust Arabic-language platform, continues to elevate the UAE's profile in research and science communication.









Studying invasive species and their region of origin will provide a trove of information for applied research to control or eradicate them from the local environment. This stands to reduce considerable threats that such species pose to both the environment and the economy in the UAE.

-Stéphane Boissinot
Center Director, CGSB





CGSB

Driving Breakthroughs in Genomics, Food Security, and Health

The Center for Genomics and Systems Biology (CGSB) conducts research on topics of direct importance to the UAE and the broader MENA region, focusing on environmental sustainability, food security, and human health. CGSB researchers use cutting-edge genomic techniques and advanced computational analyses to address fundamental biological questions and to develop practical solutions to challenges faced by the UAE.

The CGSB's **Environmental Adaptation and Sustainability Program** uses the UAE as a natural laboratory to investigate how organisms adapt to extreme environments. Its goal is to generate the scientific knowledge needed to develop practical solutions to current and future threats to the country's food security and biodiversity. One example of our contribution to food security is research on date palm. The CGSB is an internationally recognized leader in date palm genomics, having deciphered the species' domestication history and identified genetic markers of great importance to farmers. We have also launched research on the evolution of the date palm's main pest, the red palm weevil, with the aim of determining the species' route and timeline of expansion. In parallel, we are developing environmentally friendly strategies to control and potentially eliminate this pest.

The CGSB's **Biomedicine and Health Program** addresses fundamental biological questions with applications in cancer biology and neurobiological or mental disorders such as autism and depression. It also focuses on developing new approaches to drug discovery, including treatments for cancer, antimicrobial agents, and anthelmintics. The CGSB has established a high-throughput drug-screening platform,and among our recent achievements is the discovery of a molecule with strong activity against helminthic infection.

A New Class of Natural Anthelmintics Targeting Lipid Metabolism

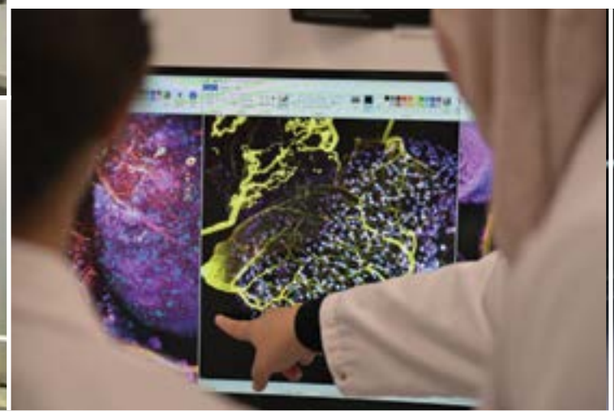
Parasitic helminths infect more than 1.5 billion people and cause enormous agricultural losses each year, yet treatment options remain limited. Only a handful of drug classes exist, and resistance is rising at an alarming rate. This heavy global burden and dwindling therapeutic efficacy signal an urgent need for new treatments that work in different ways from current medicines.

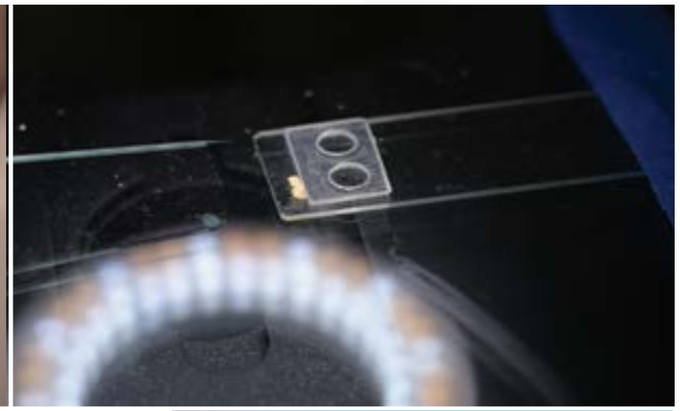
Researchers at the NYUAD CGSB and collaborators have identified a new class of anthelmintic compounds naturally found in avocado pulp and seeds (Fahs *et al.*, Nature Communications, 2025). Safe for mammals yet broadly effective against free-living and parasitic nematodes, this family of avocado-derived fatty alcohols and acetates (AFAs) stands out for two key reasons: they kill worms across all life stages—eggs, larvae, and adults—and they remain potent against strains resistant to multiple existing drug classes, indicating a completely new mode of action.

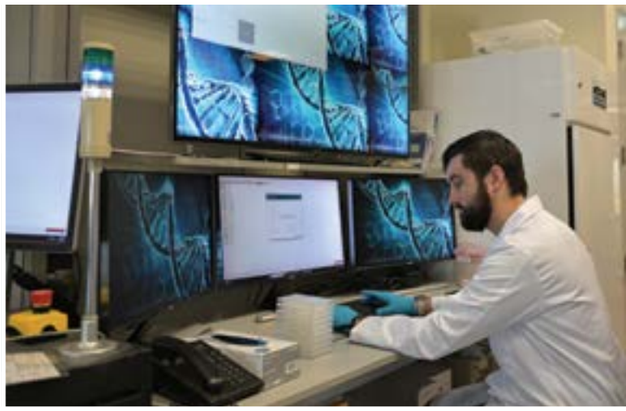
CGSB's Biomedicine and Health Program studies mechanisms and potential treatments for infectious and metabolic diseases, cancer, and neurobiological or mental disorders such as autism and depression.













Unlike current anthelmintics, these waxy molecules can penetrate the eggshell and adult cuticle, even arresting embryonic development. This has important implications: if parasite eggs cannot hatch, they cannot contaminate the environment or reinfect animals to perpetuate the cycle of disease. The team discovered that these new molecules work by inhibiting a critical enzyme in fatty acid biosynthesis, revealing lipid metabolism as a novel and promising therapeutic target. Together, these findings lay a strong foundation for developing new treatments for both human and veterinary parasitic infections.

Broad-Spectrum Activity Against Parasitic Nematodes

Because most parasitic nematodes have a complex life cycle and are difficult to culture, NYUAD researchers used high-throughput screening in free-living model species (*C. elegans and P. pacificus*) to identify compounds that are safe in mammalian cells but lethal to worms. From a library of 2,300 FDA-approved drugs and natural products, AFAs emerged as potent hits. They also proved lethal in direct tests against larvae of four major parasitic species of medical and agricultural importance: *Haemonchus contortus, Teladorsagia circumcincta, Heligmosomoides polygyrus, and Brugia pahangi*. Notably, AFAs were effective against adult filarial worms, an especially difficult stage to target, and they inhibited egg hatching, whereas several frontline drugs showed little to no effect. Even more compelling, AFAs remained effective against strains of *C. elegans* and *H. contortus* resistant to multiple existing drug classes, and no AFA resistance was detected in extensive genetic screens (~10 million genomes). These results point to a mechanism distinct from those of current anthelmintics, and which nematodes appear unable to evade. Crucially, these results translated in vivo: AFA treatment dramatically reduced adult worm burden and fecal egg counts in mice infected with *H. polygyrus*, with several animals clearing the infection entirely with no observable side effects.

A New Mode of Action: Targeting Lipid Metabolism

Understanding how AFAs work became the next goal, and here the team uncovered a key insight: AFAs cause *C. elegans* mitochondria to fragment and degenerate. Directed assays showed clear signs of oxidative stress: mitochondrial respiration dropped, reactive oxygen species (ROS) increased, and pre-treatment with antioxidants partially rescued lethality. Genetic and biochemical analyses revealed that AFAs inhibit an essential enzyme in fatty acid biosynthesis. Animals with reduced enzyme levels were more sensitive to AFAs, while supplementation with its metabolic product increased survival. Structural modeling predicted that AFAs bind tightly within the enzyme's active site, and NMR studies confirmed that they directly inhibit the purified enzyme. This is the first evidence that lipid metabolism can be exploited as a vulnerability in nematodes. Moreover, due to the high interest of lipid biology for other medical applications, this work could catalyze additional drug-discovery opportunities beyond parasitology.

By advancing new solutions for neglected tropical diseases, this research supports the UAE's broader ambitions in biotechnology, public health, and sustainable agriculture, helping the country stay resilient against emerging parasitic threats.

Why This Work Matters

This study identifies a new class of naturally occurring molecules that act through a novel mechanism, positioning AFAs as strong candidates for clinical development with translational potential in human health and agriculture. The discovery opens the door to the development of novel therapeutics to combat the global threat of anthelmintic resistance, as well as combination treatments that could extend the lifespan of existing drugs. Future efforts to devise large-scale, low-cost synthesis or extraction methods could greatly improve access to treatments in low-resource settings. Given their wide-ranging potency, cross-species efficacy, and distinct mode of action, AFAs represent one of the most promising new anthelmintic leads in decades.

Beyond its global importance, this work also has strategic relevance for the UAE. As a major international hub hosting large numbers of workers from regions where parasitic infections remain common, the UAE faces hidden but meaningful public-health risks. Drug-resistant parasitic infections also threaten livestock health and thus national food-security efforts. By advancing new solutions for neglected tropical diseases, this research supports the UAE's broader ambitions in biotechnology, public health, and sustainable agriculture, helping the country stay resilient against emerging parasitic threats. ■

CENTER FOR GENOMICS AND SYTEMS BIOLOGY

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Center Leadership and Research Team

Center Director & Principal Investigator
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- Kenneth Birnbaum
- Justin Blau
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- Neelu Begum
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- Brij Bushan
- Tiago Capote
- Janja Ceh
- Julie Connelly
- Rana El Danaf
- Nizar Drou
- Khaled Ben Elkadhi
- Rita Fahmy
- Sylvie Ferrand
- Jonathan Flowers
- Suma Gopinadhan
- Raman Gurusamy
- Trent Haydon
- Alyaa Hessin
- Samira Khalaji
- Dineshkumar Krishnamoorthy
- Zuzana Lukáčová
- Hanna Markle
- Mohammed Ateeq Ur Rahman Mohammed
- Hanan Mohamed
- Marina Nasr
- Priyam Narain
- Sam Nester
- John Oliver Orpilla
- Yanthe Pearson
- Jayaram Radhakrishnan
- Zerina Rahic
- Nabil Rahiman
- Adilla Razali
- Giuseppe-Antonio Saldi
- Mehar Sultana
- Henry Tan
- Lina Utenova
- Ligia Maria Marques Cota Vieira

Public Health Research Center

Founded in 2012, the Public Health Research Center **(PHRC)** has become a leading hub for population health research in the United Arab Emirates, with a mission to advance scientific evidence that supports improved population health outcomes.

Its flagship initiative, the UAE Healthy Future Study (UAEHFS), is one of the most comprehensive public health research programs in the region. The study has recruited a cohort of 15,000 Emirati adults who will be followed longitudinally, providing a strong foundation to investigate the determinants of noncommunicable diseases that occur at particularly high rates in the UAE, including obesity, diabetes, and cardiovascular disease. By combining detailed survey data with biological samples, physical measurements, the UAEHFS enables integrated analyses of how lifestyle factors, genetic predisposition, the microbiome, and environmental exposures interact to influence disease risk.

The UAEHFS also serves as a model of national collaboration, bringing together NYU Abu Dhabi with academic institutions, regulatory authorities, healthcare providers, and industry partners. This collaborative approach strengthens long-term research capacity, supports workforce development, and provides advanced training opportunities for students and faculty. As the first large-scale prospective cohort study in the UAE, the UAEHFS reinforces NYU Abu Dhabi's leadership in population health research and generates evidence critical for informing public health policy and improving the health of future generations.









In 2025, the Public Health Research Center (PHRC) advanced the UAE Healthy Future Study (UAEHFS) from a primarily recruitment-driven initiative into a mature, data-rich population health research platform.





PHRC

UAE's First Prospective Cohort Study Unlocks New Insights on Disease Risk

In 2025, the Public Health Research Center (PHRC) advanced the UAE Healthy Future Study (UAEHFS) from a primarily recruitment-driven initiative into a mature, data-rich population health research platform. This transition was marked by the completion of the baseline recruitment target of 15,000 participants, the establishment of participant follow-up protocols, and the launch of core data infrastructure to support long-term, high-impact research.

During this period, PHRC expanded both the scale and depth of the UAEHFS cohort. Recruitment efforts focused on addressing gender balance through the enrollment of an additional 1,000 female participants. In parallel, the center strengthened its clinical research capacity to enable active participant follow-up and to support cross-center collaborations within NYU Abu Dhabi. A data sharing agreement with Abu Dhabi Department of Health is in progress and is expected to enhance the scientific value of the cohort by enabling longitudinal linkage with health system records, positioning the UAEHFS as a uniquely powerful resource for population health research in the UAE.

To support this growing platform, PHRC established the PHRC Data Core, a centralized and secure data environment designed to manage the scale and complexity of UAEHFS data. The Data Core has led extensive efforts in data quality control, harmonization, and integration across questionnaires, physical measurements, laboratory results, and molecular datasets. These efforts have resulted in a unified data warehouse that provides curated datasets, standardized documentation, and analytical support to investigators. Automated data capture tools, validation pipelines, and reproducible workflows have been implemented to ensure accuracy, efficiency, and transparency. The platform also provides secure computational infrastructure, including visualization dashboards and integrated statistical tools, enabling researchers to analyze UAEHFS data within a governed environment. Collectively, these developments have transformed the UAEHFS into a scalable, multidisciplinary research resource of national and international relevance.

A key complementary achievement has been the development of a genomic backbone for the cohort. PHRC designed a high-density genotyping microarray comprising approximately 850,000 genetic variants optimized for research and clinical relevance in the UAE. The array includes variants associated with complex traits and diseases, as well as approximately 60,000 population- and region-specific variants enriched for alleles more prevalent in Middle Eastern populations. This design ensures both global comparability and local relevance. The microarray has now been applied to genotype the UAEHFS cohort, enabling genetic association studies, population genetic analyses, and screening for clinically relevant variants.

Collectively, these developments have transformed the UAEHFS into a scalable, multidisciplinary research resource of national and international relevance.



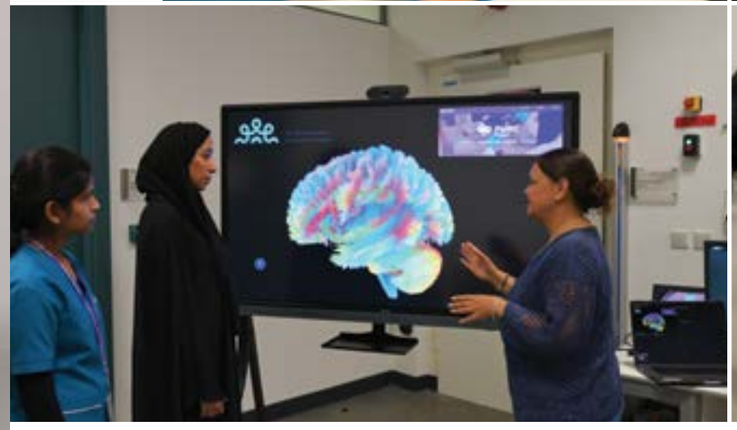
Our findings highlight the mouth as an important, yet often overlooked, part of the body's metabolic system. By studying how oral bacteria and metabolites differ in people with obesity, we can begin to understand how these microbes may influence inflammation and overall metabolic health. This opens new possibilities for early detection and prevention strategies focused on the oral microbiome.

-Aashish Jha
Co-Principal Investigator, PHRC











The scientific impact of this integrated infrastructure is already evident. A recent PHRC-led study published in Cell Reports analyzed oral microbiome samples from 628 Emirati adults, representing the most comprehensive oral microbiome study conducted in the UAE to date. By integrating microbiome sequencing with multi-omics data from a subset of participants, the study identified bacterial, functional, and metabolic signatures associated with obesity. These findings suggest potential links between the oral microbiome, systemic inflammation, and metabolic dysfunction, and highlight opportunities for early detection and prevention strategies.

Together, these achievements mark a transition from cohort construction to the establishment of a comprehensive population health research ecosystem. By integrating large-scale recruitment, longitudinal follow-up, advanced data infrastructure, and population-relevant resources, PHRC is strengthening NYU Abu Dhabi's capacity to generate actionable evidence for public health in the UAE and the wider region.

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Center Leadership and Research Team

Center Director & Principal Investigator
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- Tamadher Salem Alameri
- Mitha Albalushi
- Sara Ali Al Balushi
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- Manal Al Blooshi
- Ayesha Al Hosani
- Maryam Abed Al Marri
- Manar T. Alshaikh
- Khaloud Al Rumaithi
- Fatma Al Shuhoomi
- Thekra Al Zaabi
- Fouad Azar
- Ghausia Begum
- Judalyn Del Monte
- Mariem Elhadj
- Kristin Gunsalus
- Andrea Leinberger-Jabari
- Christopher Eric Leonor
- Fatima Mezhal
- Klaithem Mohamed
- Imane Morjane
- Manal Kayed Taimah
- Yvonne Vallès
- Manikandan Vinu
- Jiaming Zhou

Bio-
Innovation
& Health

Tech &
Information

CENTMED

Center for Translational Medical Devices

The Center for Translational Medical Devices (**CENTMED**) is a multidisciplinary research center integrating expertise in engineering, biology, chemistry, and translational medicine to accelerate the translation of laboratory-developed technologies into clinical practice. CENTMED aims to foster collaborative translational research between NYU Abu Dhabi investigators and clinicians at medical centers across Abu Dhabi and the UAE, addressing unmet clinical needs through innovative medical device development.

CENTMED focuses on the design, development, and validation of diagnostic and therapeutic medical devices, with the broader objective of advancing bioinnovation and improving health outcomes locally and regionally. The center's research is organized around three disease focus areas of high relevance to Abu Dhabi: metabolic disorders, cardiovascular diseases, and neurological disorders. These areas reflect the significant burden of non-communicable diseases, including obesity, diabetes, cardiovascular disease, and the increasing prevalence of neurological conditions.

Research activities are conducted within integrated clusters comprising scientists, engineers, and clinicians working in close collaboration through dedicated task-force teams that promote data sharing and iterative development. CENTMED is supported by vertically integrated expertise across computational modeling, device design and fabrication, electrical systems, surface chemistry, in vitro and in vivo testing, enabling end-to-end translational research from concept to preclinical validation.















Transforming Discoveries into Real-World Solutions for Precision Medicine

The primary goals of the Center for Translational Medical Devices (CENTMED) are to (1) develop novel technologies for more effective diagnosis, treatment, and management of chronic conditions and (2) enable the delivery of personalized medicine to patients in the UAE. Academically engaged at multiple levels, CENTMED serves as a hub for multidisciplinary medical device research, connecting NYU Abu Dhabi investigators with clinicians across the UAE and the broader region.

CENTMED brings together expertise in engineering, biology, chemistry, and translational medicine to transform scientific discoveries into practical healthcare solutions. By fostering close collaboration between researchers and clinicians, the center accelerates the development of diagnostic and therapeutic medical devices, advancing bioinnovation and contributing to improved health outcomes locally and globally. A key mission of CENTMED is also to cultivate a skilled workforce capable of driving the UAE's emerging health technology, startup, and entrepreneurial ecosystem.

Despite its recent establishment, CENTMED has rapidly positioned itself as a regional leader in medical device innovation. The Center's teams tackle some of the UAE's most pressing health challenges, including metabolic, cardiovascular, and neurological disorders, combining deep scientific knowledge with practical, hands-on development. Research activities are organized into integrated clusters, leveraging modeling, device design and fabrication, electronics, surface chemistry, and both in vitro and in vivo testing to ensure discoveries can efficiently progress from concept to clinic.

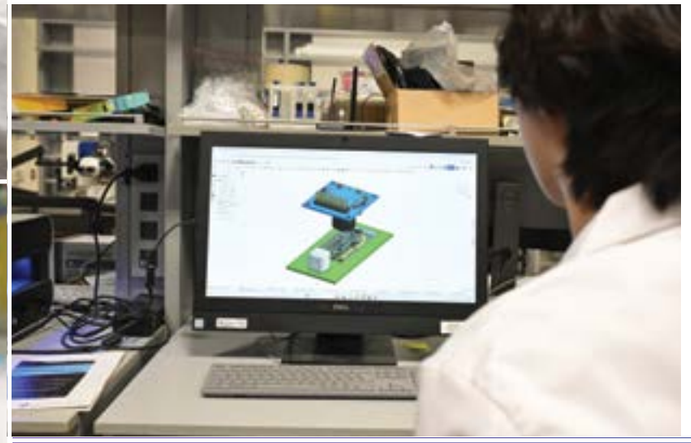
Among CENTMED's flagship initiatives is the CORAL Capsules project, led by Principal Investigator Prof. Khalil Ramadi. The human gastrointestinal tract hosts trillions of microbes that regulate immunity, metabolism, and overall health. Dysbiosis in these microbial communities has been linked to metabolic, neurological, immune, and inflammatory disorders. Current sampling methods, primarily stool analysis, capture only microbes from the distal gut, overlooking the small intestine, where nutrient absorption, immune interactions, and host-microbe communication are most active. Understanding these microbial communities is critical for early disease detection and therapeutic monitoring.

We designed CORAL to be as simple as possible; no batteries or electronics, just a precise structure that uses the gut's natural movement.











> *Translational research at CENTMED aims at bridging discoveries and patient care, accelerating treatments, improving outcomes, and benefiting human health.*
>
> **-Rafael Song,**
> **Center Director, CENTMED**



CORAL (Cellularly Organized Repeating Lattice) addresses this challenge with a marine coral-inspired, passive ingestible device that safely and non-invasively samples the small intestine. Its microlattice design, featuring maze-like pores, captures microbes along the digestive tract without motors, electronics, or moving parts, providing researchers unprecedented access to this largely invisible but vital ecosystem. “The bacterial communities in the gut profoundly influence how the body functions and responds to disease. Through CORAL, we can understand and restore this balance,” says Dr. Hanan Mohammed, lead author and driving force behind the CORAL startup initiative.

Published in Device journal, the CORAL technology has progressed from laboratory innovation to commercialization. Intellectual property protection is underway, first-in-human safety studies are conducted in collaboration with NYU Langone Health, and the technology is advancing toward market launch through the startup Corealis. The project has garnered international recognition: Corealis was selected as one of four finalists from 21 global startups for the highly competitive HealthX Biotech Academy, the only finalist from the UAE and the Middle East.

The CORAL Capsules initiative exemplifies CENTMED’s broader mission to bridge scientific discovery and clinical impact. By fostering innovation, nurturing talent, and translating research into tangible healthcare solutions, CENTMED is shaping a future-ready medical ecosystem in the UAE and contributing to the global advancement of translational medicine.

CENTER FOR TRANSLATIONAL MEDICAL DEVICES

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Center Leadership and Research Team

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- Sohmyung Ha
- Pance Naumov
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Tech & Information

CAIR

CQTS

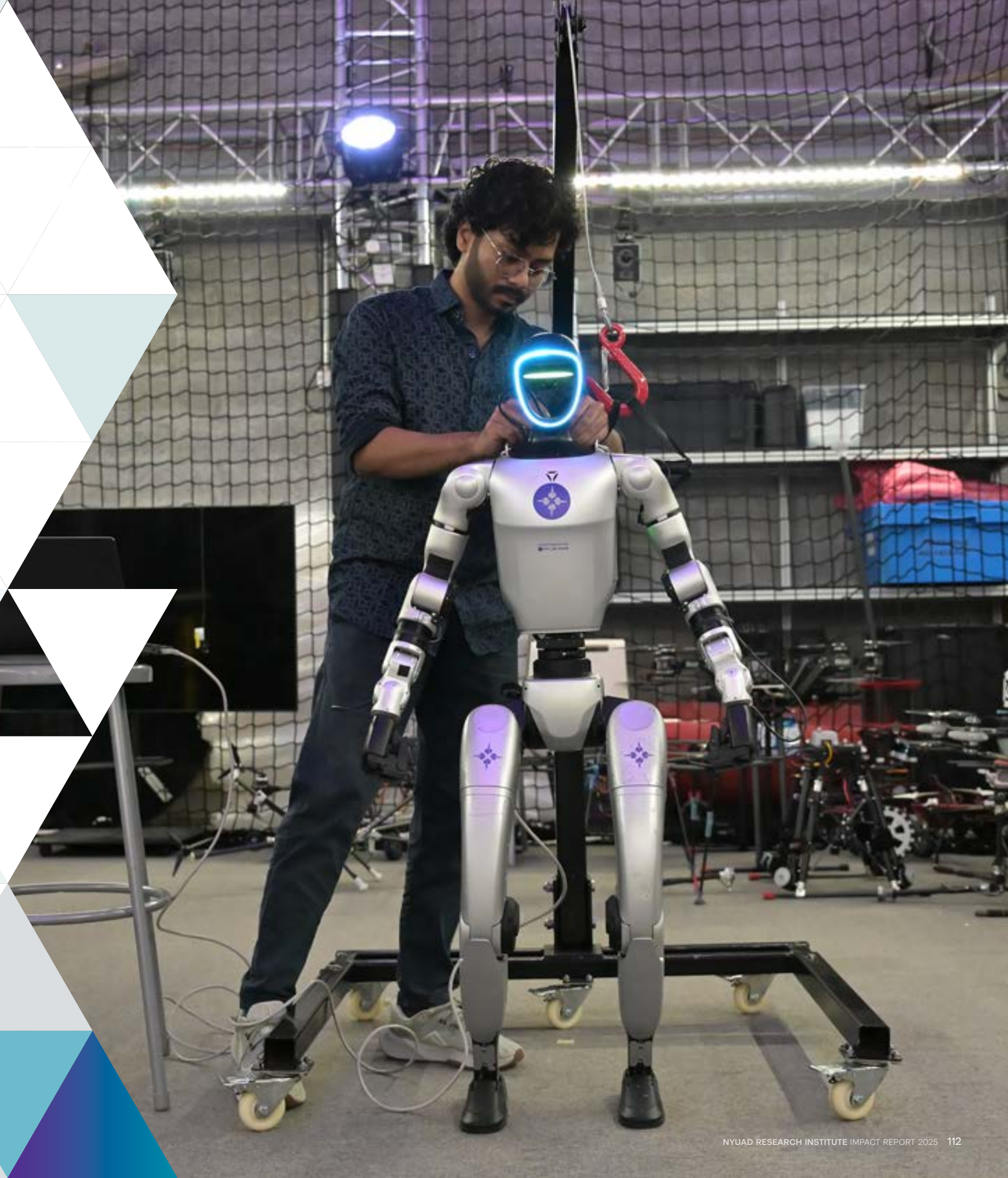
CIDSAI

Center for Artificial Intelligence and Robotics

Faculty from the disciplines of electrical, mechanical, civil, and computer engineering, as well as psychology, computer science, and interactive media, from NYU Abu Dhabi (NYUAD) and NYU New York (NYUNY) collaborate within the Center for Artificial Intelligence and Robotics (**CAIR**).

The Center conducts fundamental research and develops applied solutions in artificial intelligence and robotics. CAIR's research spans sensor data processing and fusion for environmental perception and intent recognition of moving objects; path planning and navigation in unknown or unstructured environments; coordination and control of multi-agent robotic systems; brain–machine interfaces; autonomous decision-making; robotic safety and resiliency; and machine learning security and robustness.

These activities are organized into five core research clusters within CAIR: multi-agent systems; planning, navigation, and perception; learning for safety, security, and resiliency in robotic systems; human–machine interfaces; and applications.

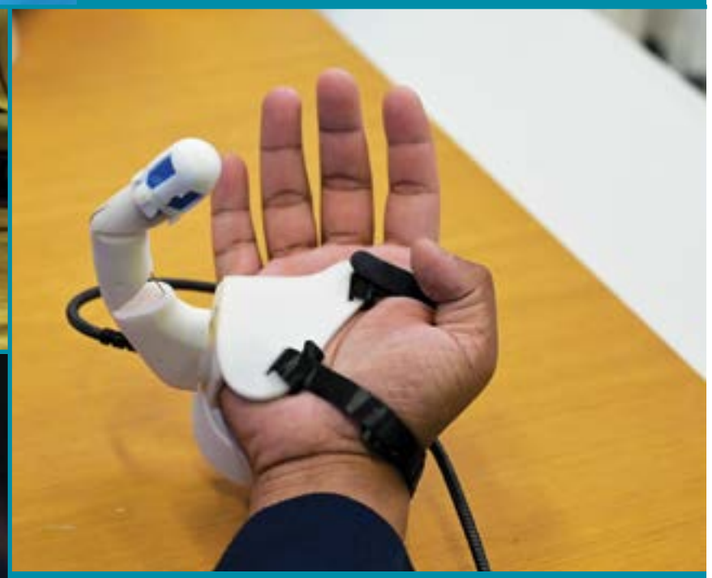






In addition to the development of a hybrid drone/vessel/UGV platform and the establishment of a UAE-based startup company (ChatSign), the development of CAIR's omnidirectional drone represents a significant research breakthrough.







CAIR

Novel Systems for AI-Driven Inspection, Safety, and Search-and-Rescue Operations

Evolution of "OmniOcta"

CAIR is well-recognized for its development of a hybrid platform for air, sea, and land; and also for its research using Large Language Models (LLMs) in humanoid robots. The Center has also established a UAE-based startup company, ChatSign, which enables real-time, bidirectional translation between sign language and spoken language. But the most recent research breakthrough from CAIR is reaching the third iteration of development on the Center's omnidirectional drone – "Omni-Octa". This drone's design is progressing toward a US patent, underscoring its novelty and impact.

Traditional drones often struggle in confined environments, such as inside buildings or dense areas, because they cannot easily move sideways or backwards without turning their entire body first. Omnidirectional drones, which can fly in any direction and rotate 360 degrees independently of movement, offer the solution to traditional drone limitations, through advanced navigation capabilities and providing a wider range of real-world problem-solving.

CAIR researchers first presented the mechatronic design of the OmniOcta drone platform at the prestigious International Conference on Automation, Robotics and Applications (ICARA) 2024. The platform's lightweight, 3D-printed structure enabled omnidirectional lift and stability in all orientations, using optimization algorithms and thruster positions to guarantee full pose control while minimizing weight and avoiding aerodynamic interference. By 2025, CAIR was able to functionally demonstrate independent position and orientation tracking in flight for the world's first functional, non-tethered omnidirectional multi-rotor UAV with fixed unidirectional thrusters and onboard power.

Several AI-algorithms have been implemented using more sophisticated hardware and a tethered solution has been tested, since the drone's initial iteration. This solution provides 2.5KW of power through an 800V connection to a power supply while the camera-feed is sent to the base station using a fiber-optic cable allowing human-UAV interaction. This power tethering option has led the development and testing of several prototypes capable of transmitting up to 4KW using AWG-16 cables over distances of up to 120meters.

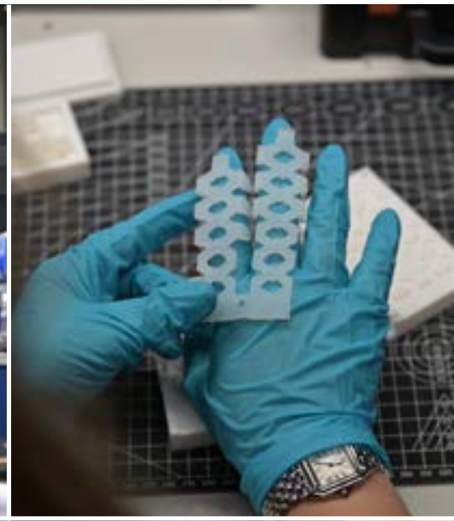
CAIR was also pleased to introduce a novel trajectory planning framework for omnidirectional drones at the 2025 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). This framework can dynamically adjust tracking velocity based on proximity to obstacles to ensure safe and efficient navigation in cluttered or dense environments. By slowing down near obstacles and accelerating in open spaces, the method enhances both safety and maneuverability.

The drone's framework has been validated through real-world experiments, demonstrating reliable navigation in constrained spaces. The OmniOcta-rotor drone can navigate through narrow passages while participating in critical inspection of infrastructure, such as taking measurements for cracks in buildings. The drone has several sensors attached to facilitate obstacle avoidance in path planning algorithms, and its complete pose can be controlled ensuring precise and safe interaction and navigation in complex environments.

To reduce operator workload and enhance operational safety, fast and reliable Control Barrier Functions (CBFs) have been implemented. These CBFs-based safety frameworks been published in several leading international journals, including IEEE Transactions on Robotics, Robotics and Automation Letters, and IEEE Transactions on Control Systems Technology.







These advancements extend to Search and Rescue (SaR) applications using quadruped robots. The quadrupeds are equipped with custom-designed thermal insulation and aluminum legs—machined and manufactured in-house—to withstand high-temperature fire scenarios. Because conventional sensors such as LiDAR perform poorly in dense fire smoke, a 60 GHz radar is employed to enable robust Simultaneous Localization and Mapping (SLAM) under such conditions.

CAIR's research and development activities around omnidirectional drones have sparked industry interest, with several corporations offering their products to replace the current autopilot function and sensors in future iterations. Furthermore, along the evolution of the OmniOcta, the Center has attracted a number of high-profile, international, academic collaborators interested in contributing to the design of faster algorithms for enhanced path planning and navigation.

Looking ahead, CAIR continues with their omnidirectional drone development for various and more complex interactions with the environment. A single degree-of-freedom gripper, or unmanned aerial manipulator has been designed and CAIR plans to soon demonstrate and showcase this design first to key UAE government entities and later to potential industry partners. While initial design uses can include routine activities such as light bulb testing and replacement, "the sky is the limit" for future use cases of the OmniOcta. As machines take on more routine and dangerous work, people are freed to focus on tasks that truly require human judgment and care.

Elevating Visibility - Beyond the Lab

In addition to producing high-quality research, the Center has exceled in translating its findings into practical applications. This includes filing multiple provisional patents, developing cutting-edge technologies, and establishing strategic collaborations with academic, industrial, and governmental partners. These efforts have addressed pressing global challenges and underscore CAIR's commitment to impactful, solution-driven research.

A major driver of the Center's translational success begins with its intentional activities beyond the lab, bringing wider visibility to CAIR's research, and ensuring bilateral engagement with key stakeholders. CAIR's participation in major exhibitions during 2025 followed a clear commercialization and external engagement strategy. These events were selected not only to share research outcomes, but also to underscore NYU Abu Dhabi as a strong and credible contributor in the applied AI and robotics ecosystem, aligned with national priorities and real industrial needs.

The Center's participation in events such as Global Rail 2025, Make it in the Emirates, and DriftX 2025 reflected the University's commitment to supporting Abu Dhabi and UAE government programs focused on mobility, logistics, transportation infrastructure, and advanced manufacturing. Through these platforms, CAIR actively contributed to the national innovation ecosystem, engaging with government entities, infrastructure operators, and industrial stakeholders, and demonstrating how AI, robotics, and autonomous systems research can translate into deployable solutions for inspection, logistics optimization, and resilient infrastructure. Exhibitions such as ADIPEC 2025 and Future Digital Twin & AI Middle East 2025 were selected for their central role in the energy, oil and gas, and large-scale industrial digitalization sectors. These events provided a high-impact venue to present CAIR's work in robotics, embodied AI, and digital-twin technologies as enablers of safer operations, predictive maintenance, and autonomous inspection in complex and high-risk industrial environments.

CAIR's presence at these events beyond the lab attracted industry professionals, government representatives, researchers, and students, leading to focused technical discussions and follow-up engagement. Many initial interactions at these events directly resulted in subsequent site visits and exploratory collaborations to bolster engagement between the Center and key stakeholders. Collectively, CAIR's exhibition activities in 2025 strengthened institutional visibility, supported government and industry alignment, and reinforced NYU Abu Dhabi's position as an integral contributor to Abu Dhabi's and the UAE's AI and robotics innovation ecosystem.

> *Every algorithm we develop, every system we test, exists to solve a real problem. The ultimate measure of our success will not be how sophisticated our robots become—it will be whether they make life genuinely better for the real people who need them most.*
>
> **-Anthony Tzes,**
> **Center Director, CAIR**

CENTER FOR ARTIFICIAL INTELLIGENCE AND ROBOTICS

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March 2025

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96
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Technologies



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- Mohamad Eid
- Yi Fang
- Eliseo Ferrante
- Siddharth Garg
- Konstantinos Kyriakopoulos
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- Akhil Krishna
- Prashanth Krishnamurthy
- Shuaihang Yuan
- Jingfeng Zhang

Center of Interdisciplinary Data Science and Artificial Intelligence

New Center

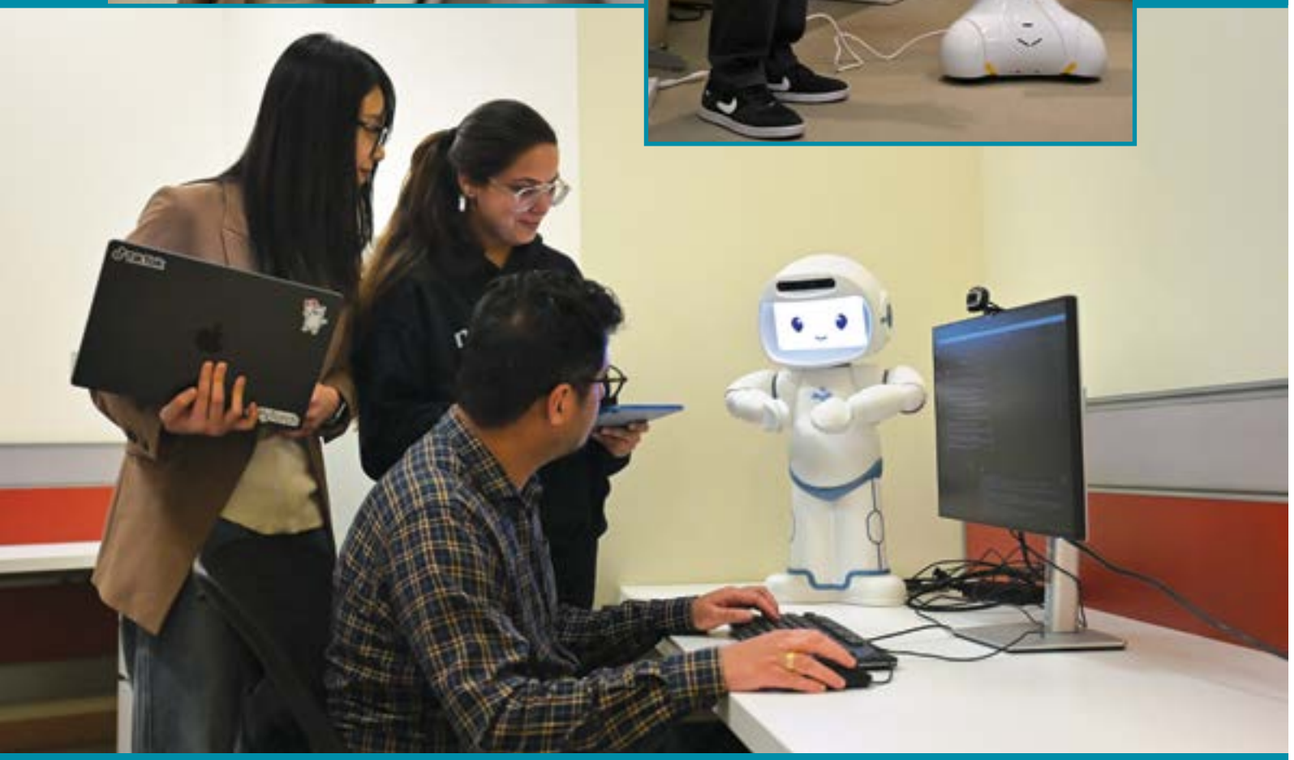
The Center of Interdisciplinary Data Science and Artificial Intelligence (**CIDSAI**) is a research hub dedicated to advancing data-driven discovery and innovation across disciplines. Its mission is to develop foundational theory, enabling technologies, and high-impact applications aligned with the UAE's strategic priorities, including healthcare, education, economic development, digital culture, and societal resilience. CIDSAI's research agenda is organized around four interconnected clusters: Foundations of Data Science; Enabling Technologies, including Arabic natural language processing, computer vision, and multimodal systems; Applications; and Bias, Ethics, and Privacy.

CIDSAI aims to position NYU Abu Dhabi as a regional leader in data science research, talent development, and responsible artificial intelligence. The center builds on NYUAD's strengths in mathematics, computer science, engineering, and the social sciences, while promoting sustained collaboration with government entities, industry partners, and the global NYU network. Current priorities include the development of Arabic-centric AI tools, personalized and adaptive learning platforms, health-focused language models, and data-driven solutions that support local industries and public-sector decision-making.









By integrating foundational theory with applied innovation, CIDSAI seeks to develop intelligent systems that augment human expertise, enable personalized experiences, and generate high-impact societal benefits.

-Pierre Youssef, Center Director, CIDSAI

CIDSAI

Innovating Data-Driven, Cross-Sector Solutions, with Arabic-centric AI Tools, Adaptive Learning Platforms, and Health-Focused Language Models.

The Center for Interdisciplinary Data Science and Artificial Intelligence (CIDSAI) at NYU Abu Dhabi is advancing a portfolio of AI-driven research initiatives designed to transform scholarship, education, healthcare, and cultural engagement across the Arab world. By integrating foundational theory with applied innovation, CIDSAI seeks to develop intelligent systems that augment human expertise, enable personalized experiences, and generate high-impact societal benefits.

AI-Platform for Mathematics: Accelerating Discovery

CIDSAI is developing an integrated AI platform aimed at accelerating mathematical discovery through a coordinated ecosystem of intelligent agents. Central to this initiative is the creation of personalized AI clones trained on individual mathematicians' work, enabling AI-assisted collaboration that mirrors expert reasoning while maintaining mathematical rigor. Complementing this, CIDSAI plans an autonomous problem-formulation engine capable of analyzing mathematical literature, identifying research gaps, and proposing precisely stated conjectures grounded in established theory. A multi-agent debate system is envisioned to refine ideas and proof sketches through structured reasoning, while a Lean-based verification layer translates informal arguments into formally verified proofs. Together, these components form a research ecosystem that could dramatically increase productivity, insight generation, and rigor in mathematical inquiry.

AI for Personalized Learning: Enhancing Education

CIDSAI aims to transform classroom instruction in the UAE through a multimodal personalized learning ecosystem. The proposed SmartClass environment captures video, audio, gesture, and engagement signals from classroom interactions, enabling research into attention dynamics, learning styles, and pedagogical strategies. Parallel efforts include GPT-powered adaptive tutoring systems that generate personalized problem sets, explanations, and actionable feedback for teachers. By integrating these data streams and AI tutoring capabilities, CIDSAI envisions a unified platform that supports continuous, data-driven educational improvement, personalized learning strategies, and scalable interventions tailored to student needs.

AI for Healthcare: Regionally Grounded Clinical Intelligence

CIDSAI is developing an Arabic medical AI model to support clinical decision-making, mental health applications, and neurodevelopmental assessment. The center is curating diverse medical datasets to train models that power interactive tools such as Arabic medical Q&A assistants, mental wellbeing support systems, and embodied agents for autism therapy and neurological evaluation. By integrating textual, audio, and visual data, these AI systems aim to provide culturally aligned guidance, enhance clinical workflows, and expand access to high-quality medical intelligence. This initiative seeks to strengthen the UAE healthcare ecosystem while advancing region-specific AI capabilities.



Bias, Ethics, and Privacy: Responsible AI by Design

Across all initiatives, CIDSAI embeds principles of responsible AI through a comprehensive framework addressing ethics, bias, and privacy. An ethics board aligned with UNESCO AI guidelines oversees policies for data governance, risk assessment, privacy protection, and model auditing. The center is also developing methods to detect and mitigate bias in Arabic language technologies, multimodal systems, and clinical AI models, with particular attention to dialect diversity, gender representation, and socio-economic fairness. Privacy-preserving machine learning techniques further ensure that sensitive data in healthcare and education remain protected, enabling innovation without compromising ethical standards.

These tools aim to support digital preservation, cultural tourism, arts education, and creative experimentation, bridging historical knowledge and contemporary innovation.











AI for Digital Culture: Preserving and Extending Heritage

CIDSAI is leveraging AI to preserve, reinterpret, and innovate the cultural and artistic heritage of the Arab world. Key initiatives include an Arabic calligraphy engine capable of recognizing classical styles and generating new forms using curated datasets, and a digital heritage reconstruction pipeline that employs Neural Radiance Fields and multimodal capture techniques to produce high-fidelity 3D models of culturally significant sites. These tools aim to support digital preservation, cultural tourism, arts education, and creative experimentation, bridging historical knowledge and contemporary innovation.

Conclusion: A Model for Impactful AI Research

Through these integrated initiatives, CIDSAI demonstrates how AI can advance mathematical discovery, personalize learning, improve healthcare, and preserve cultural heritage while embedding ethics and fairness at every stage. By combining foundational research with applied solutions, CIDSAI positions NYU Abu Dhabi as a regional and global leader in responsible, high-impact AI. The center's work provides a blueprint for interdisciplinary AI innovation that addresses societal priorities, fosters collaboration, and generates knowledge with enduring relevance for the Arab world and beyond.

CENTER OF INTERDISCIPLINARY DATA SCIENCE AND ARTIFICIAL INTELLIGENCE

Center Leadership and Research Team

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- Pierre Youssef

Co-Principal Investigators
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- Nizar Habash
- Aaron Kaufman
- Saurabh Ray
- Hanan Salam

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- Alberto Gandolfi
- Jean Imbs
- Ben Rosche
- Keith Ross
- Farah Shamout
- Minsu Park

Center Administration
- Dagny Anderson

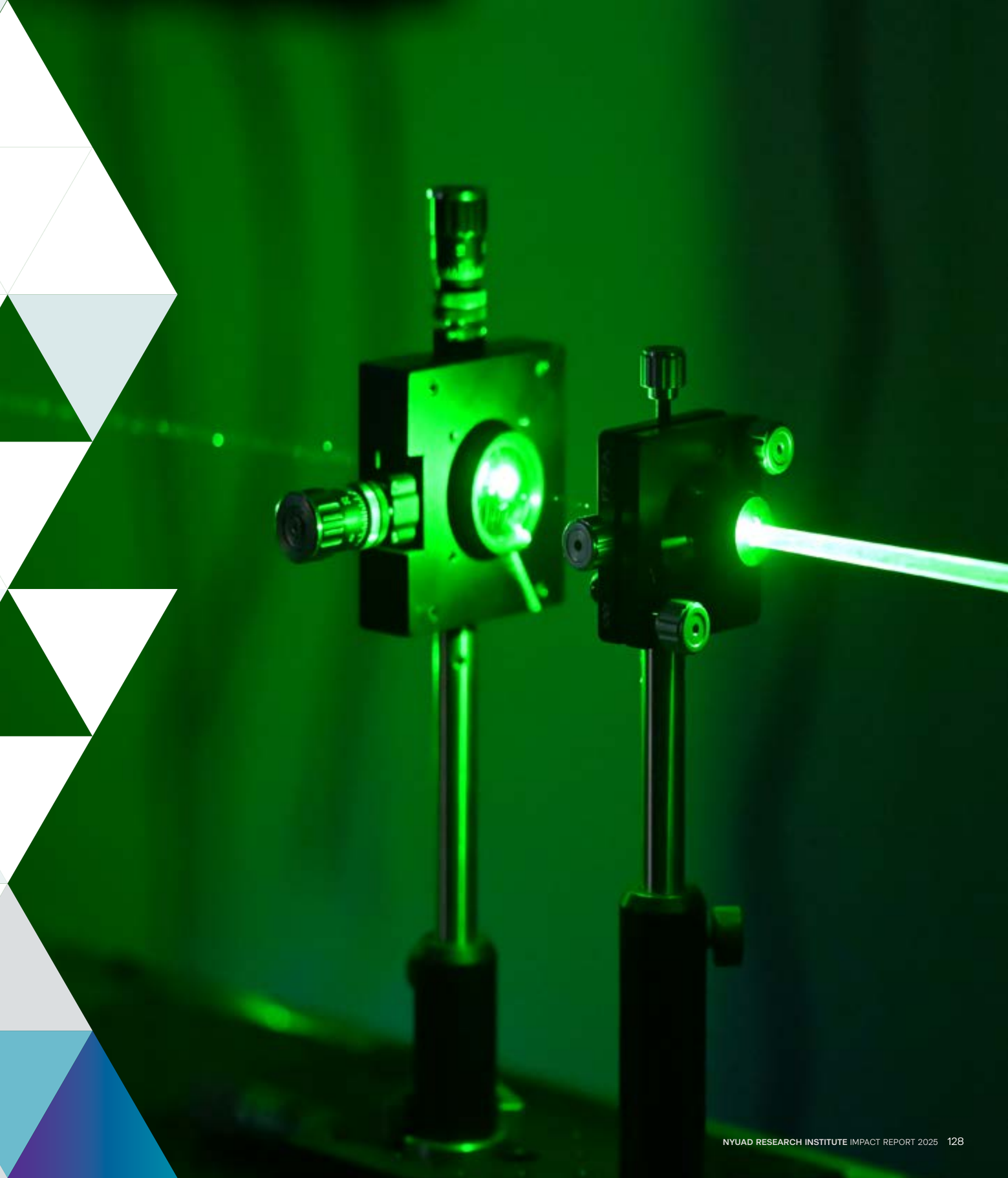
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- Jiang Li
- Mahmoud Reda
- Joonha Yu

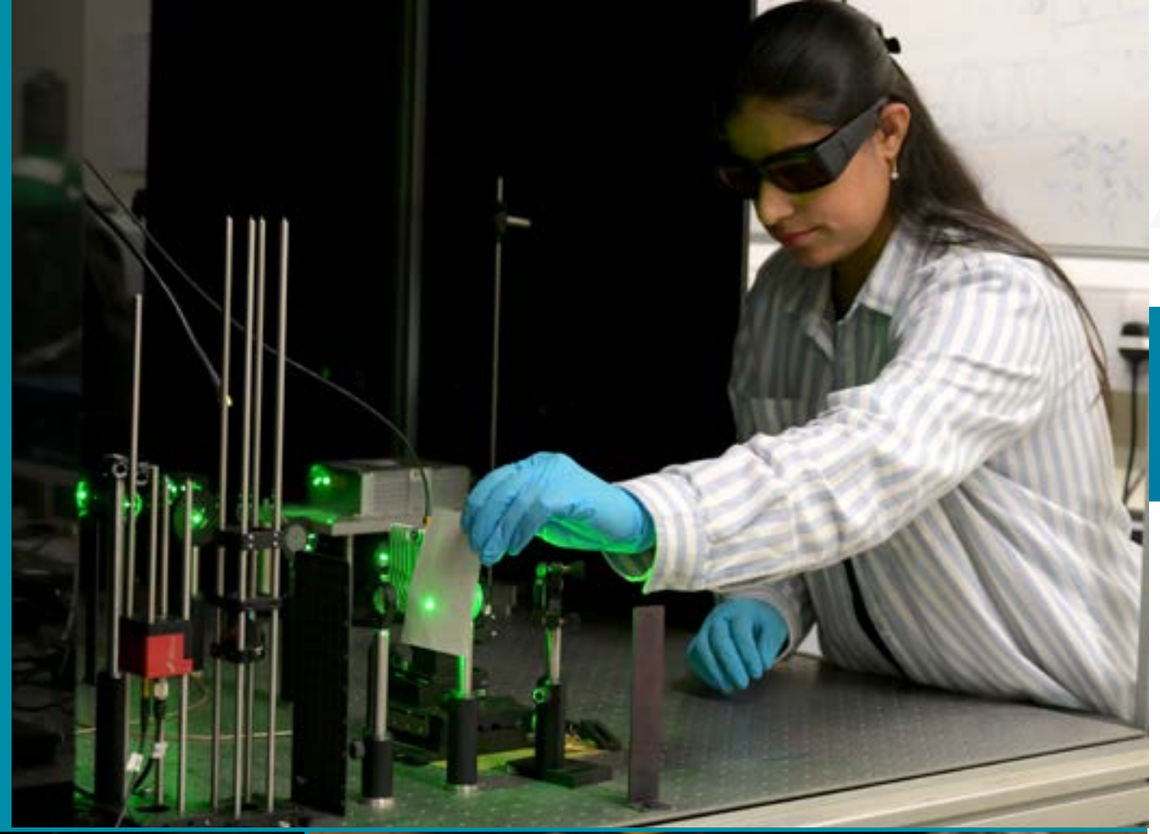
Center for Quantum and Topological Systems

The Center for Quantum and Topological Systems (**CQTS**) advances the frontiers of quantum science by transforming bold ideas into stable, scalable, and impactful quantum technologies. At a time when quantum computing, communication, and sensing promise global transformation, CQTS addresses the central challenge: turning quantum systems from theoretical constructs into practical solutions.

The Center unites deep theoretical insight with experimental innovation, fostering the next generation of quantum leaders. Its multidisciplinary team spans Mathematics, Physics, Chemistry, Computer Science, and Engineering, focusing on topological quantum computing, quantum machine learning, and quantum sensing, with applications across health, energy, finance, materials, and artificial intelligence.

CQTS also serves as a hub for talent and collaboration, hosting international events, the annual Quantum Hackathon, and the UAE's first comprehensive quantum education platform. Through research, education, and strategic partnerships, the Center is building a sustainable quantum ecosystem, positioning the UAE and the region as global pioneers in quantum innovation shaping technologies, defining standards, and inspiring the scientific community worldwide.



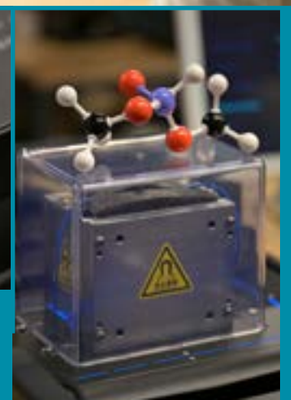












CQTS

Shaping the Future of Quantum Science Through Scalable Technologies, Global Collaboration, and Lasting Societal Impact

The Center for Quantum and Topological Systems (CQTS) began with a clear and ambitious belief: the UAE should help shape the quantum future in the MENA region, not merely adopt it. At its inception, there was no inherited infrastructure and no regional academic quantum ecosystem to lean on, only a shared commitment to create something enduring: an institution capable of anchoring discovery, talent, and innovation for decades to come.

Within a single academic year, that vision took shape. CQTS quickly became the region's most active academic quantum center, drawing together researchers, students, industry partners, and international collaborators. More than a collection of projects, it became a focal point where ideas converged, disciplines overlapped, and long-term ambition guided short-term action.

Foundations of Impact

CQTS's achievements were no accident. From the start, the center pursued balance between foundational theory and practical application, between research and education, and between global engagement and regional responsibility. This approach allowed growth to be both rapid and sustainable. Over the course of the year, CQTS established itself as a site of original discovery, a training ground for future leaders, a platform for collaboration, and a bridge to industry. Each success reinforced the next, creating momentum that extended far beyond individual achievements.

Quantum Machine Learning and Optimization

One of CQTS's earliest contributions addressed problems requiring better decisions under extreme complexity. Instead of waiting for distant hardware milestones, the center focused on immediate impact. By applying quantum-enhanced learning and optimization, CQTS demonstrated methods that outperform classical approaches in environments defined by scale, speed, and uncertainty.

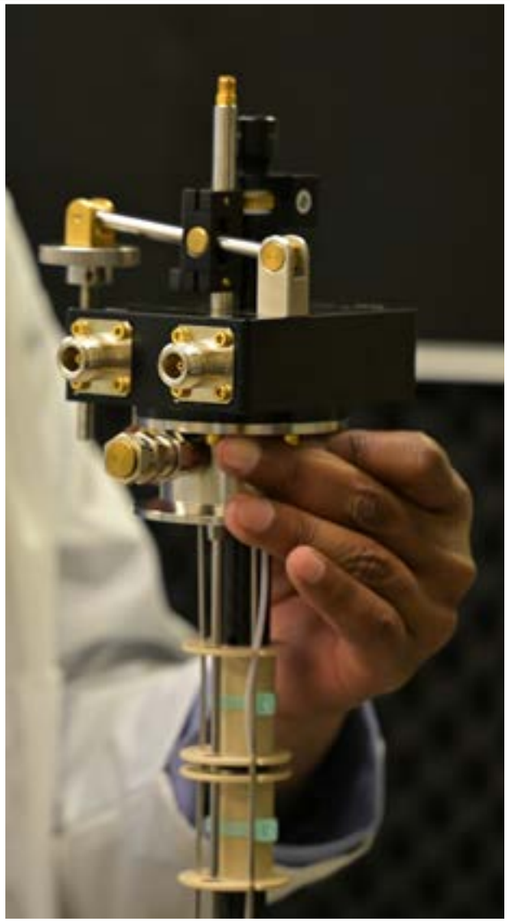
Working closely with global partners, these solutions were tested against real-world challenges and recognized through major industry awards, proving that quantum thinking can deliver measurable advantage even before fully mature quantum hardware becomes widely available.

> *Monthly Quantum Industry Days have already demonstrated the value of combining academic insight with industry needs, creating a culture of shared problem-solving.*
>
> **-Hisham Sati,**
> **Center Director, CQTS**



CQTS positions the UAE as a hub for foundational ideas that can influence the trajectory of quantum innovation worldwide.





Accelerating Decision-Making in Complex Systems

Modern critical systems, from transportation and energy networks to finance and digital infrastructure, are growing too complex for traditional tools. CQTS reimagined decision-making at scale, developing methods that promise faster responses, more efficient resource use, and improved resilience. From optimizing logistical routes to balancing energy demand and identifying patterns in massive data streams, quantum-inspired approaches provided smarter, more sustainable solutions.

Enduring Solutions

At its core, CQTS seeks not isolated demonstrations, but scalable, efficient, and sustainable solutions. The center prioritizes technologies and methods that remain effective as systems grow larger and more complex, providing strategic advantages unattainable through classical approaches alone.

Redefining Hardware with Topological Quantum Matter

Alongside near-term applications, CQTS invested in reshaping the fundamentals of quantum science. One of the field's most persistent challenges, instability, was addressed not as a limitation but as a design opportunity. Building on discoveries of unusual quantum behavior in certain materials, researchers developed theoretical insights enabling stable quantum states to be realized experimentally.

This work signals a paradigm shift: quantum systems could be protected by design, rather than relying on external correction. Such an approach lowers barriers to adoption and accelerates global progress. Beyond technical advancement, it positions the UAE as a hub for foundational ideas that can influence the trajectory of quantum innovation worldwide.

Commercialization and Ecosystem Development

CQTS recognizes that discovery gains meaning when it reaches society. The center has systematically translated research into licensable intellectual property and viable spin-off ventures. Structured collaboration with entrepreneurship and technology transfer offices ensures that innovations move efficiently from concept to impact, while maintaining strong academic ties.

CQTS co-hosted a landmark event in the UAE, uniting regional and global quantum leaders to explore innovative pathways for sustainable development. The International Conference on Quantum Science and Technology for Sustainable Development (QSTSD) is a premier, high-level event exploring the transformative potential of quantum technologies in advancing sustainable development. Hosted in collaboration with Khalifa University, and in partnership with UNESCO and the American Physical Society (APS), QSTS 2025 convened leading scientists, visionary technologists, senior policymakers, educators, and industry innovators from around the world. The conference served as a strategic forum and unique platform merging frontier quantum research with actionable sustainability goals. Attendees charted the future of quantum innovation in critical sectors such as ICT infrastructure, Fintech, Healthcare, Energy, Climate and Environment with a focus on fostering interdisciplinary collaboration, shaping global agendas, and driving impactful, real-world solutions through quantum science.

Plans for a dedicated Quantum Hub will further support startups, foster collaboration, and provide shared infrastructure for emerging ventures. Monthly Quantum Industry Days have already demonstrated the value of combining academic insight with industry needs, creating a culture of shared problem-solving.

Together, these efforts are cultivating a regional quantum ecosystem designed for long-term leadership rather than short-term excitement. By the end of the 2024–2025 academic year, CQTS had become more than a center; it had become a catalyst, demonstrating what is possible when vision, commitment, and collaboration align.

CENTER FOR QUANTUM AND TOPOLOGICAL SYSTEMS

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Center Leadership and Research Team

Center Director & Principal Investigator
- Hisham Sati

Co-Principal Investigators
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- Tim Byrne
- Asif Equbal
- Saurabh Ray
- Muhammad Shafique

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- Rishikesh Gajjala
- Nouhaila Innan
- Amaria Javed
- Muhammed Kashif
- Marwa Mannai
- Lotfi Abdelkrim Mecharbat
- David Myers
- Md Ataur Rahman
- Sajith V Sadasivan
- Smarika Sharma
- Vivek Singh
- Urs Schreiber
- Sachin Valera
- Tiantian Zheng

Kawader Fellow
- Rashed AlJasmi

Urban
Systems

+

Tech &
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CCS

WIRELESS

Center for Cyber Security

The Center for Cyber Security (**CCS**) was established in 2011, evolving from seed funding awarded to NY-based principal investigators. Its mission is to develop a world-class cybersecurity hub by partnering with leading universities, industry, and government agencies, fostering research, education, and applied practice in the UAE and the broader GCC region. CCS has focused on four core areas: Smart Cities, Hardware Security and Trust, Network Security, and Digital Forensics and Biometrics.

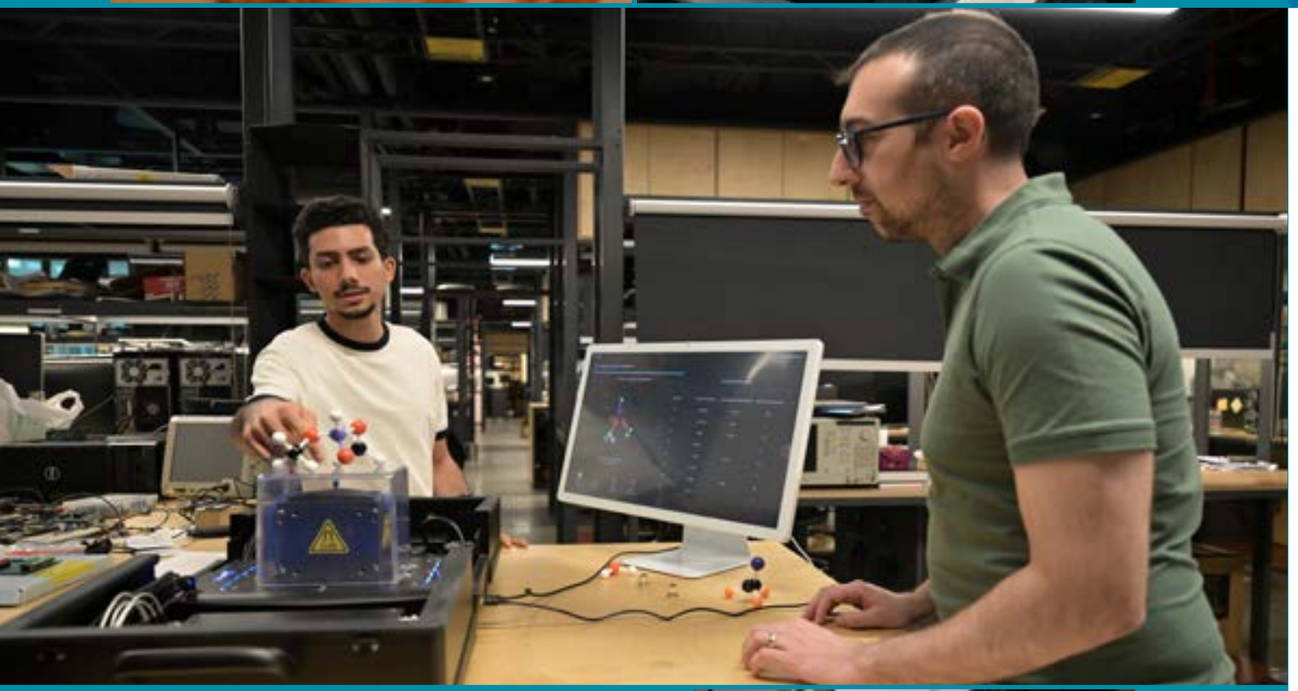
CCS, both in New York and Abu Dhabi, promote interdisciplinary approaches to security and privacy, integrating expertise from engineering, law, and public policy.

To support Abu Dhabi's Vision 2030, CCS in Abu Dhabi advances both academic and industrial cybersecurity research, emphasizing hardware security, smart city security, communication and information security, critical infrastructure protection, and trust and privacy. Through this work, the Center addresses regionally relevant challenges while contributing globally, providing a platform for innovation, talent development, and policy guidance in next-generation cybersecurity.



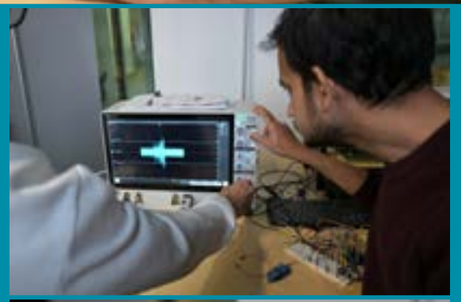






CCS has established a global reputation for pioneering secure hardware research, beginning with a landmark achievement: the UAE's first formally verified, unhackable chip.

-Ozgur Sinanoglu
Center Director, CCS





Advancing Hardware Security, Privacy, and Industrial Protection and Empowering Unhackable Chips, Homomorphic Encryption, and Global Vulnerability Mitigation

The Center for Cybersecurity (CCS) at NYU Abu Dhabi has established a global reputation for pioneering secure hardware research, beginning with a landmark achievement: the UAE's first formally verified, unhackable chip. Since its creation, this chip has remained uncompromised, and recent security theorems presented at CCS have further strengthened its formal guarantees. Building on this foundation, the team developed a software automation system capable of rendering any chip resistant to piracy and tampering. This transformative capability has been transferred to international collaborators, including chip designers at the University of Bologna (through a multi-university project funded by Abu Dhabi's Technology Innovation Institute), the University of Florida (DARPA-funded), Sorbonne University, and Khalifa University, enabling them to produce hardware with provable security properties.

The inventor of this technology, Prof. Sinanoglu, was recently elevated to IEEE Fellow, a distinction recognizing outstanding contributions to engineering, science, and technology. He was honored specifically for his pioneering work in design-for-trust and hardware security.

Building on breakthroughs in tamper-resistant silicon and secure-by-construction design, the Center's research evolved to develop hardware and tools that strengthen security across higher layers of computing systems. This led to the creation of CoFHEE, the world's first silicon-proven co-processor for Fully Homomorphic Encryption (FHE). CoFHEE accelerates core polynomial operations—including additions, subtractions, the Hadamard product, and the Number Theoretic Transform—enabling efficient outsourcing of ciphertext multiplications, the most computationally demanding component of FHE, and advancing secure, privacy-preserving cloud computation. CoFHEE is open-sourced for the broader research community.

Expanding further into the cyber-physical security stack, the Center developed ICSQuartz, the world's first fuzzer capable of natively testing Programmable Logic Controller languages. By eliminating reliance on vendor-specific or architecture-specific environments, ICSQuartz enabled the first large-scale fuzzing campaign on real-world industrial control system libraries. This campaign uncovered multiple vulnerabilities and triggered critical bug fixes, directly contributing to the protection of global industrial infrastructure. ICSQuartz is also open-sourced, accelerating progress across academia and industry.

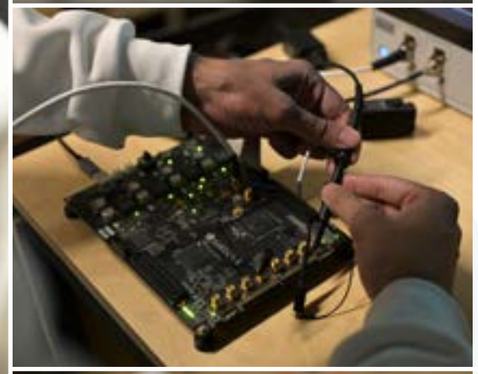
Building on breakthroughs in tamper-resistant silicon and secure-by-construction design, the Center's research evolved to develop hardware and tools that strengthen security across higher layers of computing systems.



Beyond hardware and tooling, CCS has investigated critical systems to uncover vulnerabilities affecting global security standards and industry practice.









Beyond hardware and tooling, CCS has investigated critical systems to uncover vulnerabilities affecting global security standards and industry practice. Researchers revealed weaknesses in the WPA3 “Dragonfly” handshake protocol, demonstrating that it is less robust than previously assumed. They also identified the GSMA-acknowledged 5G vulnerability CVD-2023-072, showing that SMS delivery reports could be exploited for covert user localization, posing a serious threat to location privacy. In addition, the team discovered multiple vulnerabilities in industrial control systems deployed in critical infrastructure, including CVE-2024-6876, CVE-2022-22514, and CVE-2022-22508, strengthening the global security ecosystem through mitigations adopted by standards bodies, industry partners, and infrastructure operators.

As the Center continues to advance security across hardware, communication systems, and critical infrastructure, its researchers are increasingly recognized for their contributions. Notably, Minghao Shao received the Google PhD Fellowship in Privacy, Safety, and Security for research on agentic systems—autonomous workflows and intelligent automation designed to enhance AI-driven applications. His work promises to enable smarter AI tools that allow developers, scientists, and engineers to operate more efficiently and securely.

CENTER FOR CYBER SECURITY

CCS

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Center Leadership and Research Team

Center Director & Principal Investigator
- Ozgur Sinanoglu

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- KC Lalpopuia
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- Walid El Maouaki
- Mohammed Thari Moopan Nabeel
- Mahmood Vawoo Dawood Naina
- Akashdeep Saha
- Saideep Sreekumar
- Christoforos Vasilatos

NYUAD Wireless Research Center

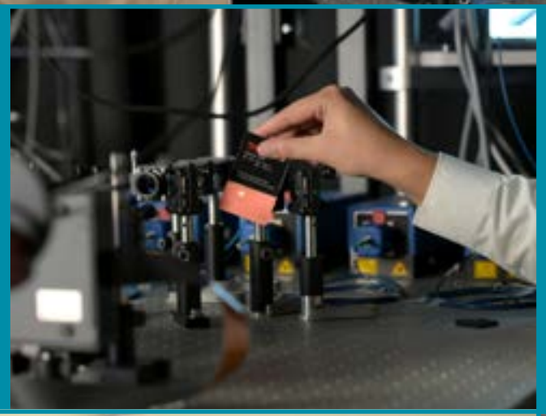
New Center

Officially launched in Fall 2025, the NYUAD Wireless Center (**NYUAD WIRELESS**) is positioned as a globally oriented research and innovation hub focused on next-generation wireless technologies, with the overarching goal of enabling ubiquitous connectivity.

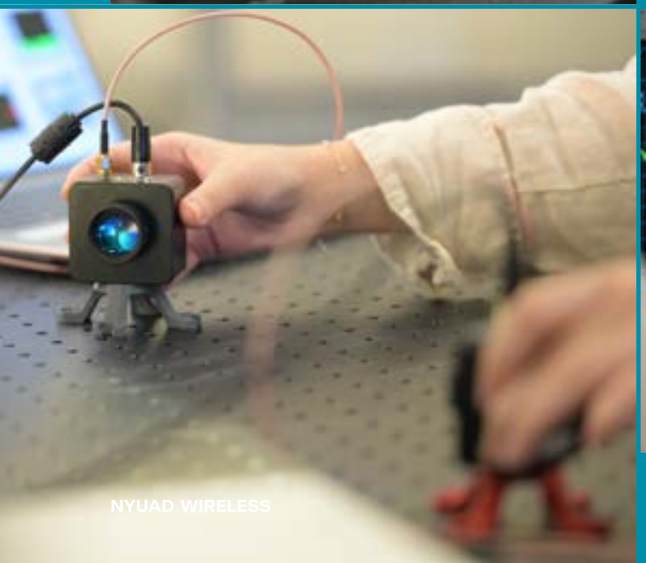
The Center's mission is to establish an institutional platform and organizational framework that facilitates collaborative research between faculty and investigators at NYU Abu Dhabi and NYU New York, leveraging complementary expertise to advance wireless communications for 6G and subsequent generations. In parallel, the Center aims to engage closely with industry to bridge the gap between theoretical research and practical implementation, thereby contributing to the UAE's competitiveness in the regional and global telecommunications landscape. A further objective is the development of human capital to address regional shortages in wireless expertise, through comprehensive education, training, and mentorship programs targeting students and early-career researchers. Finally, the Center seeks to actively participate in wireless standardization efforts in coordination with industry partners, regulatory authorities, and national and international stakeholders.







Societal transformation, driven by the growing demand for online presence and the digitalization of industries, is placing unprecedented demands on current wireless networks.



NYUAD WIRELESS



Shaping the Future of Connectivity: Omni-Band Wireless, Channel Modeling, Physical Layer Design, and Experimental Innovation

Societal transformation, driven by the growing demand for online presence and the digitalization of industries, is placing unprecedented demands on current wireless networks. Future scenarios envision a seamless integration of digital and physical worlds, effectively removing distance as a barrier to interaction. Emerging applications—including Extended Reality (XR), Holographic-Type Communication (HTC), the Internet of Senses, Integrated Communication and Sensing (ISAC), and Digital Twins—are expected to be pivotal in realizing this seamless environment, transforming work, entertainment, and social interaction. The stringent requirements imposed by this diverse set of applications necessitate innovative wireless access solutions that deliver extreme performance across multiple dimensions, as well as scalable backhaul solutions capable of supporting projected traffic growth.

To achieve truly ubiquitous connectivity, omni-band wireless communication with seamless operation across the electromagnetic spectrum—from radio to optical wavelengths—is proposed as a foundational technology for future networks. The Center's research program aims to de-risk the deployment of emerging spectrum bands (cmWave, terahertz, visible light, and infrared) for access and backhaul through fundamental scientific and technological innovations. These efforts converge toward a cognitive omni-band architecture that continuously senses its environment, autonomously selects optimal operating bands, and dynamically adapts to maintain uncompromised performance across diverse scenarios and applications.

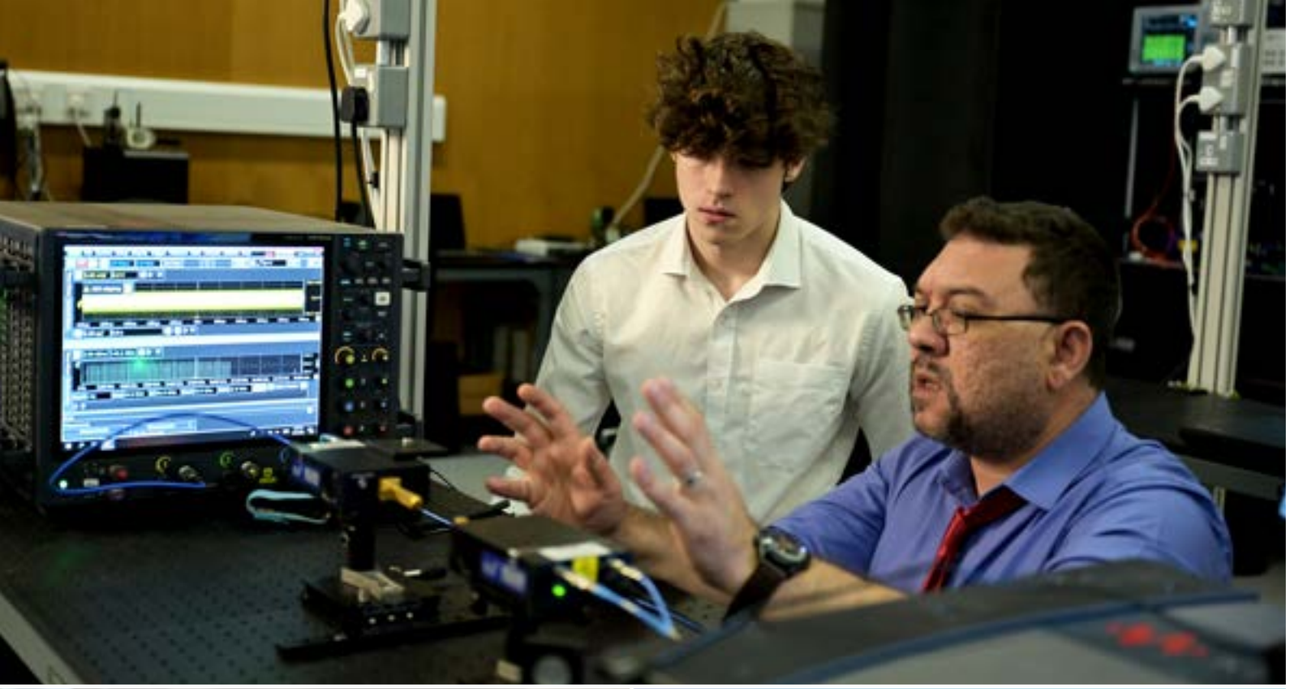
Given the technical complexity of realizing such systems, the Center's research is organized into five principal thrusts (RTs):

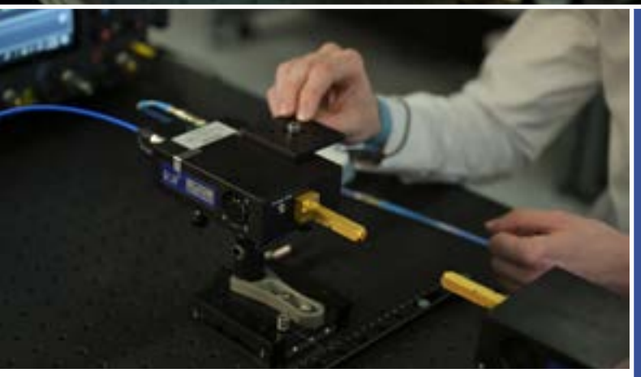
RT1 – Channel Modeling

As 6G explores new spectrum territories, existing channel models for sub-6 GHz and mmWave bands are insufficient. Dedicated modeling efforts are required for the emerging cmWave (FR3), sub-THz/THz, and optical bands to support extreme-capacity access and backhaul. ISAC applications further introduce sensing-specific propagation behaviors requiring novel modeling approaches. RT1 addresses these challenges through the development of comprehensive statistical, deterministic ray-tracing, and physics-informed models, validated via controlled experiments and real-world measurements.

We are creating a dynamic hub where cutting-edge research meets bold ideas, empowering our students and faculty to shape the future of communication and redefine what's possible in the world of technologys.

-Arlie Petters,
Chief Academic Officer and Provost,
NYUAD





RT2 – Radio-Based Wireless Connectivity

RT2 focuses on the development of physical-layer (PHY) building blocks for high-performance wireless systems across emerging 6G bands. FR3 research emphasizes regime-aware beamforming, XL-MIMO architectures, and Reconfigurable Intelligent Surface (RIS)-enabled wavefront control to exploit hybrid near/far-field propagation. ISAC research investigates how sensing can enhance communication performance while extracting environmental information from transmitted and reflected signals. THz research addresses hardware-constrained PHY design via two complementary approaches: electronics-based transceivers for compact integration and photonics-based solutions for spectrally pure, tunable carriers with inherently squint-free beam steering. These architectural choices define waveform selection, beamforming strategies, and signal processing techniques required to mitigate severe path loss and hardware non-idealities in the THz band.

Our partnership with NYUAD is built on our belief that the leaders of tomorrow will emerge from the intersection of cutting-edge technology and human ingenuity. By bringing academia and industry closer together, we're helping students turn bold ideas into real solutions. This partnership is about more than preparing youth for the digital age– We're inviting them to build it. By bringing the transformative potential of 6G into the classroom, we're empowering today's students to become tomorrow's trailblazers.

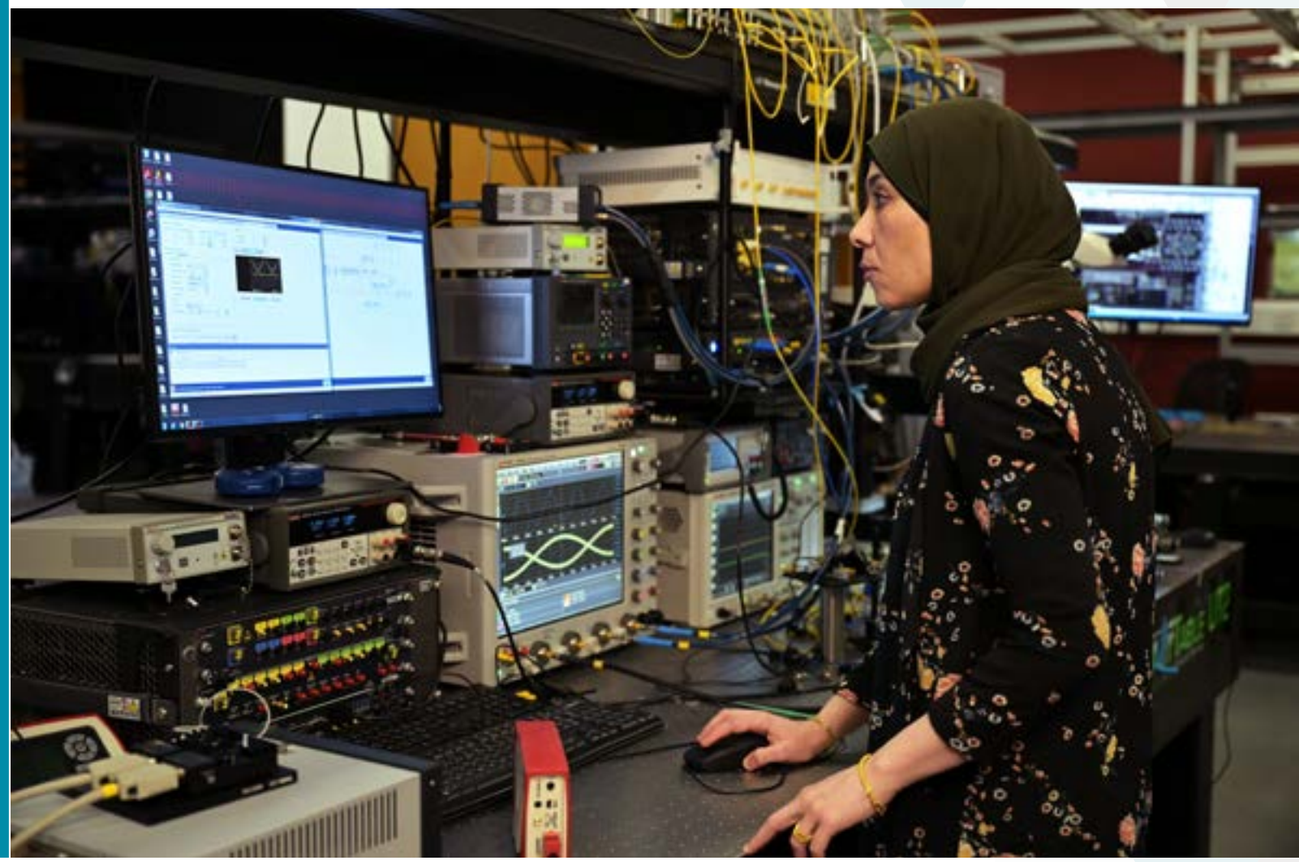
-Ali Al Mansoori,
Group Chief People Officer, e& UAE

RT3 – Light-Based Wireless Connectivity

RT3 investigates visible-light and optical wireless solutions for access and backhaul. Visible Light Communication (VLC) leverages illumination infrastructure for dual-purpose lighting and data transmission, particularly in dense user environments. Research includes coherent VLC methods beyond conventional intensity-modulation/direct-detection approaches. Free-space optical (FSO) links are also explored for ultra-high-capacity, line-of-sight backhaul and fronthaul, with emphasis on airborne platforms where mobility, turbulence, and pointing/tracking constraints pose challenges. Advanced PHY designs incorporating relay-assisted transmission and spatial-mode multiplexing are developed to ensure robust connectivity for UAVs, HAPS, and other non-terrestrial elements.

RT4 – Omni-Band Wireless Connectivity

Building on prior thrusts, RT4 investigates cognitive omni-band systems that sense their environment, identify spectral opportunities autonomously, and dynamically optimize system parameters via AI engines. This approach enables adaptive, spectrum-agile architectures that orchestrate resources across all bands, advancing the performance frontier of future wireless networks.







RT5 – Experimental Validation

RT5 ensures that theoretical and algorithmic advances are rigorously validated through prototype implementations and comprehensive measurement campaigns across FR3, sub-THz/THz, and optical bands. Band-specific waveforms and transceiver algorithms are evaluated under realistic propagation and hardware conditions, supporting the experimental demonstration of omni-band system concepts and facilitating deployable solutions for next-generation wireless networks.

Research Case Study: First Regional 6G Terahertz Trial

A demonstration of the Center's research-to-impact pathway is the Middle East's first 6G THz pilot, conducted in collaboration with e& UAE. Despite its recent launch on September 1, the Center delivered this world-class demonstration within weeks, highlighting technical expertise, agility, and industry partnerships.

Conducted at GITEX Global in Dubai, the pilot achieved 145 Gbps, validating the high-capacity potential of THz bands—key enablers for 6G. This trial initiates a comprehensive channel characterization campaign spanning 90–330 GHz, generating measurement-based insights for accurate modeling and system design across the THz spectrum.

The pilot was accompanied by the white paper "Building the Fabric of 6G: Spectrum Frontiers and Enabling Technologies", co-authored by NYUAD Wireless Center and e& UAE. The paper outlines the strategic evolution of spectrum—from sub-7 GHz to THz and beyond—and positions omni-band architectures as the defining paradigm for future 6G networks.

NYUAD WIRELESS CENTER

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Urban Systems

CITIES

Center for Interacting Urban Networks

The Center for Interacting Urban Networks (**CITIES**) is an interdisciplinary research center dedicated to advancing urban science and translating cutting-edge research into practical, real-world solutions for the benefit of society. Its overarching goal is to foster sustainable, resilient, and equitable cities. The Center's mission is to establish a vibrant, globally recognized knowledge hub for urban networks, bridge the gap between scientific discovery and practical application, and further develop the human capital that will help propel Abu Dhabi and the UAE toward a more prosperous and sustainable future. By 2030, urban areas are expected to host 60% of the global population, including more than 40 megacities, primarily in the Global South, where the benefits and burdens of urbanization will be unevenly distributed. This rapid growth presents significant economic, social, and environmental challenges. In fast-developing cities such as those in the UAE, growing demands for mobility, energy, and water require innovative and sustainable solutions. CITIES addresses these challenges by developing integrated approaches to urban design, development, and management, bringing together NYUAD faculty from all four divisions, global collaborators across the NYU network, and local stakeholders and private-sector partners in the UAE and beyond.





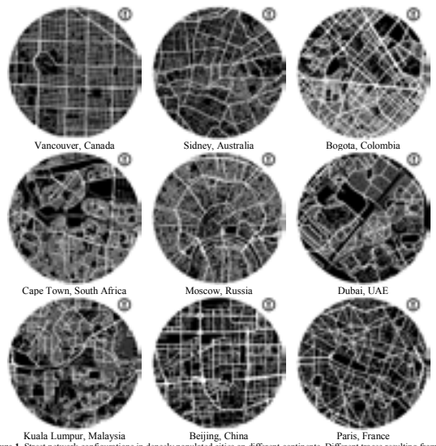
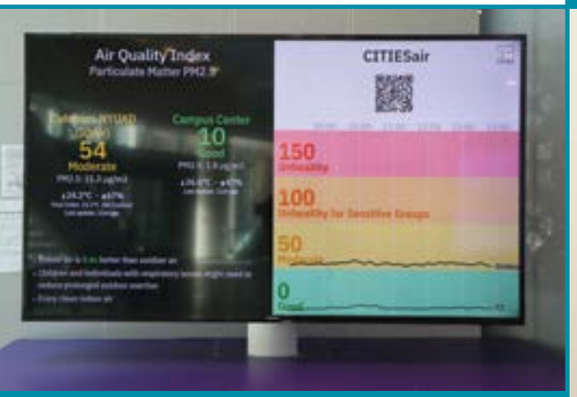


Figure 1. Street network configurations in densely populated cities on different continents. Different traces resulting from the interaction between physical and human factors. Each figure illustrates a distinct region, displaying diverse spatial scales for each city. The thickness of the lines represents the hierarchy within the street network.

CITIESair demonstrates a successful translation of environmental research into a vital community asset, reinforcing NYU Abu Dhabi's commitment to building a climate-resilient urban environment.

-Monica Menendez,
Center Director, CITIES





Monitoring, Reducing, And Quantifying The Health Impacts Of Air Pollution In Abu Dhabi And Beyond

CITIESair is a community-based research initiative that exemplifies CITIES' mission to promote urban sustainability, resilience, and public health through interdisciplinary research and innovation. It is a network of air quality sensors integrated with specialized software, designed for institutions in the UAE. Beginning with educational institutions, CITIESair's ultimate goal is to protect a wide range of organizations and urban communities in Abu Dhabi and across the UAE—a country that ranks among the top 5% most polluted globally in terms of annual PM2.5 concentration (source: IQAir). PM2.5, or fine particulate matter, is among the most dangerous air pollutants; it can penetrate deep into the respiratory system and tissues, contributing to cardiovascular disease and cancer.

To achieve this goal, CITIESair has equipped NYU Abu Dhabi and 20 UAE institutions with indoor and outdoor air quality sensors, enabling real-time comparisons between external and internal conditions and encouraging expanded indoor coverage for comprehensive monitoring across building compounds. Using best practices in user-interface design, the team developed data-rich historical dashboards that provide detailed analytics and visualizations of hourly, daily, and monthly air quality trends, delivering actionable, data-driven insights for administrators and policymakers to support community health.

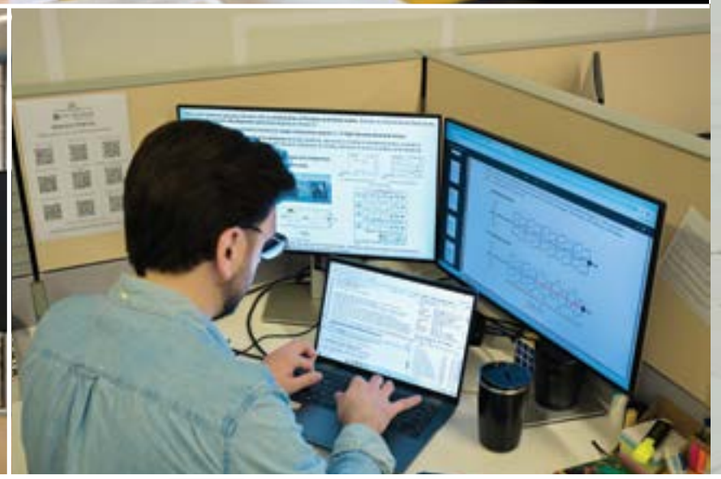
CITIESair's impact was demonstrated on 25 March 2025, when a major sandstorm activated its alert system across the emirate, helping more than 50,000 students and staff at Aldar schools remain safely indoors. In addition to supporting institutional decision-making, CITIESair extends its reach to the wider public by publishing hyper-local, real-time outdoor air quality data on IQAir. CITIESair has been named the top educational contributor on IQAir in the UAE for three consecutive years, with a growing audience of more than 80,000 followers as of January 2026.

CITIESair has also fostered interdisciplinary collaborations, integrating expertise in environmental science, engineering, and public health at NYU Abu Dhabi. In partnership with the Mubadala Arabian Center for Climate and Environmental Sciences (Mubadala ACCESS), next-generation scientific air quality sensors have been deployed in schools to improve measurement accuracy. Collaboration with the S.M.A.R.T. Construction Research Group has enabled on-campus air quality data to be visualized within an immersive digital twin environment, informing occupants about real-time indoor conditions. Beyond the UAE, CITIESair has recently expanded to Kampala, Uganda, serving as a testbed for scalable solutions in the Global South. Real-time air quality data from 15 sensors across the city are displayed at the Royal Seat of the Buganda Kingdom, increasing awareness among policymakers and supporting evidence-based decisions on emissions control and public health interventions.

CITIESair has established itself as a cornerstone of Abu Dhabi's proactive public health infrastructure. The system's real-time alert capabilities successfully mitigated respiratory risks for over 50,000 students and staff across the Aldar Academies network during a severe sandstorm in March 2025.









Beyond monitoring, CITIESair has extended its work to include indoor air purification interventions. Research shows that daily exposure to air pollution is strongly influenced by indoor environments, particularly in the UAE, where people spend up to 90% of their time indoors. In response, CITIESair seeks to reduce overall exposure by improving indoor air quality.

In partnership with Aldar and IQAir, CITIESair implemented pilot air purification projects in three Abu Dhabi schools. Using rigorous experimental methods to isolate the effects of purifiers from other variables—such as occupancy rates and door-opening frequency—the study demonstrated that portable air purifiers reduced average classroom PM2.5 levels by 50–60%, bringing them within WHO annual guidelines. These findings, communicated through accessible scientific reports, supported schools in evaluating their HVAC systems and investing in improved filtration, directly benefiting the health of thousands of students and staff.

Building on this success, CITIESair continues to advance research on the health impacts of air pollution. In a landmark study involving NYU Abu Dhabi campus residents, CITIES conducted the UAE's first study assessing the physiological impacts of indoor air purification. Globally, it was also the first air purification study to employ the Apple Watch for continuous, non-invasive, high-resolution health monitoring. Results revealed that even at low concentrations, further reductions in PM2.5 were associated with 2–4% improvements in heart-rate metrics, demonstrating that small-scale interventions can yield measurable health benefits.

Collectively, these efforts embody CITIESair mission to bridge scientific discovery and societal impact. CITIESair illustrates how an interdisciplinary approach—integrating environmental science, engineering, digital innovation, and public-health management—transforms complex data into practical solutions that enhance well-being, resilience, and sustainability in urban communities, both locally and globally.

CENTER FOR INTERACTING URBAN NETWORKS

Through non-invasive health monitoring, CITIES continues to advance research on the effects of air pollution and the benefits of air purification.

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Center Leadership and Research Team

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- Xiaolin Gong
- Ella Goeckner-Wald
- Abdullah Kaya
- Tenshi Kawashima
- Aira Khaliq
- Khiangte Ch. Lalropuia
- Junwoo Lee
- Lukelo Luoga
- Alejandro Guerra Manzanares
- Thomas Marlow
- Fares B. Mehouachi
- Diego A Polanco Necochea
- Vince Nguyen
- Maria Pulido
- Shahid Rabbani
- Cody Reed
- Benedek Sarnyai
- Inderjeet Singh

Kawader Fellow
- Maryam Al Memari

Urban
Systems

+

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SITE

CSEM

SHORES

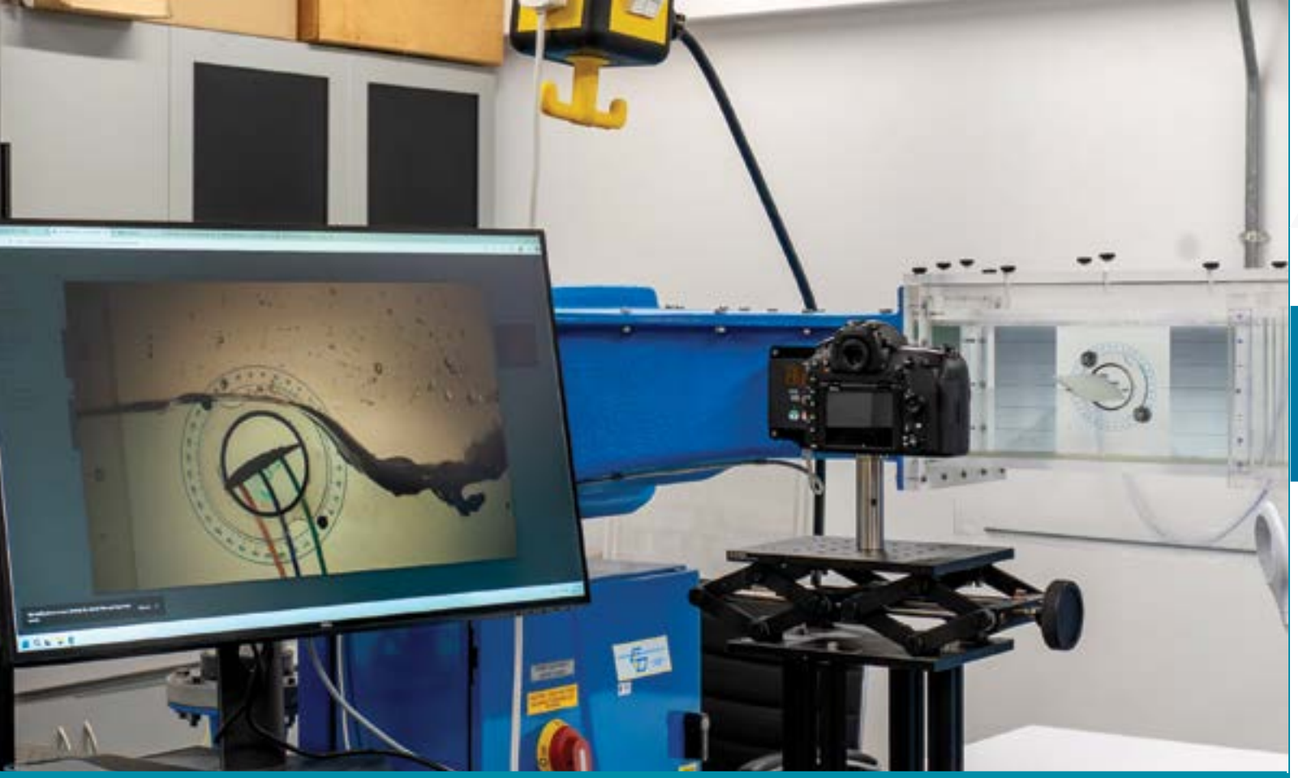
Center on Stability, Instability and Turbulence

The Center for Stability, Instability, and Turbulence (**SITE**) is an interdisciplinary research center dedicated to advancing the fundamental understanding of how complex systems transition from stable states to instability, turbulence, and chaotic behavior. Drawing on expertise in mathematics, fluid dynamics, computational modeling, and experimental science, SITE investigates the mechanisms that govern stability loss across natural, engineered, and societal systems.

SITE's research focuses on identifying the conditions under which systems become unstable, developing predictive frameworks for these transitions, and exploring strategies to control or mitigate their effects. By integrating theoretical analysis with numerical simulations and experimental validation, the center aims to generate transferable knowledge applicable across multiple domains.

The center's work addresses challenges of direct relevance to environmental protection, urban resilience, infrastructure reliability, and socio-economic stability, with a particular emphasis on Abu Dhabi, the UAE, and the wider MENA region. SITE seeks to translate foundational scientific insights into practical tools that support safer cities, more resilient ecosystems, and robust engineering and networked systems.

Through its interdisciplinary approach and commitment to applied impact, SITE aspires to be a leading international hub for research on stability and turbulence, while positioning the region at the forefront of global advances in complex systems science.



Stability is a word we use in our daily life- not only in math and physics. The kind of questions we ask in math or physics, you can ask in social sciences, political sciences, or even relationships.

-Nader Masmoudi,
Center Director, SITE





Fluid Motion: Extreme Behavior can Develop from Smooth Beginnings

The Center for Stability, Instability, and Turbulence (SITE) has achieved a significant research breakthrough that sheds new light on how smooth, orderly motion in fluids can abruptly transition into extreme and unstable behavior. This work, led by SITE in collaboration with international partners including Tarek Elgindi (University of California, San Diego), addresses one of the most enduring and fundamental questions in fluid dynamics.

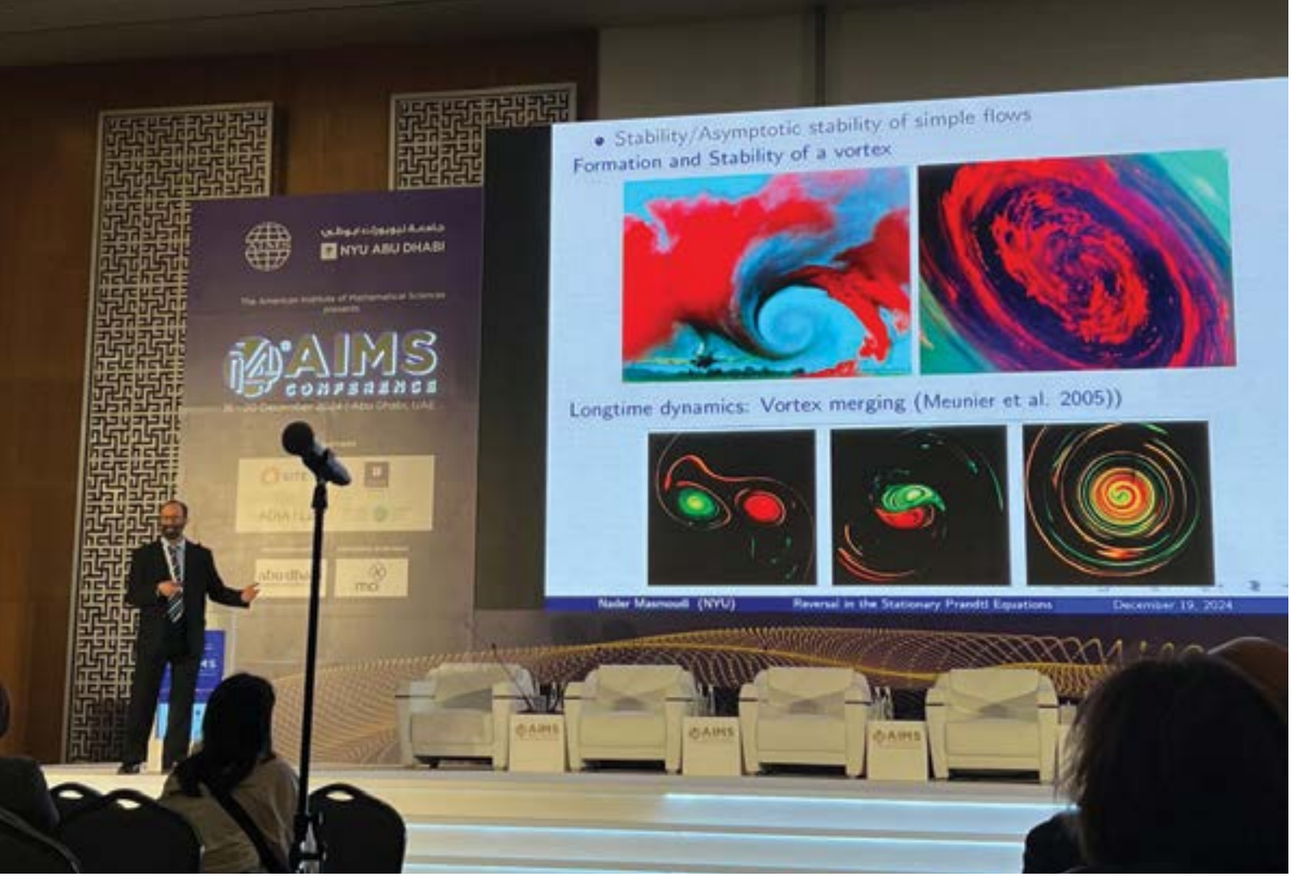
At the heart of the study lies a classical problem that has challenged scientists for more than two centuries: understanding the behavior of ideal fluids, such as air and water, as described by foundational mathematical equations developed approximately 250 years ago. These equations serve as simplified models for a wide range of physical phenomena, including atmospheric circulation, ocean currents, storms, and many engineered flow systems. Despite their long history and widespread use, many of their implications, especially in three-dimensional settings, remain poorly understood.

One of the most profound unresolved questions concerns the stability of fluid motion. Specifically, researchers have long asked whether a fluid that begins in a smooth, calm state can spontaneously develop extreme behavior in a finite amount of time, without any external forcing. In mathematical terms, the question is whether the equations governing ideal fluid motion can produce a “blow-up,” a scenario in which quantities such as velocity or rotation grow without bound, causing the mathematical description itself to break down.

Physically, this question is closely tied to turbulence, extreme weather, and violent natural phenomena. If calm flows can self-organize into highly concentrated and intense states, this would help explain the sudden emergence of strong vortices, atmospheric bursts, or powerful oceanic events. For decades, opinions in the scientific community were divided. Some researchers believed that smooth initial conditions should lead to globally well-behaved solutions, while others suspected that under certain conditions the equations might allow for singular events. Until now, however, no clear and stable example had demonstrated how such extreme behavior could arise naturally in three dimensions.

The SITE-led team made a decisive step forward by constructing a new scenario that reveals how extreme fluid behavior can develop from smooth beginnings and persist under small perturbations. Rather than relying on artificial assumptions or highly constrained setups, the researchers identified a natural mechanism through which different components of the flow interact and reinforce one another. As the fluid evolves, stretching and twisting motions concentrate energy into increasingly localized regions. This concentration creates a feedback loop: intensifying motion accelerates further growth, leading to ever-stronger gradients in the flow.

The mathematical analysis shows that this reinforcing process can drive the system toward a finite-time singularity. In other words, the equations predict that the motion becomes unbounded after a finite period, marking a sudden and dramatic transition from calm behavior to an extreme state. Importantly, this breakdown occurs without any external input or forcing, demonstrating that the equations themselves are capable of generating such events.



A key strength of this result is its stability. The extreme behavior identified by the team is not a fragile or isolated example that disappears when conditions are slightly altered. Instead, it remains robust under small disturbances, suggesting that the mechanism could realistically arise in fluid systems rather than being a purely theoretical curiosity. This stability provides strong evidence that the equations governing ideal fluids can naturally produce extreme events in three-dimensional settings.

The implications of this finding extend well beyond mathematical theory. Extreme concentration of motion in fluids is closely connected to real-world phenomena, including violent whirlpools, intense atmospheric bursts, powerful ocean waves, and strong rotating flows capable of damaging infrastructure, ships, and energy systems. By uncovering a clear pathway through which such extremes can form, this research offers valuable insight into the origins of dangerous and unpredictable events in natural and engineered environments.

Understanding how and when smooth systems become unstable is essential for improving predictive models and designing safer technologies. Advances in this area can contribute to better weather and climate forecasting, enhanced coastal and urban resilience, and more reliable energy and transportation systems. In this sense, the research directly aligns with SITE's broader mission to study transitions from stability to instability and to translate fundamental insights into practical relevance.

The breakthrough has attracted significant international attention. Major science media outlets covered the work, including Quanta Magazine, one of the world's leading publications for mathematics and physics. In its coverage, Quanta described how the classical equations of fluid motion can unexpectedly "spring a leak," highlighting the importance of the SITE team's contribution in revealing this long-suspected but previously unproven behavior. The results were also discussed across research blogs, university news platforms, and scientific forums worldwide.

This visibility underscores SITE's ability to produce research that is both technically rigorous and broadly impactful. By communicating complex ideas in a way that resonates beyond specialist audiences, the center helps bridge the gap between abstract theory and societal understanding of risk, uncertainty, and extreme events.

Beyond its immediate scientific impact, this work strengthens SITE's role as a hub for interdisciplinary collaboration. The breakthrough emerged from the integration of advanced mathematical analysis, physical intuition, and computational reasoning, combined through close cooperation among researchers with complementary expertise. This collaborative model enables SITE to tackle problems that have resisted solution for decades.

In summary, this research represents a major advance in understanding how calm, stable systems can suddenly transition into extreme and unstable states. By providing the first stable, three-dimensional example of finite-time breakdown in ideal fluid equations, the SITE team has resolved a longstanding question and opened new pathways for research into turbulence and extreme phenomena. The findings reinforce SITE's commitment to addressing deep scientific challenges while contributing to long-term goals in safety, sustainability, and resilience. Through this work, SITE continues to illuminate the complex dynamics that shape both the natural world and the engineered systems on which modern society depends.

CENTER ON STABILITY, INSTABILITY AND TURBULENCE

A 200-year-old equation may solve a 21st century real-world problem.







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- Slim Tayachi
- Mohamed Lazhar Tayeb

Center for Smart Engineering Materials

Leadership in materials innovation at the energy–water nexus will play a decisive role in shaping the global competitiveness, technological sovereignty, and strategic influence of the world's most advanced economies. Recognizing this imperative, the UAE has placed materials innovation at the heart of its long-term scientific and economic vision. The NYU Abu Dhabi Center for Smart Engineering Materials (**CSEM**) was established to advance this ambition through a bold, cross-disciplinary mission: to operate at the critical interface between fundamental scientific discovery and engineering translation, transforming disruptive ideas in materials science into technologies with tangible societal and economic impact.

At the core of CSEM lies a clear principle: breakthroughs in atomic-scale science must fuel the development of transformative devices, systems, and solutions that address the most pressing challenges of our time. The Center has pioneered research in unconventional and advanced materials engineered to embed intelligent functionalities, adapt dynamically across space and time, and autonomously self-sense and self-repair. These discoveries are systematically translated into proof-of-concept devices, functional demonstrators, and application-driven prototypes.

This seamless integration of curiosity-driven science with engineering innovation defines CSEM's impact. Through advances in smart membranes, adaptive crystalline materials, and hybrid materials platforms, the Center is delivering solutions for energy-efficient separations, atmospheric water harvesting, resilient infrastructure, and sustainable technologies—positioning the UAE and the broader MENA region at the forefront of global materials innovation.





CSEM is the UAE's flagship center for advanced materials research, delivering globally recognized, high-impact discoveries and transformative technologies that define the foundation of a sustainable, secure, and technologically resilient future for the United Arab Emirates.

-Panče Naumov
Center Director, CSEM



CSEM

Smart Engineering Materials Provide Concrete Solutions for Resilient Infrastructures

As reported in the journal *Construction and Building Materials* (2024, 411, 134653), within just 3.5 years of its establishment, the NYUAD Center for Smart Engineering Materials (CSEM) has achieved significant technological progress, including the demonstration and mechanistic understanding of how natural fibers can control the hydration and carbonation behavior of reactive magnesium oxide (MgO) cement. This low-carbon alternative to conventional Portland cement offers major potential for sustainable construction. CSEM's research provides new mechanistic insights into how fiber additives regulate moisture transport, reaction kinetics, microstructural evolution, and phase formation during curing. These findings establish a robust scientific foundation for engineering more durable and sustainable cementitious composites.

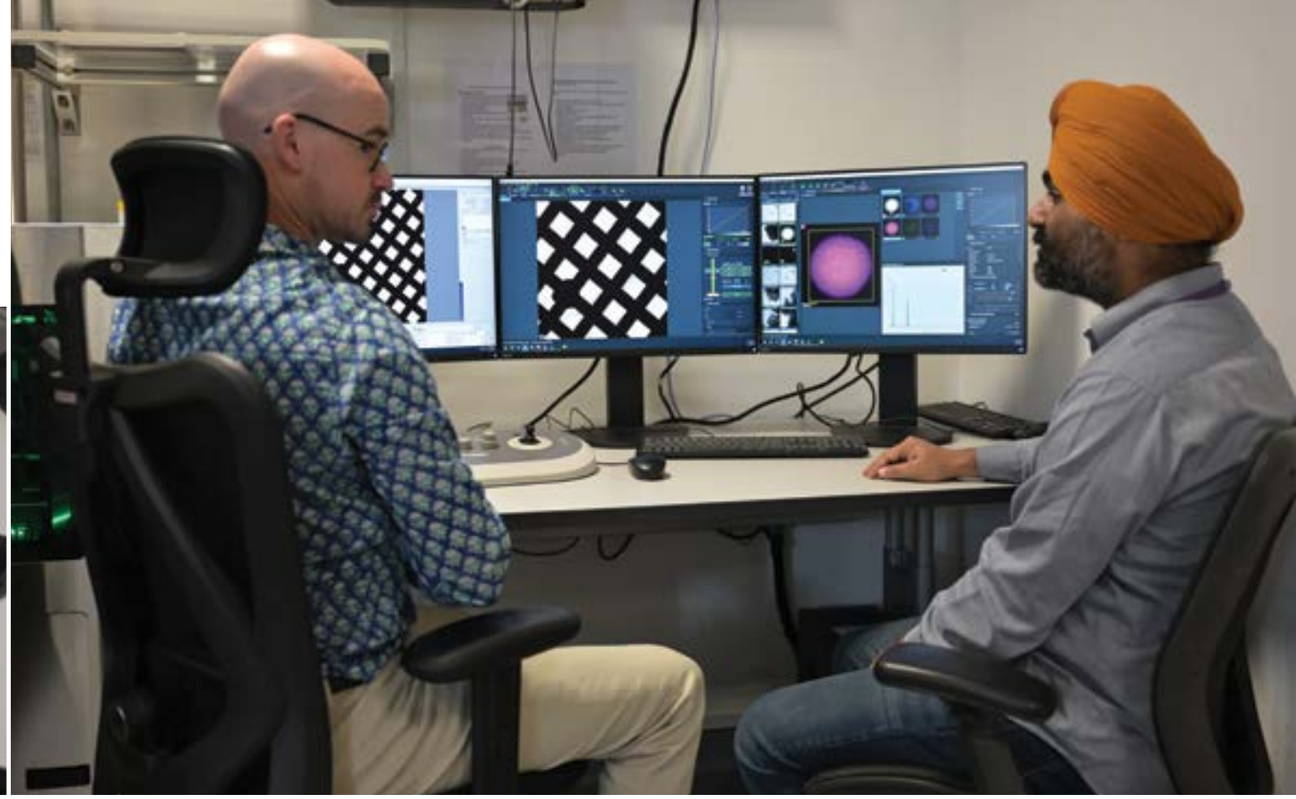
This work directly addresses one of the major challenges hindering widespread adoption of MgO-based cements: achieving predictable mechanical performance and long-term stability while maintaining a low environmental footprint. By showing how natural fibers can systematically influence both hydration and carbonation pathways, CSEM has enabled new strategies to optimize strength development, crack resistance, and durability in sustainable construction materials. The implications are particularly relevant for the UAE construction sector, where there is growing strategic demand for low-carbon building technologies and climate-resilient infrastructure. These findings have attracted strong industry interest and are supporting applied research efforts focused on scaling fiber-reinforced MgO cement systems for real-world use. More broadly, this work contributes to global efforts to decarbonize the construction sector by providing scientifically grounded design principles for next-generation cement and concrete technologies.

A central objective of CSEM's research during its first phase has been the development of next-generation wireless structural health monitoring networks (WSHMN) with active self-healing capabilities for cement-based infrastructure. To support this vision, the Center has introduced AI- and machine-learning–enabled methodologies for materials characterization, molecular simulation, and predictive modeling, significantly expanding analytical capabilities and enabling new interdisciplinary research directions. CSEM has developed an advanced electronic sensing platform capable of multi-channel, high-frequency, and long-duration monitoring of cementitious materials. Using this platform, the sensing performance of concrete incorporating calcined clay and carbon fibers was systematically studied. The research identified percolation thresholds across different mix designs, optimized fabrication procedures for scalability, and characterized the electromechanical sensing response of more than 80 specimens under varied mechanical loading conditions.

To gain quantitative insight into damage evolution, Digital Image Correlation (DIC) measurements were integrated with electrical and mechanical datasets, establishing robust correlations between strain, microstructural damage progression, and sensing response. Together, these results establish both material-level and system-level foundations for scalable distributed sensing in wireless structural health monitoring networks. This work advances the development of intelligent, self-monitoring infrastructure systems capable of early damage detection, performance tracking, and long-term resilience.







CSEM's research in self-healing materials has focused on identifying and validating bacterial strains capable of enabling bio-based crack repair in cementitious systems. Three bacterial strains from marine and saline environments, belonging to the genus *Marinobacter*, have demonstrated strong potential for self-healing construction materials such as concrete. These strains were systematically evaluated for viability, metabolic activity, and mineral precipitation capacity under conditions representative of the highly alkaline environment of concrete. Larger-scale culture experiments confirmed consistent behavior under increased production volumes, supporting their viability for future integration into cement-based materials.

With foundational sensing and biological components now established, CSEM is advancing toward fully integrated demonstrations of wireless structural health monitoring networks that incorporate self-healing functionality. The next phase of research focuses on embedding selected bacterial strains into cementitious matrices using carefully engineered carrier and encapsulation strategies. These strategies aim to enhance bacterial survivability without compromising the mechanical performance of the host material, paving the way for fully autonomous, self-repairing infrastructure systems.

Beyond the development of bacterial strains, CSEM has also identified innovative construction solutions inspired by marine environments. The Center has been granted a patent for "Marine water as a hydration agent for reactive magnesium oxide cement," introducing a novel hydration and curing approach for reactive magnesium oxide (RMC)–based cement systems that utilizes marine water instead of freshwater. This breakthrough addresses two pressing sustainability challenges: the environmental impact of conventional Portland cement and the growing scarcity of freshwater resources.

The patented approach leverages the unique ionic composition of seawater to influence the hydration kinetics and reaction pathways of RMC, improving mechanical performance, refining microstructure, and potentially enhancing long-term durability. By eliminating freshwater requirements in cement hydration, the technology significantly reduces resource consumption while enabling broader, geographically scalable deployment of RMC-based binders—particularly in coastal and arid regions. More broadly, this innovation introduces an alternative hydration chemistry with the potential to transform practices in one of the world's most resource- and energy-intensive industries: construction. If adopted at scale, this technology could accelerate the shift toward low-carbon, resource-efficient, and circular construction, offering a practical pathway for decarbonizing cement and concrete production.

CSEM's discoveries are shaping the future of the UAE construction sector by delivering advanced materials solutions that support low-carbon building technologies and climate-resilient infrastructure at national scale.

In direct alignment with its mission to translate scientific discovery into real-world impact, CSEM actively bridges the gap between fundamental research and industrial deployment through strategic partnerships with leading technology companies. Collaborations with industry partners such as Universal Matter, a Canadian advanced materials company, position the Center at the forefront of innovation in next-generation low-carbon construction materials. These collaborations accelerate the translation of laboratory discoveries into deployable technologies that offer enhanced mechanical performance, improved durability, and significantly reduced environmental impact. This reinforces CSEM's role as a leader in sustainable materials engineering and its ability to deliver real-world solutions with measurable impact.

From its inception, CSEM has prioritized capacity building and human capital development as strategic pillars equal to scientific discovery and technological innovation. The Center's mission extends beyond high-impact publications and breakthrough technologies. It is fundamentally committed to cultivating the scientific and engineering workforce needed to drive the UAE's future knowledge economy. Through intensive mentorship, interdisciplinary training, and direct involvement in cutting-edge research, CSEM prepares the next generation of scientists, engineers, and innovators to tackle critical technological challenges.

By empowering students, training emerging researchers, and expanding global research collaborations, the Center actively shapes the future leadership of materials science in the UAE and the broader region. This commitment strengthens the nation's position as a global hub for advanced materials innovation and reinforces its long-term strategy for sustainable, technology-driven economic growth.

CENTER FOR SMART ENGINEERING MATERIALS

Spotlights

April 2024
March 2025

38
Presentations

35
Journal Papers

$552k
External Funds

7
International Collaborations

2
Workshops



Center Leadership and Research Team

Center Director and Principal Investigator
- Panče Naumov

Principal Investigator
- Mohammed Daqaq

Co-Principal Investigators
- Kemal Celik
- Asif Equbal
- Serdal Kirmizialtin
- Mahmoud Rasras

Investigators
- Maryam Al Nahyan
- Safiya Khalil

Center Administration
- Kauthar Al Shally

Researchers
- Mizan Gebremicheal
- Durga Prasad Karothu
- Amerteja Kocherla
- Sanjit Manohar Majhi
- Rabindranath Paul
- Farah Shahbaz
- Kirubel Solomon Tesfaye

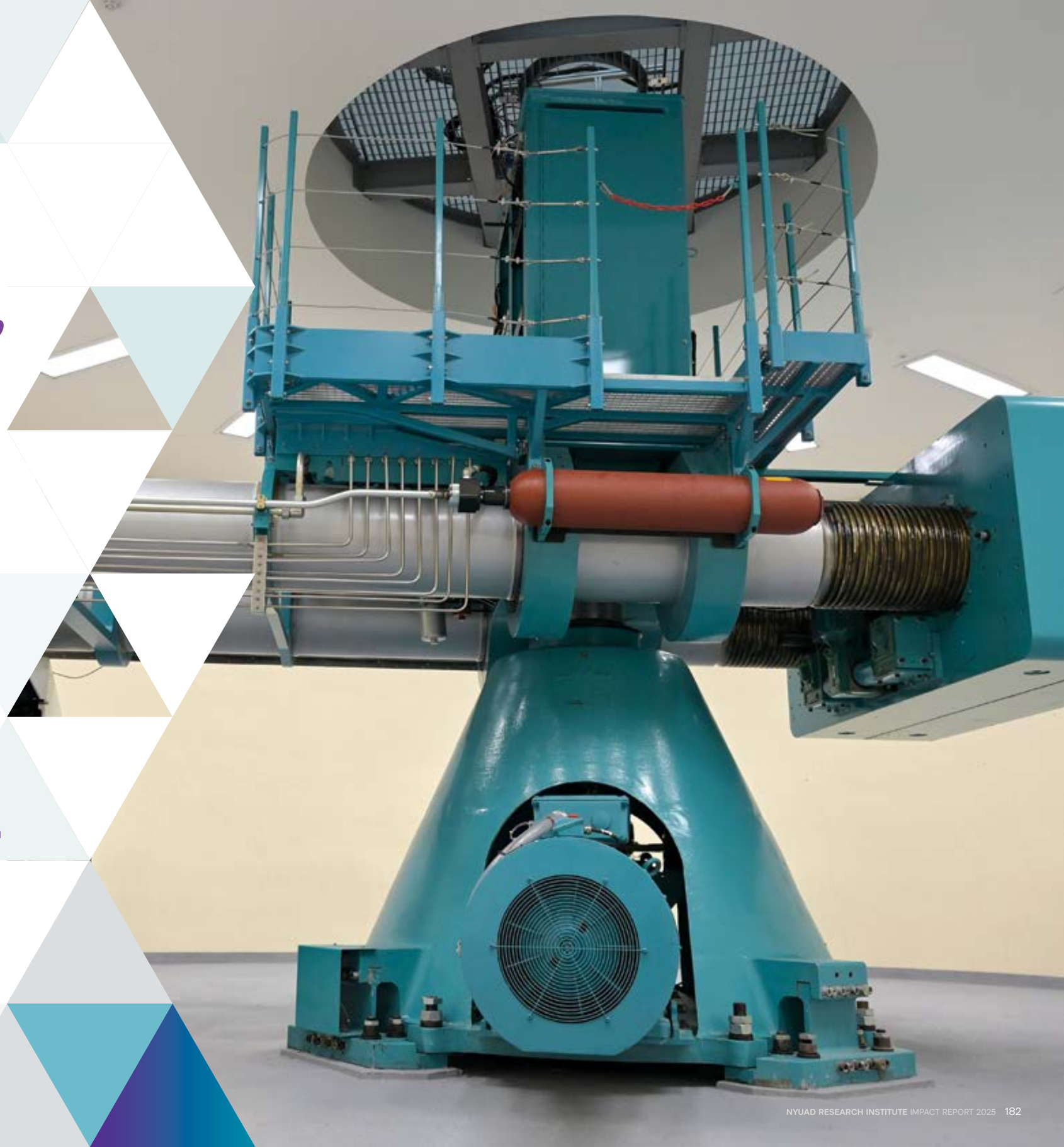
Kawader Fellow
- Mariam Binari

Sand Hazards and Opportunities for Resilience, Energy, and Sustainability

The Sand Hazards and Opportunities for Resilience, Energy, and Sustainability (**SHORES**) Center is dedicated to addressing the complex challenges of sustainable development in desert environments. As a global research hub, SHORES conducts cutting-edge research informed by local community needs and collaborates with industry and government partners to translate innovation into practical solutions.

The center's mission is to enhance the resilience and sustainability of civil and energy infrastructure in the UAE and beyond. This is achieved through the development and deployment of advanced technologies focused on resilient construction, sustainable manufacturing, and efficient energy systems. In parallel, SHORES provides students with unique interdisciplinary educational opportunities, equipping them to tackle future challenges.

SHORES envisions becoming a world-leading center for research and innovation in desert sustainability. By integrating expertise across multiple disciplines and partnering with international institutions, the center develops solutions that support decarbonization and sustainable economic growth. Key initiatives include strengthening infrastructure integrity, advancing AI and machine learning applications for infrastructure management, and exploring the use of sand as a resource for construction and energy systems. Through these efforts, SHORES seeks to foster a resilient and sustainable future for desert regions globally.

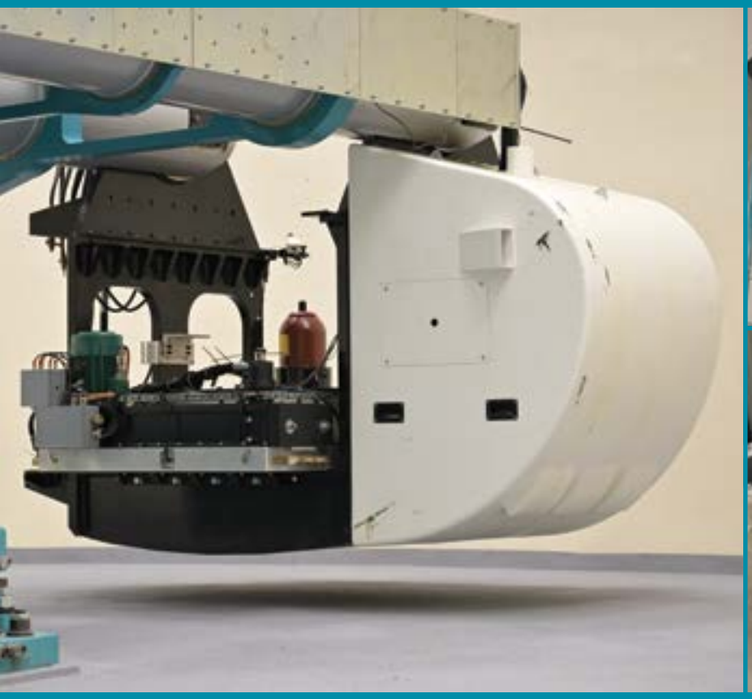






Building on this success, SHORES secured funding from Abu Dhabi Municipality (ADM) and Sandooq Al Watan (SWARD) to develop a full-scale, operational Digital Twin for the Mussafah Bridge, a critical 1970s-era transportation link.

-Tarek Abdoun,
Center Director, SHORES





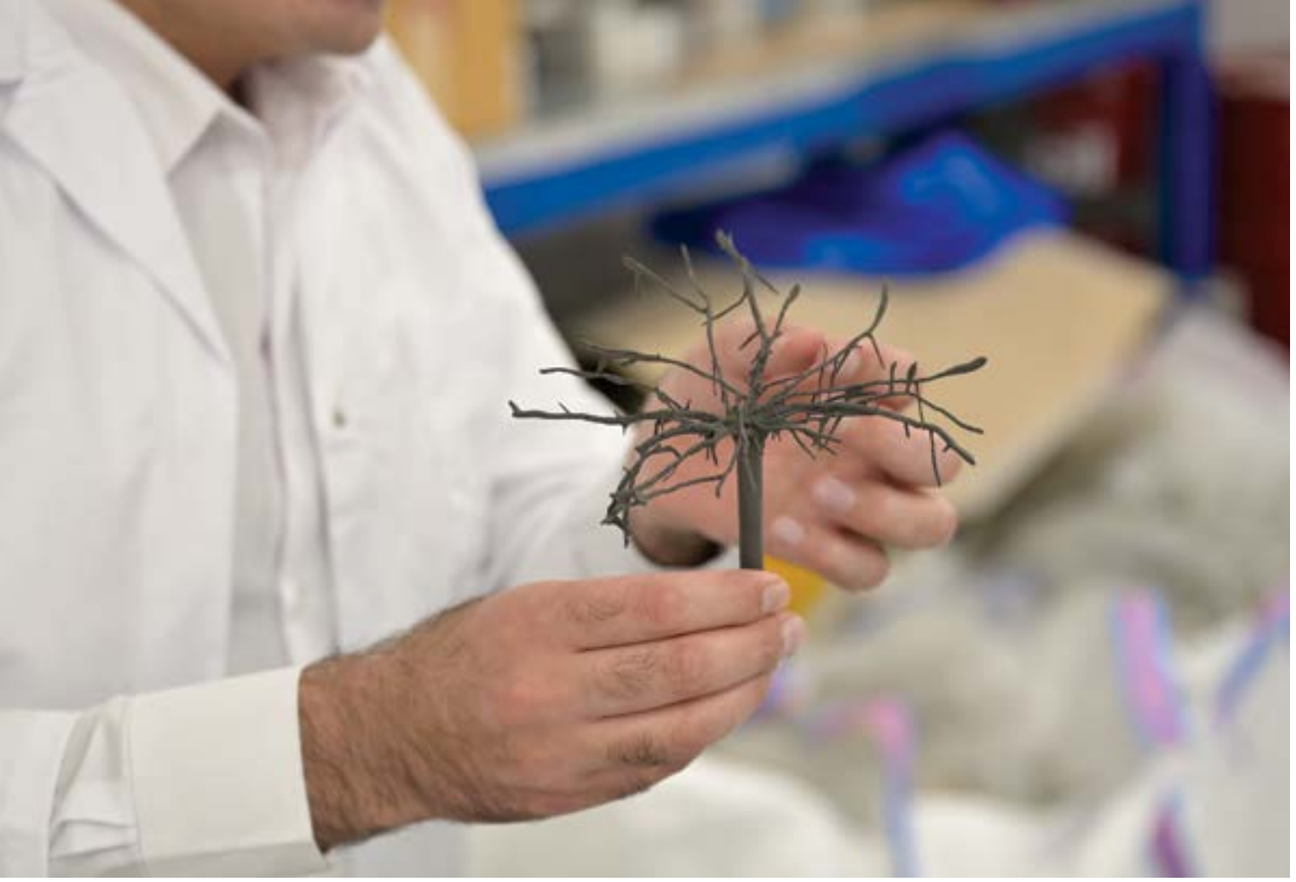




AI-enabled "Digital Twin" Turns 1970s bridge into a “Smart Bridge” with Real-Time Resilience Monitoring

A significant research breakthrough in AY 2024–2025 is the advancement of Structural Digital Twin technology for bridges, led via a collaboration between Professor Mostafa Mobasher and Professor Tarek Abdoun. A key demonstration of this effort is the development of a Structural Digital Twin prototype for the KW51 Bridge in Belgium, which was designed, built, and successfully validated, representing a landmark achievement in hybrid AI–physics modeling for advanced civil structures. The KW51 prototype integrates high-fidelity finite element models, machine learning algorithms, and automated anomaly detection pipelines, demonstrating how structural behavior, stiffness degradation, damage signatures, and dynamic load effects can be captured with unprecedented accuracy in a digital environment. Remarkably, the prototype can replicate the current structural state 100× faster than conventional numerical methods while maintaining numerical- and field-data-level fidelity. Using sophisticated ML-driven algorithms, field data can be precisely classified to identify damage locations and severity, providing predictive insights and proactive decision-making capabilities for asset management. Validation under controlled conditions provided international proof of concept, positioning SHORES as an emerging leader in AI-enabled infrastructure intelligence and demonstrating the potential for smart, resilient, and self-aware civil systems.

The success of the KW51 prototype directly catalyzed a major expansion initiative within the UAE. Leveraging technical credibility, the SHORES team secured high-level funding from Abu Dhabi Municipality (ADM) and Sandooq Al Watan (SWARD) to develop a full-scale, operational Structural Digital Twin for the Mussafah Bridge, one of Abu Dhabi’s most critical transportation

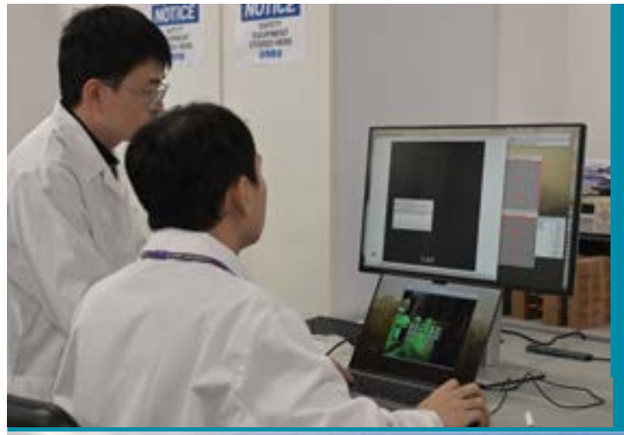


links. Constructed in the 1970s, the Mussafah Bridge provides a unique opportunity to demonstrate how legacy infrastructure can be transformed into a smart, self-aware asset. The Mussafah Bridge Digital Twin, currently under development, integrates advanced sensor networks, vision-based monitoring, physics-informed neural networks, and multimodal data fusion into a unified, real-time platform capable of detecting deterioration, forecasting structural performance, and supporting data-driven, predictive maintenance decisions. Once completed, it will be the first fully functional real-time bridge digital twin in the GCC region, setting a benchmark for intelligent infrastructure management and resilient urban mobility. This initiative contributes directly to making Abu Dhabi's infrastructure smarter, safer, and more adaptive to future urban challenges while reinforcing the city's vision for high-tech, climate-resilient urban systems.

This pioneering work is led by a multidisciplinary team whose expertise spans structural, geotechnical, materials, and digital engineering. Dr. Mostafa Mobasher, Principal Investigator of the Mussafah Bridge DT project and Co-PI of SHORES, provides the computational and structural mechanics foundation critical to hybrid AI–physics modeling, ensuring the DT captures stiffness degradation, load-path changes, and real-time structural deterioration with scientific rigor. Professor Tarek Abdoun contributes world-leading expertise in soil–structure interaction and geotechnical dynamics, supporting the DT's geotechnical modules to incorporate long-term soil behavior, environmental effects, and realistic loading scenarios for aging bridges with deep foundations. Dr. Waleed Elsekelly provides critical expertise in geoenvironmental engineering, focusing on erosion and liquefaction mitigation. By employing sustainable and environmentally friendly techniques, his research enhances the resilience of geotechnical systems against environmental hazards, ensuring the long-term stability of infrastructure in desert and coastal regions. Dr. Borja García de Soto integrates advanced automation, robotics, and digital workflows, linking field inspections with the DT's data ecosystem for accurate real-time updates and enhancing scalability across infrastructure assets. Dr. Rita Sousa advances risk modeling and resilience analytics through AI-driven probabilistic methods, embedding hazard models, soil–structure risk metrics, and tunnel/ground interaction analyses to support evidence-based, long-term decision-making. Dr. Kemal Celik provides insight into aging materials and concrete degradation, guiding the representation of long-term material deterioration critical for 1970s structures like the Mussafah Bridge. Dr. Mohamed Moustafa ensures robust experimental validation, calibrating digital predictions against real structural behavior under dynamic, environmental, and operational loads. Together, this cross-disciplinary team ensures the UAE's first full-scale Structural Digital Twin is implemented with scientific rigor, operational robustness, and strategic alignment with urban resilience objectives.

The combined achievements of the KW51 prototype and the Mussafah Bridge Digital Twin underscore SHORES' leadership in redefining how infrastructure is monitored, managed, and sustained. By shifting from reactive maintenance to predictive, data-driven decision-making, the Center is establishing a new standard for resilient, intelligent infrastructure in Abu Dhabi and across the GCC. Beyond bridges, the platform will scale to offshore structures, reclaimed islands, energy networks, and smart city ecosystems, directly contributing to the UAE's vision of future-ready, AI-enhanced, and climate-resilient urban infrastructure. In doing so, SHORES is not only advancing the state-of-the-art in smart center but also delivering tangible contributions to the community, making Abu Dhabi's infrastructure smarter, safer, and more resilient while reinforcing the role of artificial intelligence as a transformative tool for sustainable urban development.

SAND HAZARDS AND OPPORTUNITIES FOR RESILIENCE, ENERGY, AND SUSTAINABILITY



Together, the KW51 and Mussafah Bridge initiatives demonstrate SHORES' leadership in transitioning from reactive to predictive infrastructure management.



Spotlights

April 2024
March 2025

35
Journal Papers

11
International Collaborations

24
Presentations

$2.74m
External Funds

12
Regional Collaborations

6
External Grants



Center Leadership and Research Team

Center Director & Principal Investigator
- Tarek Abdoun

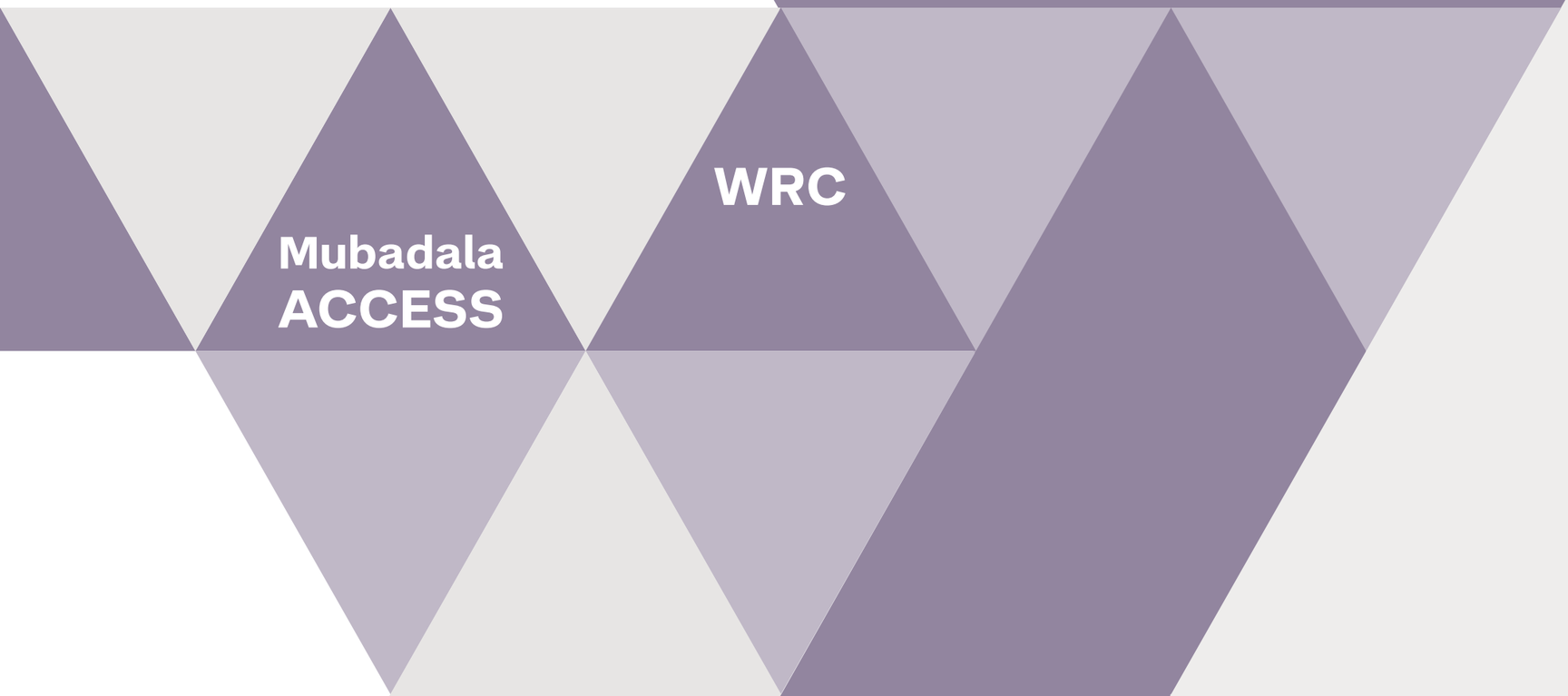
Co-Principal Investigators
- Kemal Celik
- Magued Iskander
- Mostafa Mobasher
- Borja Garcia de Soto

Investigators
- Shady Amin
- Waleed Elsekelly
- Mohamed Moustafa
- Rita Leal Sousa

Center Administration
- Caroline Neuber

Researchers
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- Yijun Chen
- Liang Chen
- Mohamed Ghazy
- Pankaj Kumar
- Prajowal Manandhar
- Ahmed Nasr
- Ellen Piercy
- Prabu Raja
- Jenisha Singh
- Xiangyu Wang
- Zihao Zheng

Environmental Sustainability



Mubadala Arabian Center for Climate and Environmental Sciences

The Mubadala Arabian Center for Climate and Environmental Sciences (**Mubadala ACCESS**) is a multidisciplinary research hub dedicated to advancing the understanding of climate change and environmental systems across the Arabian Peninsula and wider region. Established in 2021, the Center's mission is to deliver world-class science that drives evidence-based solutions to the UAE's most pressing environmental challenges.

Mubadala ACCESS brings together expertise in atmospheric, terrestrial, and marine sciences to investigate the drivers and impacts of climate variability, coastal change, and ecosystem resilience within arid and hyper-arid landscapes. Its vision is to position the UAE as a global leader in climate research, adaptation, and sustainability-focused innovation.

Through a network of field observatories, laboratory facilities, and advanced modeling programs, Mubadala ACCESS generates actionable data and insights that inform national policy, conservation strategies, and climate-resilience planning. The Center fosters regional and international collaboration, builds scientific capacity, and serves as a conduit between research, government, and society, ensuring that knowledge developed in the UAE contributes meaningfully to global understanding of our changing planet.



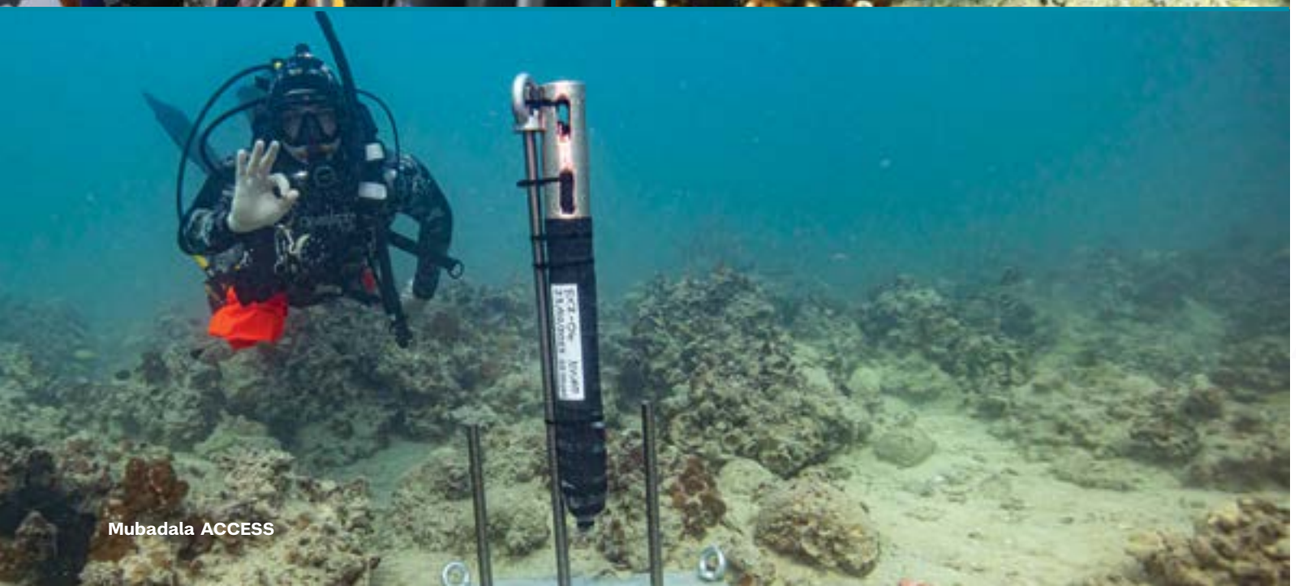


Our findings have important implications for predicting extreme heat events weeks to months before they occur, giving decision makers advance notice to monitor and protect vulnerable ecosystems such as coral reefs.

-John Burt,
Co-Principal Investigator,
Mubadala ACCESS







Mubadala ACCESS

Our Research Shows UAE Corals Can Tolerate 36°C, Reshaping Global Understanding Of Reef Survival

Mubadala ACCESS has achieved a series of transformative advances in marine science this academic year, positioning the UAE at the forefront of global coral reef resilience research. Building on more than a decade of foundational studies on the Gulf's extreme marine environment, the Center's integrated, cross-disciplinary research now spans environmental observation, modeling, and ecosystem impact studies. Collectively, this work is redefining scientific understanding of how marine ecosystems persist under the complex threats facing the Emirates, its environment, ecosystems, and people.

The Coral Reef Monitoring Program, conducted with regional collaborators, provides essential spatial context for site-specific and experimental research. The program includes more than 25 reef sites surveyed annually across the UAE, documenting coral cover, species diversity, bleaching incidence, and habitat complexity. Beyond national monitoring, Mubadala ACCESS has compiled over 800 surveys covering 379 sites across the region, with data spanning from 1985 to 2024. These datasets have been shared with the Global Coral Reef Monitoring Network (GCRMN) for inclusion in the 2025 Global Coral Reef Status Report, highlighting the UAE's growing role in regional and global reef assessments. During the 2024 bleaching season, Mubadala ACCESS scientists conducted rapid-response surveys capturing valuable field data linking environmental anomalies with biological outcomes. Despite extreme temperatures, many reefs exhibited remarkable resilience, further evidence that UAE coral populations harbor adaptive potential unmatched elsewhere. This long-term dataset is now the Gulf's most comprehensive coral reef time series and forms a critical baseline for conservation and restoration strategies.

Complementing these efforts is the Marine Monitoring Network, a cornerstone of the Center's environmental observation program. Over the past year, Mubadala ACCESS expanded its network of bottom-mounted monitoring stations across Abu Dhabi's reefs. These autonomous sensors continuously log temperature, dissolved oxygen, salinity, turbidity, and chlorophyll at coral depth, providing high-resolution data on benthic variability. Early analyses reveal that Abu Dhabi's reefs experience daily and seasonal fluctuations that rival or exceed the severity of marine heatwaves elsewhere, helping explain their exceptional physiological resilience.

The continuous data stream has also illuminated a growing stressor in the Gulf: hypoxia. Mubadala ACCESS researchers have documented seasonal low-oxygen events across lagoons and offshore reefs, often coinciding with peak temperatures. These episodes alter benthic community structure and reduce ecosystem productivity. Integrating sensor data with sediment biogeochemistry and biological surveys, researchers are quantifying how warming and deoxygenation interact to shape the future habitability of shallow marine ecosystems. This knowledge is increasingly vital for predicting global climate impacts.



At the core of this year's achievements is a breakthrough study conducted in summer 2025 using the Coral Bleaching Automated Stress System (CBASS), a standardized platform for assessing coral thermal tolerance. The marine team deployed CBASS across Abu Dhabi's coastal reefs, exposing fragments from multiple coral species to simulated marine heatwaves. The results were striking: Abu Dhabi's corals demonstrated the highest heat tolerance ever recorded, maintaining photosynthetic function at temperatures exceeding 36°C, levels that cause mass mortality on most tropical reefs. This was the first geographically widespread heat-stress assay of its kind, yielding results with both global and local relevance. Mubadala ACCESS scientists are now coupling these physiological findings with genomic and microbial analyses to identify the genetic pathways and symbiotic mechanisms underlying extreme tolerance, offering insights that may inform global approaches to selective breeding and assisted evolution.

Two additional research efforts underscore the Center's growing global influence. A study published in Geophysical Research Letters (2024) revealed that weakening summer winds in the Arabian Gulf are accelerating warming, deoxygenation, and acidification. Using coupled physical and biogeochemical models, the team demonstrated that reduced circulation limits exchange with the Sea of Oman, trapping heat and CO_2 and intensifying stress on coral and seagrass ecosystems. This mechanistic understanding strengthens Mubadala ACCESS's forecasting models for heat and oxygen-stress exposure and underscores the UAE's role as a living laboratory for studying warm, low-oxygen, and increasingly acidic oceans.

Meanwhile, ongoing work on marine heatwave-driven thermal stress brings a global dimension to the Center's portfolio. Using satellite datasets validated by in-situ observations, researchers quantify the frequency, duration, and intensity of marine heatwaves across major reef provinces and link them to bleaching and mortality patterns. These analyses place the Arabian Gulf within a global framework, showing that while Gulf reefs endure the highest baseline temperatures on Earth, their corals exhibit exceptional thermal thresholds. Together, this work refines predictive models of coral vulnerability and resilience under accelerating climate change.

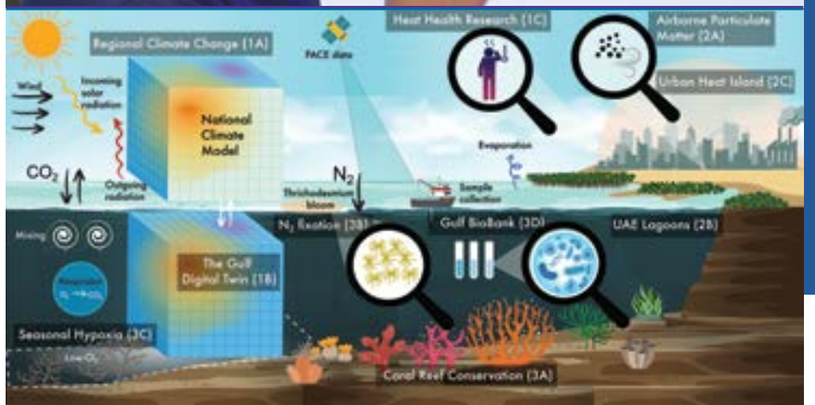
Expanding beyond national boundaries, Mubadala ACCESS is leading the Red List of Ecosystems (RLE) assessment for Arabian Gulf coral reefs in collaboration with the International Union for Conservation of Nature (IUCN) and regional partners. The RLE applies a standardized framework to evaluate the risk of ecosystem collapse using ecological, environmental, and spatial data to classify threat status across Gulf countries. Once complete, this will be the first RLE for the region and the first global RLE assessment focused on coral reefs, with results incorporated into IUCN's global database. This initiative will provide a scientific foundation for conservation policy and transboundary collaboration under a unified regional framework, exemplifying Mubadala ACCESS's mission to generate actionable science that supports environmental governance at all levels.

The synergy among these research themes: thermal tolerance, environmental monitoring, hypoxia dynamics, ecosystem assessment, and global modeling, demonstrates the holistic and interdisciplinary nature of Mubadala ACCESS's approach. Each component reinforces the others: field observations guide experimental design; sensor data validate satellite analyses; physiological thresholds inform ecosystem-scale assessments; and global models contextualize local adaptation. Together, they form a self-reinforcing cycle of discovery that is rapidly elevating the UAE's role in international marine and climate research.

Through these integrated efforts, Mubadala ACCESS is transforming the Arabian Gulf into a model for understanding climate resilience in the world's oceans. Its discoveries reveal how ecosystems can adapt to extreme conditions once thought unsurvivable, offering critical insights for the protection and restoration of coral reefs regionally and globally.

MUBADALA ARABIAN CENTER FOR CLIMATE AND ENVIRONMENTAL SCIENCES





Elevating the UAE's role in international marine and climate research, Mubadala ACCESS' long-term dataset is the Gulf's most comprehensive coral reef time series, forming a critical baseline for reef conservation and restoration strategies.

Spotlights

April 2024
March 2025

40
Media Features

$1.8m
External Funds

45
Journal Papers

31
International Collaborations

29
Presentations

6
Technologies



Center Leadership and Research Team

Center Director and Principal Investigator
- Francesco Paparella

Co-Principal Investigators
- Shady Amin
- John Burt
- Monica Menendez
- Olivier Pauluis
- Farah Shamout
- Shafer Smith
- Antonios Tzes

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- Mihi Joshi
- Priyanka Sadhwani

Researchers
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- Iulia Bibire
- Louie Buccella
- Nanda Busireddy
- Georgenes Cavalcante
- Nathalia Delgadillo
- Oliver Farrell
- Stefanos Georgiadis
- Thomas Grevesse
- Subrota Halder
- Elisaphane Irankunda
- Arpita Kanrar
- Basit Khan
- Muhammad Hassan Khan
- Swathy Krishna
- Sreejith Kottuparambil
- Zouhair Lachkhar
- Christian Lewes
- Yohan Louis
- Georgina Matthews
- Arah Narida
- Muhammad Nabeel
- Pearl Rwauya
- Brian Strehlow
- Sourav Taraphdar

Kawader Fellows
- Mohamed Abuhlaiqa
- Maryam Al Memari

Water Research Center

The Water Research Center (**WRC**) is an interdisciplinary research and innovation hub focused on translating fundamental and applied water science into practical solutions that enhance water security.

The Center's mission is to advance research in water desalination, wastewater treatment, and sustainable environmental practices, with the goal of developing scalable technologies that address critical regional and global water challenges. Its vision is to support sustainable development and economic growth, build national research capacity in the United Arab Emirates, and contribute to global sustainability through measurable, real-world impact.

The WRC hosts the most advanced water research laboratory in the Middle East and North Africa, featuring pilot-scale membrane manufacturing and testing facilities. These capabilities enable the design and optimization of next-generation membranes and integrated water treatment systems under realistic operating conditions.

Research activities at the WRC span desalination, water reuse, resource recovery, and responsible water management. The Center's work directly supports the UAE Water Security Strategy 2036 and aligns with six United Nations Sustainable Development Goals. By bringing together faculty from science and engineering disciplines with government, industry, and international partners, the WRC addresses complex water challenges while fostering collaboration and long-term resilience in water systems.



Our tailored membranes integrate nanoscale engineering, controlled polymerization, and surface chemistry to optimize permeability, resist fouling, and scale lab innovation for industry.

-Nidal Hilal,
Center Director, WRC

















Securing the UAE's Water Future: From Lab to National Impact

For the United Arab Emirates, water security is a core pillar of national resilience. The nation's reliance on seawater desalination is not just a technical reality but a strategic one. Recognizing this, the NYUAD Water Research Center (WRC) has, in the 2024–2025 academic year, translated its mission into tangible results. The Center's breakthroughs are not isolated achievements but three interconnected pillars of a single strategy: to move the UAE from a passive consumer of foreign water technology to an active innovator and producer of solutions tailored to its critical needs.

Historically, the UAE has been entirely dependent on importing generic, one-size-fits-all desalination modules. These are not optimized for the Arabian Gulf's high-salinity and high-fouling conditions, leading to higher energy costs and shorter operational lifespans.

This year, the WRC achieved a defining milestone: the end-to-end, in-house production of the first industrial-scale Reverse Osmosis (RO) module ever manufactured in the UAE.

Developed entirely within the WRC labs using advanced equipment unique in the Middle East, this breakthrough bridges fundamental chemical research to full-scale industrial fabrication. Successfully showcased at the "Make it in the Emirates" Forum 2025 and the Trends 5th Annual Conference 2025, this achievement is a flagship example of the initiative. It demonstrates that world-class academic research can be translated into tangible, high-tech industrial products. This new capability allows the WRC to develop and test modules specifically tailored to the region, creating a blueprint for a high-value manufacturing sector supporting the UAE Water Security Strategy 2036.



This year, the WRC achieved a defining milestone: the end- to-end, in-house production of the first industrial-scale Reverse Osmosis (RO) module ever manufactured in the UAE.

Building the hardware is only the first step. The WRC is simultaneously re-engineering core components to improve efficiency and sustainability. For decades, desalination modules have relied on bulky plastic feed spacers, which create blockages, increase energy consumption, obstruct active membrane area, and contribute to plastic waste. The WRC has developed and patented a sustainable alternative: surface-patterned membranes that integrate the feed spacer function directly onto the membrane surface. This innovation opens a new path for sustainable membrane design. By uniting structure and function in a single layer, this technology reduces energy consumption through improved flow dynamics, increases water production by expanding the effective membrane area, and eliminates the need for separate plastic spacers. This patented breakthrough provides the "software" for new "hardware," laying the foundation for simpler, lighter, and energy-efficient desalination systems.

The Center's vision extends beyond desalination to the full water-waste nexus, tackling two of the UAE's most pressing environmental challenges: plastic pollution and water contamination. Globally, less than 9% of the 353 million tons of plastic bottles produced annually are recycled. The WRC has developed a novel strategy to convert PET bottles and other burnable-waste-derived nanomaterials into high-performance water filtration membranes. Using a simple, scalable electrospinning setup, this "waste-to-value" approach produces filters optimized for removing contaminants. This method bridges innovation and application, reducing plastic waste, supporting UAE circular economy principles, and advancing SDG 6 (Clean Water) and SDG 12 (Responsible Production).

Together, these achievements represent the WRC's unified strategy. The Center is not only building the capability for technological independence (RO module) but also pioneering efficiency (patterned membranes) and sustainability (recycled PET membranes) that will define the future of water security in the UAE and beyond.

WATER RESEARCH CENTER

Spotlights

April 2024
March 2025

12
Awards and Honors

50
Media Features

58
Journal Papers

28
International Collaborations

32
Presentations



Center Leadership and Research Team

Center Director and Principal Investigator
- Nidal Hilal

Co-Principal Investigators
- John Burt
- Raed Hashaikeh
- Ali Trabolsi

Center Administration
- Huden Khalil

Researchers
- Jamaliah Aburabie
- Farah Ahmed
- Rawan Abu Alwan
- Raed Al-Juboori
- Neveen AlQasas
- Bikash Garari
- Lucia Gastoldi
- Daniil Golubenko
- Yazan Ibrahim
- Asmaa Jrad
- Noman Khalid Khanzada
- Muzamil Khatri
- Mahendra Kumar
- Anil Kumar Kumaran
- Shabin Mohammed
- Haya Nassrullah
- Dmitrii Petukhov
- Imran Shafi

Legacy Centers



Established in
2010

Center for Technology and Economic Development (CTED)

Enhances technology-driven economic development in developing regions.



Established in
2011

Data Center and Cloud Computing

Designs future data center and cloud computing platforms that provide improved performance in the aspects of security, resilience, scalability, and flexibility, among others.



Neuroscience of Language Lab (NeLLab)

Seeks to find how the brain mediates the most critical aspects of our communication system and which part of the brain facilitate language.

Established in
2010



Established in
2012

Computational Modeling of Normal and Abnormal Cortical Processing

Establishes a computational neuroscience research group that will address theoretical and computational modeling of neuronal processing in the normal and abnormal brain (e.g. schizophrenia, alzheimer's)



Established in
2011

Center for Prototype Climate Modeling (CPCM)

Bridges the gap between climate theory, modeling, and observation, with the goal of improving our ability to predict future climate change.



Established in
2014

Global Ties for Children (TIES)

Designs, evaluates, and advises on programs and policies to improve the lives of children and youth in the most vulnerable regions across the globe.



Established in
2011

Center for Global Sea Level Change (CSLC)

Combines observations and computational models to understand past and project future sea-level rise.



Established in
2016

Research & Empirical Analysis of Labor Migration (REALM)

Aims to shed light on the processes that sustain unfair migrant labor by improving our empirical understanding of the structures and dynamics implicated in recruitment for temporary work in the Gulf region.

Collaboration

Culture and Heritage

Abu Dhabi International Book Fair	UAE
American University in Cairo	Egypt
American University of Beirut	Lebanon
Carleton University	Czech Republic
College of William & Mary	USA
Escuela de Traductores de Toledo	Spain
Geneva Graduate Institute	Switzerland
Global Sixties Journal	UK
Graduate Theological Union	USA
Institut national d'histoire de l'art	France
Johns Hopkins University	USA
King Abdulaziz University in Saudi Arabia	Saudi Arabia
L'Année du Maghreb Journal	France
L'Ouest saharien Journal	France
Masaryk University	Czech Republic
Ministry of Heritage and Tourism	Oman
National Endowment for Humanities	USA
National Library	Tunisia
Northwestern University in Qatar	Qatar
Ohio State University	USA
Penn Museum - University of Pennsylvania	USA
Pierre du Bois Foundation	Switzerland
Princeton University	USA
SOAS University of London	UK
Sorbonne University Abu Dhabi	UAE
Sorbonne University Paris	France
The Journal of African History	UK
Univeristy of Castilla, La Mancha	Spain
University of Pennsylvania	USA
University of Barcelona	Spain
University of California, Los Angeles	USA
University of Cambridge	UK
University of Heidelberg	Germany
University of New England	Australia
University of Nicosia	Cyprus
University of Sydney	Australia
University of Tübingen	Germany
University of Utah	USA
Weltmuseum	Austria
Yale University	USA

Culture and Heritage The Arts ++

First Gallery - UAE Artists and Collections Custodians	UAE
Guggenheim Abu Dhabi	UAE
Tate Modern	UAE
The Louvre Abu Dhabi	UAE

Space Science

Mohammed Bin Rashid Space Centre	UAE
UAE Space Agency	UAE
Curtin University	Australia
Emirates Mars Mission (EMM) Team with Laboratory for Atmospheric and Space Physics (LASP) in University of Colorado, Boulder	USA
Intel Technology India Pvt. Ltd.	India
NASA GSFC - Greenbelt	USA
Nice Observatory	France
Oxford University	UK
Parallel Computing Lab, Intel Inc.	USA
SuperCam team on NASA's Perseverance rover	France
University of Buenos Aires	Argentina
University of Oxford	UK

Economic and Social Development

Ecole Polytechnique	France
Erasmus University	Netherlands
Exeter University	UK
Florida State University	USA
Free University of Amsterdam	Netherlands
Huazhong University of Science and Technology	China
Leuphana University Lüneburg	Germany
London Business School	UK
Luxembourg Institute of Socio-Economic Research	Luxembourg
Maastricht University	Luxembourg
Monash University	Australia
National University Singapore	Singapore
Northwestern University	USA
Paris School of Economics	France
Presidential Court	UAE
Texas A&M University	USA
Tilburg University	Netherlands
UAE General Civil Aviation Authority (GCAA)	UAE
UAE Ministry of Economy	UAE
Universidad de Chile	Chile
University of Birmingham Dubai	UAE
University of Bologna	Italy
University of Geneva	Switzerland
University of Haifa	Israel
University of Michigan	USA
University of South Denmark	Denmark
University of Tennessee	USA
University of Texas at Dallas	USA
University of Toledo	USA
Vanderbilt University	USA
Warwick University	UK
WZB Berlin Social Science Center	Germany

Bio-Innovation andHealth

Abu Dhabi Agricultural Club	UAE
Abu Dhabi Department of Health	UAE
Abu Dhabi Health Services Company	UAE
Abu Dhabi Stem Cell Center	UAE
Acelen Renewables	Brazil
Agricultural Research Institute	Cyprus
ART Fertility Clinic LLC	UAE
ASPIRE	UAE
Atlantis - The Palm	UAE
Bogor Agricultural University	Indonesia
Cairo University	Egypt
Centro de investigacion Ciantifica de Yucatan	Mexico
City St George's, University of London	UK
Cleveland Clinic Abu Dhabi	UAE
Embrapa	Brazil
Environmental Agency	UAE
Florida Agricultural and Mechanical University	USA
Fujairah Environmental Agency	UAE
Fujian University of Agriculture and Forestry	China
HudsonAlpha Institute for Biotechnology	USA
Imperial College	UK
Indian Council of Agricultural Research	India
Institute of Marine Science	Tanzania
International Coral Reef Society	Global
International Rice Research Institute	Philippines
Iowa State University	USA
Karolinska Institute	Sweden
Kasetsart University	Thailand
Khalifa Center for Genetic Engineering	UAE
Khalifa University	UAE
Korea Advanced Institute of Science & Technology	South Korea
KU Leuven Cancer Center	Belgium
Liverpool Hope University	UK
Ludwig Maximilian University of Munich	Germany
Mideast Coral Reef Society	Jordan
Mohamed bin Zayed University of Artificial Intelligence	UAE
OceanX - Dalio Philanthropies	USA
Optimal Clinic Dubai	UAE
Port Said University	Egypt
Public Authority of Agriculture Affairs and Fisheries	Kuwait
Qatar University Agricultural Research	Qatar
Ras Al Khaimah Environmental Protection and Development Authority	UAE
Saint Joseph University of Beirut	Lebanon
School of Health Sciences - Polytechnic of Porto	Portugal
Smithsonian Tropical Research Institute	Panama
Swiss Tropical and Public Health Institute	Switzerland
Sylhet Agricultural University	Bangladesh
Trinity College	Ireland
U.S. Department of Agriculture	USA
UAE Ministry of Higher Education & Scientific Research	UAE
UAE University	UAE
Ulm University	Germany
Universidad de Andes	Colombia
Universidad de Las Américas	Chile
Universidad Nacional de Colombia	Colombia
Universitat Pompeu Fabra	Spain
Université Toulouse 3 Paul Sabatier	France
Universities of Bologna and Trento	Italy
University of Agriculture	Pakistan
University of Bari	Italy
University of Basrah	Iraq
University of California San Diego	USA
University of Cambridge	UK
University of Cordoba	Argentina
University of Glasgow	UK
University of Guadalajara	Mexico
University of Malaysia Terengganu	Malaysia
University of New Mexico	USA
University of Surrey	UK
University of Waterloo	Canada
University of Wisconsin-Madison	USA
UT Southwestern	USA
Viatris	USA
Vietnam Academy of Science and Technology	Vietnam
Yas Clinic	UAE
Zayed University	UAE
Zhejiang Sci-Tech University	China

Bio-Innovation and Health + Tech and Information

Cleveland Clinic Abu Dhabi	UAE
Catholic University of Korea	Korea
Korea Advanced Institute of Science & Technology	Korea

Tech and Information

Abu Dhabi Global Market Square	UAE
Abu Dhabi Investment Authority	UAzE
American University of Sharjah	UAE
Aristotle University of Thessaloniki	Greece
Beijing Computational Science Research Center	China
CAS Key Laboratory of Theoretical Physics, Chinese Academy of Sciences, Beijing	China
ChatSign Technology	UAE
Classiq	Israel
Creed & Bear	UAE
Dartmouth College	USA
Duke Kunshan University	China
ETH Zürich	Switzerland
Federal University of Technology	Nigeria
Friedrich-Alexander University of Erlangen-Nuremberg	Germany
Frontiers Science Center of AI and Deep Learning, Shanghai	China
Hamad bin Khalifa University	Qatar
Hassan II University of Casablanca	Morocco
Indian Institute of Technology, Bombay	India
Institute for Theoretical Solid State Physics, IFW Dresden	Germany
Institute of Applied Technology, Abu Dhabi	UAE
Institute of Chemistry, The Hebrew University of Jerusalem	Israel
Institute of Informatics	Japan
Institute of Quantum Computing, University of Waterloo	Canada
Institute of Science, Banaras Hindu University	India
Khalifa University of Science and Technology	UAE
King Abdullah Financial District	Saudi Arabia
Kipu Quantum	Germany
Kyoto University	Japan
Lahore University of Management Sciences	Pakistan
Manchester Metropolitan University	United Kingdom
Max Planck Institute for the Physics of Complex Systems	Germany
Max Planck Institute for the Science of Light	Germany
Mohammed Bin Rashid Centre for Government Innovation	UAE
Nanyang Technological University	Singapore
National and Kapodistrian University of Athens	Greece
National Technical University of Athens	Greece
National University of Singapore	Singapore
Northwestern University	USA
Rome University, La Sapienza	Italy
Saarland University	Germany
Shanghai Research Center for Quantum Sciences	China
Siegen University	Germany
Sorbonne University, Paris and Abu Dhabi	UAE
State Key Laboratory of Precision Spectroscopy, East China Normal University, Shanghai	China
Technical University of Munich	Germany
Technische Universität Wien	Austria
Technology Innovation Institute	UAE
The Barcelona Institute of Science and Technology	Spain
Topos Institute, Berkeley	USA
UAE Ministry of Foreign Affairs	UAE
UAE University	UAE
University of Illinois at Urbana-Champaign	USA
Universidade do Porto	Portugal
Universitat de València	Spain
University of Basel	Switzerland
University of California, Santa Barbara	USA
University of Kent	United Kingdom
University of Minnesota	USA
University of Southern California	USA
University of Thessaly	Greece
University of Tunis El Manar	Tunisia
Vernewell Management Consultancies	UAE
Vernewell/QInnovision	UAE
Waterloo Institute for Nanotechnology	Canada
Xanadu	Canada
Zhejiang Institute of Modern Physics	China
Zhejiang Normal University	China

Urban Systems

Abu Dhabi Integrated Transport Centre	UAE
ALEC Engineering and Contracting Company	UAE
Center for Automation and Robotics	Spain
Chang'an University	China
China Gulf Forum Collaboration	China
Cornell University	USA
Czech Institute of Healthcare Information and Statistics	Czech Republic
Denmark Technical University	Denmark
ETH Zurich	Switzerland
Eurecom	France
Hempel Paints	UAE
Hongkong Polytechnic University	Hong Kong
IBM Research	UK
Imperial College London	UK
King Abudlaziz University	Saudi Arabia
Masdar	UAE
Max Planck Institutes for Empirical Aesthetics	Germany
National University of Singapore	Singapore
Rutgers University	USA
SecurityScorecard	USA
Shanghai Business School	China
Shanghai Electric Vehicle Public Data Collecting Monitoring and Research Center	China
SKEMA Business School	France
Smart City Expert	UAE
Southeast University	China
Southwest Jiaotong University	China
Southwest University	China
Southwestern University of Finance and Economics	China
Sultan Qaboos University	Oman
Sun Yat-Sen University	China
Technical University of Delft	Netherlands
Technical University of Denmark	Denmark
Technical University of Munich	Germany
Tufts University	USA
University of Massachusetts Amherst	USA
University of Leipzig	Germany
Université catholique de Louvain	Belgium
University Gustave Eiffel	France
University of British Columbia	Canada
University of California Berkeley	USA
University of Cambridge	UK
University of Central Florida	USA
University of Essex	UK
University of Fribourg	Switzerland
University of Hong Kong	Hong Kong
University of London	UK
University of Oxford	UK
University of Sharjah	UAE
University of Valencia	Spain
University of Waterloo	Canada

Urban Systems and Environmental Stability

Abu Dhabi Maritime Academy	UAE
Abu Dhabi Mobility	UAE
Abu Dhabi Municipality	UAE
Abu Dhabi Ports	UAE
ADNOC Logistics & Services	UAE
ALEC Holdings	UAE
Center of Excellence for Nonmetallic Building Materials (ACI-NEx) Aramco	USA
China Spallation Neutron Source	China
CSA Research	USA
Denmark Technical University	Denmark
Fugro	UAE
Imperial College London	UK
Kent Engineering	UAE
Korea Advanced Institute of Science & Technology	South Korea
Mubadala Investment Company	UAE
National Marine Dredging Company	UAE
Paris-Saclay University	France
Sandooq Al Watan – ReThink Brine Project	UAE
Saudi Aramco	Saudi Arabia
Scottish Association for Marine Science	UK
SESAME Synchrotron - HESEB Beamline	Jordan
Sheikh Shakhbout Medical City	UAE
Singapore Ministry of Education	Singapore
Southwest Jiaotong University	China
Space 42	UAE
Swiss Federal Technology Institute of Lausanne - LC3 research	Switzerland
Texas A&M	USA
Universal Matters	Canada
University of British Columbia	Canada
University of California, Irvine	USA
University of California, Los Angeles	USA
University of Cambridge	UK
University of Pennsylvania	USA
University of Seville	Spain
Utah State University	USA
Zayed University	UAE
Zhejiang University	China

Environmental Stability ++

Abu Dhabi Natural History Museum	UAE
Abu Dhabi Ports	UAE
Alverson Laboratory, University of Arkansas	USA
American University of Sharjah	UAE
Atlantis Lost Chambers	UAE
Bayanat	UAE
Bülent Ecevit University	Turkey
Cadi Ayyad University	Morocco
Cardiff Metropolitan University	UK
Center for Environmental Science, University of Maryland	USA
City University of Hong Kong	Hong Kong
Collaboration Universidad Complutense de Madrid	Spain
Dalio Philanthropies	USA
Dendra Systems	UAE
Dolphin Energy	UAE
Emirates Aviation University	UAE
Emirates Nuclear Energy Corporation	UAE
Environmental Agency	UAE
Florida Fish & Wildlife Conservation Commission	USA
Florida International University	USA
Fujairah Environmental Agency	UAE
Fujairah Environmental Agency & Fujairah Research Center	UAE
Fujairah Research Center	UAE
GFZ Helmholtz Centre for Geosciences	Germany
GHD Engineering, Architecture & Construction Services	UAE
Global Coral Reef Monitoring Network (GCRMN)	Global
Global Coral Reef Monitoring Network (GCRMN) under the International Coral Reef Initiative (ICRI)	USA / Australia
Gulf University	Bahrain
Hydrexa	UAE
IMT Atlantique	France
Institute for Ecology Technische Universität Berlin	Germany
Institute of Meteorology and Climate Research Atmospheric Environmental Research (IMK-IFU)	Germany
International Coral Reef Initiative (ICRI)	Japan
International Coral Reef Initiative (ICRI)	Australia
International Coral Reef Initiative (ICRI)	France
International Coral Reef Initiative (ICRI)	USA
International Coral Reef Society	Global
International Coral Reef Society (ICRS)	USA
Karlsruhe Institute of Technology	Germany
Khalifa University	UAE
King Abdullah University of Science and Technology	Saudi Arabia
KIT Institut für Photogrammetrie und Fernerkundung	Germany
Kurnakov Institute of General and Inorganic Chemistry	Russia
Kuwait University	Kuwait
Marine Chemical Ecology Lab, University of Haifa	Israel
Masdar Institute Environmental Monitoring Platform, Khalifa University	UAE
Max-Planck Institute for Marine Microbiology	Germany
Mideast Coral Reef Society	Jordan
Ministry of Climate Change and Environment	UAE
Mubadala Foundation	UAE
Nanyang Technological University of Singapore	Singapore
NASA's PACE (Plankton, Aerosol, Cloud, Ocean Ecosystem) Early Adopters Program	USA
National Center for Atmospheric Research	UAE
National Oceanography Centre	UK
Naturalis Biodiversity Center	Netherlands
OceanX	USA
Ras Al Khaimah Environmental Protection and Development Authority	UAE
Red Tide Institute, Mote Marine Laboratory & Aquarium	USA
Regional Carbon Cycle Assessment and Processes Phase 2 (RECCAP2)	Global
School of Marine Science, University of California, Santa Barbara	USA
SeaWorld Abu Dhabi	UAE
Sharjah Environment and Protected Areas Authority	UAE
SOLAS Scientific Steering Committee (SSC)	Global
Space42	UAE
Sultan Qaboos University	Oman
Tabreed	UAE
Terraforma	UAE
Texas A&M University	USA
The Segev Lab, Weizmann Institute of Science	Israel
UAE Department of Energy	UAE
Universiti Malaysia Sabah	Malaysia
University Complutense of Madrid	Spain
University of Cape Town	South Africa
University of Hawaii	USA
University of Konstanz	Germany
University of Luxembourg	Luxembourg
University of Texas, Austin	USA
Zonguldak Bülent Ecevit University	Turkey



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