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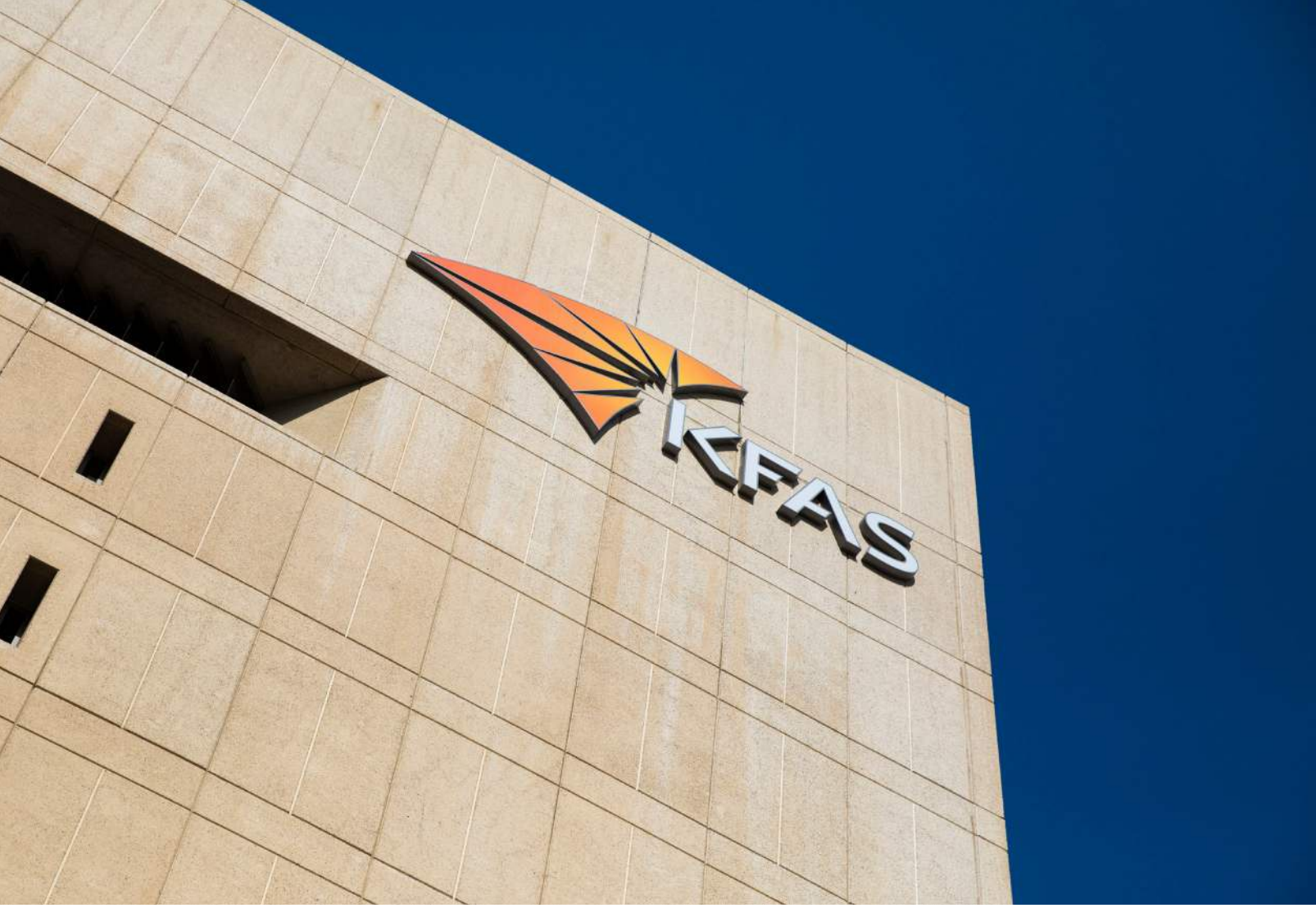


KFAS
مؤسسة الكويت للتقدم العلمي
Kuwait Foundation for the Advancement of Sciences

## Vision

A thriving culture of science, technology and innovation (STI) for a sustainable Kuwait.

## Mission

Stimulate and catalyse the advancement of STI for the benefit of society, research and enterprise in Kuwait.

مؤسسة الكويت للتقدم العلمي
Kuwait Foundation for the Advancement of Sciences

# التقدم العلمي
AL-TAQADDUM AL-ILMI

Issue 127
October – December 2024

**A quarterly scientific cultural magazine published by the Kuwait Foundation for the Advancement of Sciences**



KFAS | أحد مراكز CENTERS

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# Celebrating a Year of Progress and Promise

As 2024 draws to a close, the Kuwait Foundation for the Advancement of Sciences (KFAS) proudly reflects on a year defined by growth, innovation, and impactful contributions. From nurturing local talent to fostering global collaborations, KFAS has once again demonstrated its unwavering commitment to advancing science, driving innovation, and inspiring Kuwait's youth.

A shining example of this dedication is the Sabah Al-Ahmad Center for Giftedness and Creativity. Last November, ten Kuwaiti innovators participated in a groundbreaking AI Innovation Program at the renowned "Mind the Bridge" Center for Innovation in Silicon Valley. The program, hosted at one of the world's leading innovation hubs, equipped participants with advanced tools and strategies, preparing them to excel on the global stage. This initiative reflects KFAS's mission to cultivate talent, foster creativity, and open doors to international opportunities.

In healthcare, the inaugural conference of the LSE Kuwait Programme, supported by KFAS, spotlighted groundbreaking healthcare innovations and policy reforms. Held in Kuwait, the event brought together nearly 80 experts from academia, policymaking, and industry to discuss the intersection of healthcare technology and socioeconomic factors. The conference also celebrated 125 years of Kuwait-U.K. relations, showcasing the strength of scientific collaboration between the two nations and reaffirming the value of international partnerships and science diplomacy in addressing critical challenges.

KFAS's support for impactful research has also addressed Kuwait's pressing environmental and health challenges. One standout project, led by Abdalrahman Alsulaili, explored the use of date seeds in sustainable wastewater treatment, demonstrating how local resources can offer creative solutions to global issues. Meanwhile, a collaboration between the Dasman Diabetes Institute and KDD successfully re-engineered a classic chocolate ice cream, proving that healthier food alternatives can maintain the quality and flavor consumers love—an important step in combatting metabolic diseases like type 2 diabetes.

At this year's Kuwait International Book Fair, KFAS brought science to life through its physics-themed booth, "Adventures in the World of Physics: From Atoms to Space." With interactive activities, engaging demonstrations, and carefully curated publications, the booth inspired young learners, educators, and families, fostering curiosity and making science accessible to all. As we look to the future, KFAS remains committed to advancing Kuwait's scientific landscape, supporting innovators, and inspiring the next generation. Together, we continue to build a brighter, more innovative future for our nation.

**Ameenah Farhan**
**Director General**

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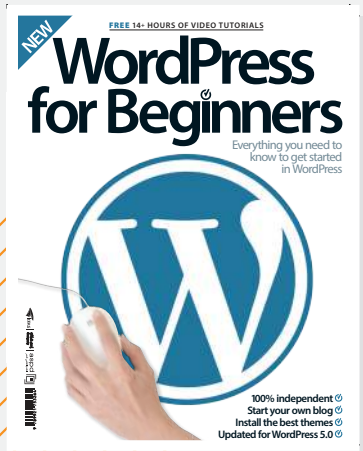




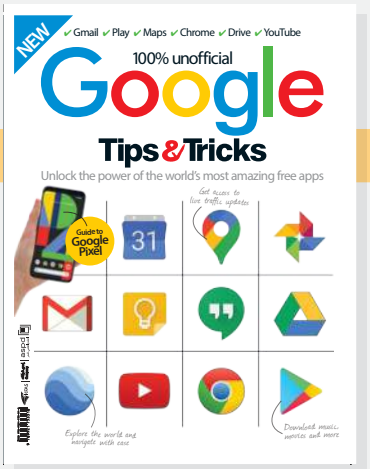


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# Bridging Science and Policy for Kuwait's Healthcare Future

## LSE Kuwait Programme Advances Health Innovation and Policy Reform


The Kuwait Programme at the London School of Economics (LSE) recently hosted its inaugural conference in Kuwait for 2024, spotlighting healthcare innovation and policy reform. Sponsored by the Kuwait Foundation for the Advancement of Sciences (KFAS), the event featured discussions on healthcare technology, socioeconomic factors in health, and system-wide improvements. With approximately 80 attendees, including members of academia, policy circles, industry, and decision-makers, this year's conference highlighted the strength of Kuwait–UK scientific collaboration and science diplomacy. The event leveraged LSE's global expertise and coincided with the 125th anniversary of bilateral relations between the two countries.

## Strengthening the Kuwait–UK Ties through Science

The LSE Kuwait Programme, driven by the KFAS's investment and vision, has served as a research link between Kuwait and the UK since its founding. The Programme fosters cross-national dialogue, helping Kuwait address local issues within a global framework through scientific insight. Since its inception, the Programme has drawn on LSE's academic expertise across disciplines, from economics and governance to healthcare, adapting these insights to Kuwait's unique challenges.

## 2024 Conference Themes

This year's event focused on delivering healthcare excellence to Kuwait. Launched by the LSE Professor Alistair McGuire, an expert in health economics, the conference sessions examined themes such as digital healthcare infrastructure, chronic disease management, and health data analytics. McGuire's keynote on global healthcare trends set the stage for the

conference, urging Kuwait to consider how technologies such as telemedicine and digital health records can enhance patient outcomes.

The conference featured three primary panels. In the first, chaired by Mariam Behbehani of the Kuwait Institute for Scientific Research (KISR), experts discussed the transformative role of technology in healthcare delivery. Dr. Dari Alhuwail of Kuwait University (KU) and Dr. Huda AlRashidi, Kuwait College of Science and Technology (KCST), showcased innovations in health informatics, emphasizing the potential of digitized patient records and AI-driven predictive tools for conditions such as air pollution, which has significant health impacts in Kuwait.

Dr. Saad Alsharrah from the Dasman Diabetes Institute (DDI) presented research on using geospatial data to identify disease clusters. These insights could be crucial in addressing Kuwait's high rates of diabetes and other lifestyle diseases, which have become national health priorities.

The second panel examined lifestyle and socioeconomic factors contributing to chronic diseases, led by Dr. Abdullah Alibrahim. LSE's Dr. Zlatko Nikoloski presented research on diabetes, focusing on its financial toll and socioeconomic disparities. Mariam Behbehani discussed infertility treatment costs—a pressing issue as Kuwaiti families confront financial challenges related to long-term health care. This discussion highlighted the need for expanded healthcare access for all income groups.

In the final panel orchestrated by Dr. Zlattko, Dr. Zainab AlMeraj (KU), discussed how accessibility in healthcare, particularly through digital channels, can create a more inclusive system. Dr. Abdullah Alibrahim (KU) shared insights regarding patient-centered policies that prioritize care quality and access, emphasizing that equitable treatment across public and private sectors could increase trust in Kuwait's healthcare system.

The LSE faculty's involvement demonstrated the value of international academic perspectives in addressing Kuwait's healthcare challenges. Each expert, in tandem with Kuwaiti panelists, contributed unique insights, from health economics to data science, enriching the discourse on healthcare reform. This academic collaboration helps shape policies with practical applications for Kuwait's healthcare infrastructure while providing crucial experience for Kuwaiti researchers in presenting their valuable findings to a large audience from the healthcare network.

### Moving Forward: A Legacy of Collaboration

This year's conference underscored the Kuwait Programme's support in addressing healthcare and scientific needs in Kuwait. By linking research insights with policy discussions, the Programme supports efforts to enhance health access and equity. As the partnership evolves, it remains an example of international collaboration that encourages knowledge exchange and applied research, helping to inform public welfare initiatives in Kuwait.

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# 2024 Science Month in Kuwait: Journey through Innovation and Discovery

The Kuwait Foundation for the Advancement of Science (KFAS), through its centers and partners, launched the 2024 Science Month in Kuwait (SciMik). Held from November 14 to December 12, that year's Science Month featured interactive workshops, exhibitions, lectures, and family activities that explored topics ranging from transforming medical education to environmental stewardship, with a particular focus on space research and its peaceful applications.

The Science Month in Kuwait orchestrated a series of events designed to inspire curiosity, promote scientific knowledge, and encourage engagement across various fields of science and technology. The goal was to make science accessible, engaging, and inspiring for people of all ages. Through these events, the Science Month in Kuwait fostered a culture of scientific inquiry and promoted lifelong learning by exposing communities to the wonders of discovery and innovation.

The primary objectives of the Science Month in Kuwait included raising awareness about the impact of science and technology on daily life, encouraging youth to consider careers in STEM fields, and supporting public understanding of key scientific issues that shape our world. By offering hands-on experiences and interactive exhibits, science festivals make learning enjoyable, simplified complex topics, and bridged the gap between scientists and the public—ultimately fostering a more scientifically literate and informed society.

The central theme of that year's Science Month in Kuwait was From Space to Earth: Pioneering Environmental Solutions with Space Technology. This theme was dedicated to exploring the peaceful applications of space technology, which played a crucial


role in addressing the environmental challenges on Earth. The workshops and accompanying public talks featured presentations and exhibits on satellite technology, illustrating how space-based tools were employed for environmental monitoring, disaster management, and communication. Through interactive exhibits and expert-led sessions, attendees discovered how space technology could contribute to a more sustainable future.

Aligned with this theme, a special highlight of the Science Month in Kuwait wasKFAS's booth at Kuwait International Book Fair 47, under the theme Adventures in the World of Physics: From Atoms to Space, organized by KFAS's centers ASPD and SACGC. Taking place from November 20–30, this event featured interactive workshops that explored everything from atomic particles to the vast cosmos, inviting families and teachers to discover the wonders of physics. Visitors also explored a curated selection of books and magazines rich with content delving into these themes—ideal for deepening their understanding of how physics shapes our world.

Every Thursday during the Science Month in Kuwait, the Scientific Center Kuwait (KFAS's center) hosted STEAM Days—a series of exciting, family-friendly activities designed to explore captivating space themes. These events blended fun with discovery, making science unforgettable for participants of all ages.

Engaging the community in environmental conservation was at the heart of Step into Nature: Rediscovering Our Ecosystems. Birds of Kuwait—an open family day event hosted by the Kuwait Institute for Scientific Research (KISR) in collaboration with the Kuwait Environmental Lens—invited families to explore Kuwait's bird species through


bird-watching activities. Additionally, dedicated workshops for teachers provided essential skills to incorporate bird-watching and nature conservation into classroom learning, fostering environmental awareness among young learners.

Under the same theme, Tracking Success: The Journey of Rehabilitating and Releasing Turtles, the Scientific Center Kuwait (TSCK) offered attendees a glimpse into Kuwait's marine conservation efforts. Participants witnessed first-hand the crucial steps involved in rehabilitating injured turtles and learned about the significance of protecting marine ecosystems.

As part of the Science Month in Kuwait, the Nature Masterclass Workshop equipped researchers with essential skills to enhance the clarity and impact of their scientific communication, boosting both their chances of publication success and the reach of their work post-publication. This workshop offered practical insights and actionable strategies, with a focus on effective writing, audience engagement, and amplifying research visibility.

# Dasman Diabetes Institute Wins Safety Star Award


The Diagnostic Radiology Department at the Dasman Diabetes Institute (DDI) received the 2023 Safety Star Award from the Ministry of Health, Kuwait, in recognition of its outstanding efforts to enhance patient safety and uphold international quality standards.

Established as a center of the Kuwait Foundation for the Advancement of Sciences (KFAS), DDI serves as an integrated hub for diabetes research and healthcare. The department earned this award through the implementation of innovative technologies, such as the advanced 'Dosewatch' tool, which provides precise, real-time radiation dose monitoring. This technology ensures safe radiation levels, offering optimal protection for both patients and staff.

The Ministry of Health, represented by the Assistant Undersecretary for Public Health Affairs, Dr. Munther Al-Hasawi, commended the Institute's efforts, emphasizing that the award reflects its commitment to enhancing healthcare quality and patient safety. Launched a decade ago, the Safety Star Award promotes safe work environments and fosters innovation in patient safety programs, aligning with the Ministry's vision of delivering high-quality care that meets international standards.

Dr. Abdulmohsen bin Nakhi, Director of the Diagnostic Radiology Department, highlighted that the collaboration between the Ministry of Health and DDI has achieved meaningful outcomes in implementing best practices in diagnostic radiology. He emphasized that the department's approach—focused on delivering 'the best radiology services in a safe environment'—ensures patient safety and boosts staff well-being, which is a crucial factor in earning the award.

This year, the Safety Star Award recognized 23 projects out of 56 submitted by governmental and private institutions across various hospitals and primary healthcare centers, including nine hospitals and eight primary care centers. Six projects from private sector institutions were also honored. The celebration, held in conjunction with World Patient Safety Day, promotes healthcare workers' awareness of safety programs and provides essential training for implementing best practices.

Dr. Talal Al-Fadala, Director of the Ministry of Health's Quality and Accreditation Department, noted that the award fosters healthy competition within the healthcare sector, honoring institutions that efficiently execute safety programs. This year's celebration also promotes the exchange of successful practices and enhances cooperation among institutions to attain higher standards in patient safety.

The Safety Star Award serves as a strong incentive for the Dasman Diabetes Institute to continue innovating technologies and programs that improve patient safety and enhance the work environment. Aligned with the Institute's mission to advance healthcare quality and address Kuwait's health challenges, particularly in diabetes and chronic diseases, the institute is actively exploring new collaborations with local and international organizations to elevate radiation safety technologies and improve the community's quality of life.

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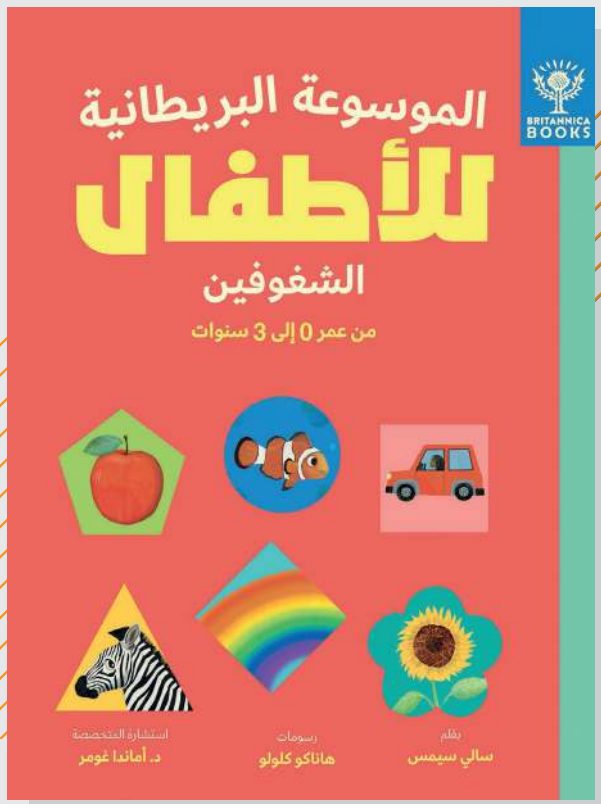


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# Sabah Al-Ahmad Center for Giftedness and Creativity: 10 Kuwaiti Innovators to Participate in AI Innovation Program in Silicon Valley—San Francisco

The Sabah Al-Ahmad Center for Giftedness and Creativity, a center of the Kuwait Foundation for the Advancement of Sciences (KFAS), announced that, in cooperation with the Mind the Bridge Foundation, ten Kuwaiti innovators and inventors will participate in a specialized artificial intelligence innovation program. The program will take place in Silicon Valley, San Francisco, USA, from November 18 to 27, 2024.

The center's General Manager, Neda Al-Daihani, stated in a press release today that the ten participants were selected from approximately 50 applicants by a specialized jury and evaluation committee from Mind the Bridge. The selection criteria included product readiness, market size, previous achievements, business model, team strength, and English communication skills.

Al-Daihani explained that the Sabah Al-Ahmad Center for Giftedness and Creativity aims to enhance participants' innovation capabilities through this program, which will be held at the Mind the Bridge Center for Innovation in San Francisco, one of the world's leading innovation hubs. The program will provide participants with the tools and resources needed for success, excellence, and expansion, aligning with the center's commitment to promoting innovation and supporting Kuwaiti innovators in developing their ideas and exploring new opportunities in global markets.

He added that the program offers a unique opportunity for Kuwaiti innovators with scientific expertise to gain in-depth insights into the latest trends in artificial intelligence and innovation, benefiting from an environment that is among the most vibrant and creative in the world.

He highlighted that the program's significance lies in enabling Kuwaiti innovators to deepen their understanding of the American market, refine their innovation strategies, and build a network of connections with key partners for success in the United States.

Al-Daihani also listed the ten promising innovations selected for this program as follows:

**Kaffy – Saad Al-Mutairi**
A leader in biometric technology, Kaffy provides palm scan-based payment solutions and has expansion plans into healthcare and education, aiming to enhance safety and convenience.

**Oqood AI LegalTech – Khalid Al-Rashid**
An AI-powered legal workspace, Oqood automates routine legal tasks and securely generates confidential legal documents and agreements.

**Golden Egg – Mohammad Malallah**
Golden Egg is a global platform that connects livestock breeders with potential investors, facilitating engagement, sales, and the exchange of expertise.

**Classi AI – Abdulrahman Al-Anzi**
Classi AI helps teachers in Kuwait by automating lesson planning and activity creation aligned with local curricula, streamlining the educational process.

**TiM – Ahmed Al-Salem**
TiM leverages AI to create an integrated healthcare resource management system that enhances efficiency, reduces errors, and improves patient outcomes.

**Ayadi – Lateefa Ayman Bin Essa**
Ayadi is an online mental health platform connecting users with certified therapists, emphasizing privacy and cultural sensitivity for accessible mental health support.

**EkosLive – Jassim Mutlaq**
EkosLive is an all-in-one platform enhancing the astrophotography experience with smart features for cloud storage, scheduling, and community sharing.

**Brailleiance – Lateefa Al-Zoubi**
A Braille-based interactive educational device designed to empower blind students in learning mathematics, fostering self-directed learning and inclusivity.

This initiative underscores SACGC's dedication to empowering Kuwaiti innovators with a global outlook, enabling them to obtain in-depth insights into AI trends, establish networks with key partners, and develop strategies for success in the American market.

**ScansX – Sarah Abu Arjoub**
ScansX is a portable medical device that leverages AI to diagnose brain injuries rapidly and accurately, enhancing healthcare outcomes and saving lives.

**Mortex BCI – Abdulaziz Al-Zakeer**
Mortex BCI allows control of devices through thought, using AI and brain activity sensors to interpret motor imagery.

# A New Scoop: Re-Engineering a Classic Ice Cream for a Healthier Future

## A groundbreaking, collaborative clinical trial provides proof that reduced sugar doesn't have to mean reduced taste

By Emma Stenhouse

High rates of metabolic diseases, such as Type 2 diabetes, affect people worldwide—and Kuwait is no exception. 'Kuwait has a Type 2 diabetes prevalence of more than 20%,' said Dr. Ebaa Al Ozairi, Chief Medical Officer at the Dasman Diabetes Institute (DDI).

One of the main drivers of Type 2 diabetes is obesity, combined with our growing reliance on ultra-processed foods. But as it is unrealistic to expect most people to stop the consumption of these foods, the pressure is on the food and beverage industry to re-engineer healthier alternatives.

Founded in 1962, the Kuwaiti Danish Dairy Company (KDD) is a family-oriented brand that is blazing a new trail regarding improving nutrition in Kuwait. "KDD has long been appreciated as a cultural icon in Kuwait because they go beyond just providing products," said Wolfram Alderson, Executive Manager of Research and Innovation at KDD. "There's a genuine interest in the health of consumers, and

that drove the leadership to say, 'let's update how we design our foods with the latest science.'"

This interest in consumer health has led to a ground-breaking partnership between the KDD and the DDI, with a grant from the Kuwait Foundation for the Advancement of Sciences (KFAS), to re-engineer KDD's classic chocolate ice cream. The goal was not just to replace added sugar with healthier sweeteners, but to maintain the same flavor, consistency, and quality that the brand is famed for. "We know that our customers, the people here in Kuwait who've grown up with KDD chocolate ice cream, wouldn't take kindly to a product without the same deliciousness factor, even if it has better nutrition," said Alderson.

In addition to re-engineering the ice cream, the KDD also wanted to quantify the benefits of the new formulation. To achieve this goal, a clinical trial was required. "This was a partnership between DDI and KDD, funded by KFAS, to address important societal needs," said Al Ozairi.

The trial is a "huge achievement: the first randomized, cross-over trial conducted on the local Kuwaiti population. The aim of the study was to evaluate the postprandial glycaemic response in people with type 2 diabetes," said Dr. Al Ozairi. The results showed that the no-added-sugar ice cream demonstrated significantly lower blood glucose and insulin responses in people with diabetes. While the new ice cream formulation does not have added sugar, it still contains some sugar from natural products within milk. "People with diabetes need to understand it's not what other brands might claim is 'zero total sugar' it is no added sugar, but it improves the spikes of the blood glucose," said Al Ozairi. "Clear messaging to the people is very important."

The paper titled, "Reformulating ice cream to improve postprandial glucose response: an opportunity for industry to create shared value" has garnered significant international attention, receiving more page views than 96% of all other articles published in the Frontiers in Nutrition journal.

After the success of the clinical trial, three flavors of the newly formulated ice cream, branded "Good for Me," were launched in June 2024: chocolate,


strawberry, and vanilla. The launch was accompanied by a symposium, which Al Ozairi said was "very well received and probably one of the most successful events that Dasman has led with public engagement."

In addition to creating a healthier version of KDD's much-loved ice cream, this research has generated other benefits, including inspiring the next generation of Kuwaiti scientists. "What we're really proud of is the amount of capacity building that we have done in this project," said Al Ozairi. "The whole team that has run the research project are young Kuwaitis from different sectors." The project also underwent the scrutiny of Professor Carel le Roux, a worldwide expert in obesity.

Another benefit of the project was its emphasis on the community-driven nature of the Kuwaitis who participated in the trial. 'This was a rather laborious experiment, undertaken entirely for the purpose of advancing science and addressing community needs,' said Al Ozairi.

Both Alderson and Al Ozairi are grateful for the support received during this trial. "The KFAS team has been very enthusiastic and really understands how important it is to connect the dots between the industry and health outcomes," said Alderson. "None of this would be happening without them (Chairman and CEO of KDD, Sir Mohammed Jaafar, and Deputy Chairman, Deputy CEO and CFO of KDD, Ms Bahia Ezzat Jaafar) commissioning this project," he added.

The hope at the KDD is that research such as this inspires other companies within the food and beverage industry to believe that change is possible: "We're sharing this research openly so it can benefit other companies, including our competitors," said Alderson. "We need an ecosystem of competition...we want people competing to make healthier products versus competing to make unhealthy products."

At the DDI, this project is the beginning of new aspirations to spread the importance of shared value throughout the private industry. "We will be working on many future projects that look into different aspects of how to incorporate new products at KDD, while also welcoming other private industry companies to address important health issues including low muscle mass, sleep, and well-being," said Al Ozairi.

After the success of the three "Good for Me" ice cream flavors, the KDD is now working on re-engineering a wide range of their products, as well as developing new releases. "There's no limits to how far our leadership wants us to go," said Alderson.

**Huge achievement: the first randomized, cross-over trial conducted on the local Kuwaiti population. The aim of the study was to evaluate the postprandial glycaemic response in people with type 2 diabetes**





# مغامرات فيزيائية:
# من الذرة إلى الفضاء



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# **Innovating Water Treatment with Local Resources**

## Abdalrahman Alsulaili's Path from Mathematics to Sustainable Water Solutions

By Jonathan Feakins

Abdalrahman Alsulaili did not expect to build a research career around water. After a love for mathematics led him to a bachelor's and master's in civil engineering at the University of Kuwait, he received a scholarship to pursue a PhD at the University of Texas at Austin. The scholarship, however, was for environmental engineering. His resulting research on water treatment, as it turns out, propelled him toward a field of study of incalculable significance for the whole Gulf region.

"Kuwait is a rich country," Alsulaili says. "But, on the other side, it's very, very poor in water."

As a professor of civil engineering at Kuwait University, Alsulaili has developed a critical perspective in a profoundly arid landscape. For being one of the most water-stressed nations in the world, Kuwait certainly does not act like it: the country's per-capita water consumption regularly ranks as one of the highest in the world, imbibing more than four hundred liters of water per day. Approximately three-fifths of this supply flows out of a network of less than a dozen desalination plants. Another one-fifth is tapped from the region's scarce and depleting groundwater, which is often so brackish that it must be mixed with the desalinated supply, or used for non-drinking purposes such as irrigation or construction.

The remaining one-fifth, or 20%, of Kuwait's water resources derive from treated wastewater (which actually makes Kuwait—along with other modestly-sized, water-scarce countries such as Qatar and Singapore—something of a world leader). This success, however, may prove insufficient for the coming resource crunch: current projections suggest that, by 2050, the entire Gulf region may lose as much as half of its water availability per capita, falling vastly short of its future needs.

Alsulaili, however, has recently completed a project funded by the Kuwait Foundation for the Advancement of Sciences (KFAS), which may provide a creative tactic to help address this looming shortfall. His final report, "Utilization of Dates Seeds as Waste Material in The Treatment of Wastewaters," investigated the potential of the humble date—750,000 tons of dates are consumed in Kuwait each year—as a natural, affordable form of wastewater bio-filter.

This is hardly the first attempt by engineers to find a productive use for agricultural waste. Waste management is currently enjoying a research heyday, as every municipality on earth seeks out ways to wrest a little profit out of their waste stream (while also reducing the growing burden of land-intensive, unsanitary landfills). Prior to his most recent publication, Alsulaili had authored a conference paper titled, "Agricultural Waste-Based Biochar as a Low-Cost Sorbent for Water Treatment," which investigated the potential of not just date seeds, but banana peels, Rhamnus seeds, and coffee residue.

"But when I read the literature, one thing that got my attention is that they talked about date seeds as if they're all the same," Alsulaili says. "But if you visit us in Kuwait, there are different types! Big, small, sweet—and so, when we talk about the activated carbon we can produce, are all these seeds the same or not? This is the idea in my head."

Alsulaili's hypothesis, as it turned out, proved especially fruitful. Along with his co-authors Abdelrahman Refaie (also of Kuwait University) and Hector Garcia (of the IHE Delft Institute for Water Education, in the Netherlands), Alsulaili tested an impressive spread of nine distinct date varieties. After selecting smaller seeds to undergo the process (with diameters from 0.3 to 0.85mm), the researchers thoroughly rinsed and dried the dates for twenty-four hours to prepare them for "activation"—a treatment process that would fill the seeds with small, porous holes. This treatment exponentially increases the activated object's surface area by giving it a microscopic "sponge"-like structure to which molecules can adhere.

While each variety, theoretically, did prove to be capable as a substitute for activated carbon, the most potent varieties proved to be as much as seven or eight times as effective than others; the Khalas and Khodari varieties, for example, activated especially successfully. But while the Khodari variety exhibited an especially porous structure, the Khalas variety ultimately emerged on top: Khalas pores—by being fewer in number, but larger in diameter—proved less prone to clogging.

When all was said and done, Alsulaili found that activated Khalas seeds could attain adsorption rates as high as 71% (when compared to commercially available activated

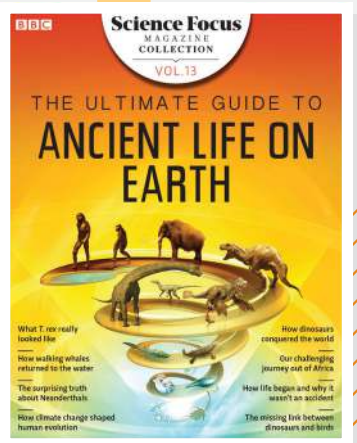
charcoal). Furthermore, the activated date seeds—a waste product that would otherwise wind up in Kuwait landfills—could be produced at 55% less expense. These figures, meanwhile, represent early results, achieved with the finite resources available to Alsulaili's laboratory; if activated date seeds are appropriately commercialized and produced at scale, they might exhibit even higher rates and more economical production costs.

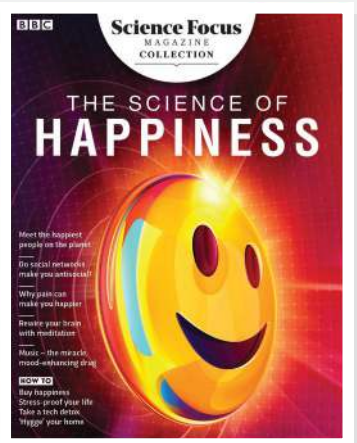
Activated date seeds may also find utility when applied to a major by-product of the Kuwaiti oil industry: a mixture of oil, water, and suspended solids known as "produced water." This water cannot be remediated for public use—its high salinity renders it unsuitable even for irrigation. Alsulaili investigated whether activated date seeds could facilitate the filtration of produced water in such a manner that it can be re-injected into Kuwaiti oil wells.

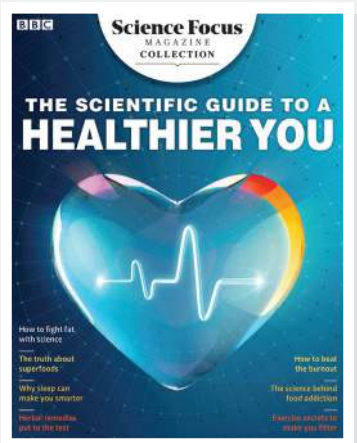
In October 2023, Alsulaili served as chair of the Kuwait University's First GCC Engineering Symposium, in the hopes of bringing together his fellow researchers to address these pressing challenges. "Kuwait, Qatar, Saudi Arabia: we all have the same problems!" Alsulaili says. "We have the same culture, we have the same challenges. Maybe the same problem I work on here in Kuwait, another group is working on in Qatar. Why must we duplicate ourselves? We should unify our efforts."

"This is what I love about environmental engineering," Alsulaili says. "Yes, you can build some buildings, or increase the strength of concrete or steel. But if you create good for the environment? You can affect everyone's lives."

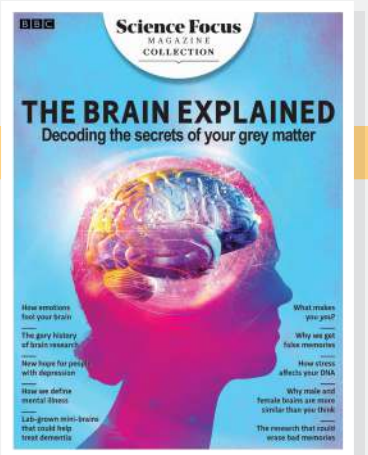
> **If you create good for the environment, you can affect everyone's lives**





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# Pioneering Sustainable Building Design: Lessons from Al Hamra Tower Research

## Enhancing Safety through Structural Health Monitoring

For more

**Our goal is to enhance building safety and sustainability by utilizing real-time data collection and analysis, ensuring compliance with rigorous engineering standards**

Kuwait's 414-meter-high Al Hamra Tower—the tallest curved concrete tower in the world—stands not only as an architectural marvel but also as a beacon of innovative research in structural health monitoring. The Kuwait Foundation for the Advancement of Sciences (KFAS) funded the research project, Ground Motion Modeling and Structural Monitoring of Tall Building—a first of its kind in Kuwait—to set new standards for building safety and sustainability not only in Kuwait and the Middle East but also globally.

The Al Hamra Tower is part of a larger research initiative named the Sustainability of Kuwait's Built Environment (SKBE) project—a collaborative effort among the Massachusetts Institute of Technology (MIT), Kuwait University (KU) and Kuwait Institute for Scientific Research (KISR). Launched in 2013, this multidisciplinary project brought together over 60 scientists and research and engineering professionals with the overall objective of developing innovative solutions and methodologies for the sustainability of Kuwait's built environment. The project aimed to establish a new paradigm in engineering design that could be used not just in Kuwait but globally.

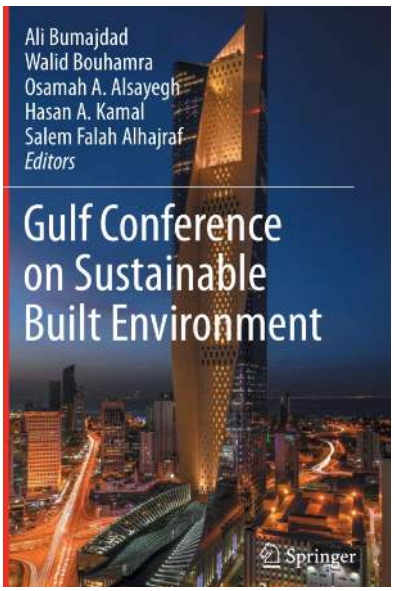
To achieve these objectives, the research focused on three key areas: building materials, structural performance, and energy efficiency. 1) Using nano-engineered building materials to enhance durability. 2) Monitoring and controlling tall building structures to evaluate their response to earthquakes and wind. 3) Improving energy efficiency in buildings and neighborhoods throughout Kuwait City."

According to Dr. Hassan Kamal, co-principal investigator for the project (on behalf of the KISR), the idea here was to apply and test structural health monitoring technology on existing high-rise buildings, focusing on natural hazards such as earthquakes, high-speed winds, and thunderstorms. The availability of the Al Hamra Tower as a research site offered a significant advantage, given the building's unique design and iconic architechute.

To begin with, a variety of sensors were installed throughout the tower. These included accelerometers to measure vibrations, GPS sensors for movement tracking, wind sensors and thermal sensors. Data collected from these sensors were utilized as input for the computer model specially developed by the research team to analyze these data. The model was designed to help improve building designs before construction by understanding performance based on location-specific earthquake hazards and other movements.

But that was not all. As Dr. Kamal explained, "The purpose of structural health monitoring is to increase the safety of the building, improve building codes, provide early warning systems and develop a maintenance strategy for the future of these buildings." Structural health monitoring as part of the SKBE project and data collected therein were expected to have a four-fold impact on future buildings in Kuwait. One, improvements in building safety based on data analysis. Two, designing local building codes. Three, developing an early warning system. Four, building the framework for facility maintenance strategy of tall buildings.

A key outcome of this research was the development of robust building codes tailored to Kuwait's unique conditions. This was essential considering that the Kuwait 4th Master Plan proposes development of new cities and urban areas. Dr. Kamal says that because of the special local environmental conditions, Kuwait should have a local building code.




Gulf Conference on Sustainable Built Environment (GSBEKW-2019)

In addition to being a desert area near the sea, Kuwait lies close to the Zagros belt of earthquakes, which makes it vulnerable to seismic and other environmental activities that can damage its infrastructure—high-rise buildings, industrial buildings, bridges, etc.

Designers usually adapt the most suitable international building code, which may not fully account for local environmental factors, and hence, has to be customized. For example, the extreme temperature variations and high humidity in Kuwait could significantly impact building material performance as well as structural integrity. By using real-time data monitoring and analysis as well as advanced modeling, the research aims to address deficiencies in existing building codes formed on the basis of prevalent international building codes.

research also emphasizes the importance of structural health monitoring for building maintenance and lifecycle cost reduction. A data-driven approach facilitates the early detection of structural issues, enabling timely interventions and ensuring the building's integrity during future seismic, heat wave, and other environmental incidents. By providing early warning systems and detailed performance data, these technologies help to choose the appropriate construction material, design better maintenance strategies, and reduce the overall cost of building ownership. This approach benefits both government projects and private building owners, ensuring that buildings are not only safe but also economically sustainable.

In the context of the impact of the research on both government and private entities, the special role of Dr. Hasan Kamal must be noted because it transcends research. As an elected member of Kuwait's Municipal Council, he works to bridge the gap between research findings and policy implementation. His dual role also allows him to advocate for the incorporation of scientific insights into building regulations, thus enhancing the overall safety, resilience, and sustainability of Kuwait's built environment.

The SKBE project is a testament to the power of collaborative research and its impact on real-world applications. The project has already produced significant outcomes, including the Gulf Conference on Sustainable Built Environment in 2019 where findings were shared with regional experts and a book published detailing the research. These efforts underscore the importance of applying scientific research to practical challenges, ensuring that infrastructure development keeps pace with technological advancements.

Dr. Hasan Kamal states that by leveraging advanced technology and collaborative expertise, the research is not only enhancing building safety in Kuwait but also setting a new transformative standard for resilient and sustainable infrastructure development globally.

The research was initially meant for a five-year period. However, data collection continues to this day—even the 2023 earthquake in Turkey was captured by these sensors.

The insights obtained from the project are expected to facilitate the development of more resilient and sustainable cities and urban areas in Kuwait in the future.