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AL-TAQADDUM AL-ILMI

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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

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Director General

مؤسسة الكويت للتقدم العلمي
Kuwait Foundation for the Advancement of Sciences

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AL-TAQADDUM AL-ILMI

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aspd التقدم العلمي للنشر

Anthropology: The Science of Human Society

Anthropology has its roots in ancient Greek historical and philosophical writings on human society and its organizations initiated by the Greek historian Herodotus, who lived in the fourth century BC. Anthropology is the study of the human race through an interconnected network of natural, social and human sciences represented by the study of the evolution of human behavior and languages and the evolution of societies, past and present, in order to understand the diversity of human behavior and societies around the world.

This issue sheds light on some of the main areas that make up Anthropology, such as Cultural Anthropology, which encompasses studying all aspects of human culture such as language, religion, customs and traditions, values and norms, beliefs and rituals, remnants and other aspects that lead to the success of the merging process between civilizations. It depends on the ability of people to view cultural differences as a valuable opportunity to form a global human culture that reflects the values of world peace between civilizations. It also sheds light on Educational Anthropology, emerging from Cultural Anthropology, which is the study of educational phenomena and institutions of socialization in society.

This issue also deals with one of the most important branches of Anthropology, Linguistic Anthropology, which studies the composition of extinct (or endangered) and living human languages, and the importance of this science lies in the revelation of the relationship between the language of a people and the civilized aspects of its culture, considering language as a carrier of culture. It studies the mutual influence between language and various human social activities and practices and the role of language in shaping society and its culture. We also do not overlook Medical Anthropology and the relationship of folklore to diseases and illnesses on the one hand, and the overlap of Modern Anthropology, Genetics, Food and Diseases on the other hand. The rise of Modern Anthropology has also been associated with the emergence of Population Biology. Epidemics throughout the ages have undoubtedly affected the population movement, either by encouraging migrations away from the sources of the epidemic, or by limiting the movements of human groups and social communication, as in the COVID-19 pandemic.

The State of Kuwait has a share in Anthropology. This science is related to Archeology and Exploration of life and development of nations. It involves studying human cultures and their time divisions from the Stone, Copper, Iron and BC eras, and the interest in knowing the daily behaviors of human society and delving into the details of its political, social, artistic, economic and intellectual life. By tracking the temporal development and spatial spread of the archaeological finds. Archaeological evidence provided the existence of a system of trade exchange and transfer of products and raw materials between the people who lived on the island of Failaka and the Civilizations of Mesopotamia in the Bronze Age. There is currently wide Scientific Cooperation between the Archeology and Anthropology Laboratory at the College of Social Sciences at Kuwait University, the Polish Archaeological Mission, the Kuwait National Museum, and specialists from American and European universities to learn more about the Socio-Political, Economic and Lifestyle component of Failaka Island in the Neolithic period.

Finally, this issue will address Digital Anthropology, which is a modern science that emerged in 2012, that deals with the study of the relationship between human culture and the technologies of the digital age by analyzing human interaction with digital worlds in terms of devices, inventions, programs and applications, and how human behavior changes in parallel technological development and globalization.

Editor-in-Chief
Dr. Salam Ahmad Al-Ablani

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Kuwait Family Wins First Prize at the Technovation World Summit 2020

KFAS hosts the training sessions of the Artificial Intelligence Family Challenge, which led to a global winner

Sabah Almadani and her family

KFAS recently partnered with local associations and Technovation—a global, non-profit organization that sparks girls' and families' interests in coding and AI—to host training sessions about machine learning and artificial intelligence for Kuwaiti families. At the training, the Al Mohammad Ali family created an app to promote biodiversity and won first place for Technovation Families, Junior Division at the Technovation World Summit 2020.

The participating families were asked to use machine learning to solve a problem they see within their community. Worried about local endangered birds, the winning family ran a survey about environmental awareness and created Kuwait Birds Tracker: an app based on machine learning that identifies bird species and suggests how to protect the environment. This project was selected among six finalists out of 250 submissions in thirteen countries.

"Keeping the environment clean and healthy is one of our family goals," said Sabah Almadani, the mother of Fatemah (11), Abdul Hameed (9) and Abdul Allah Al Mohammad Ali (7). "During a family trip, we noticed some people tossing litter and harmful things at birds, so we decided to work on an AI project that raises public awareness of the environment and endangered species. We want to ensure that birds continue to visit and pass through Kuwait safely. I loved the idea of using artificial intelligence and machine learning to help my community."

This is the first Artificial Intelligence Family Challenge in Kuwait. The training took place between August 2019 and January 2020, and was delivered by mentors from Google Developers Group (GDG) and Women Techmakers Kuwait, in collaboration with AI4DevelopmentAgency (AIDA), kuwait.ai and Niu - Collaborative Community.

"GDG-WTM Kuwait City is a nonprofit organization that aims to spread knowledge and give support to the tech community in Kuwait. We hold free events and workshops to teach or introduce different tech topics," said engineer Abdulaziz Ahmed, GDG organizer and member of the volunteer training team, which included developer Samira Awad and Technovation mentor Elena Ardelean.

All finalists share a portion of nearly $30,000, which is intended to fund their education in STEM and/or bring their products to market. The Al Mohammad Ali family planned to use this prize for the Kuwait Institute for Scientific Research summer student training program, currently suspended due to COVID-19. They also took part in a TV show to raise awareness of biodiversity in Kuwait.

New Model Sheds Light on the Link Between Fasting Blood Sugar and COVID-19 Morbidity

Evidence from a Kuwaiti research team shows that elevated blood sugar could be a predictor of COVID-19 severity

Hamad Ali

A new study linking fasting blood glucose in COVID-19 patients to coronavirus severity and the risk of being admitted to the intensive care unit offers fresh insights using a new statistical modeling technique.

Conventionally, and according to the American Diabetes Association, patients are typically divided into three categories based on their fasting blood sugar levels: non-diabetic, pre-diabetic, and diabetic, which is both clinically and statistically convenient. "Clinically, if you have this value then you belong to this group and your management will depend on the three categories, such as changing your diet or starting an anti-diabetic drug," said Hamad Ali of the Health Sciences Center in Kuwait University. "Statistically, we have also been relying on these categories or the dichotomy of diabetic versus non-diabetic to ask questions like, 'what is the probability of severe COVID if you fall in either category?'"

While relying on this information, or this dichotomy, is intuitive for scientists and easy to interpret, it does come with "many strong assumptions that are not realistic and sometimes biologically implausible," said Ali. For instance, a small difference in the reading of fasting blood glucose level—as small as 0.1 mmol/L—might place a patient in a different category, with a different set of expected risks, and a different treatment plan.

Instead, Ali and his colleagues decided to follow another modelling approach when testing for fasting blood glucose as a predictor for COVID-19. "We [opted to] model the data from diabetic patients in Kuwait to track disease progression flexibly and let the biology determine the shape of the relationship," said Ali.

Using statistical techniques known as smoothing and penalized splines, which follow the data and not the investigator's prior assumptions about the patients or where they fall along the diabetes spectrum, the researchers arrived at an interesting—and rather enlightening—"dose-response" relationship, "without under- or over-fitting the data," according to Ali. "The results and the graphs show that there is a steep linearly high risk of severe COVID that increases for every unit increase in fasting blood glucose."

In other words, their statistical model showed that even a small incremental increase in the normal range of a patient's fasting blood sugar was associated with a substantial increase in risk of ICU admission if they are infected with COVID-19. "This argues for strict glucose management on admission and a continuously aggressive glucose control without being forced into the box of the three diabetes categories," said Ali.

Finally, Ali says that peers can use this statistical modeling approach employing different variables, not just blood glucose, to track disease progression; predictors such as age, BMI, waist circumference, cholesterol levels and blood pressure can also be inputted.

PHOTO: BANDELE ZUBERI

Streamlined Automation at the Commercial Bank of Kuwait

Skills learnt on the KFAS Innovation Challenge have brought automated self-service to the forefront of business at the Commercial Bank of Kuwait

The automated self-service machines at CBK

Since taking part in the KFAS Innovation Challenge in 2019, the Commercial Bank of Kuwait (CBK) has designed and rolled out more than 140 automated self-service machines across their branch network. This has made a significant difference to the efficiency of their processes and has transformed the banking experience for their customers.

"It is very important to put people at the center of our business to succeed in the competitive banking sector," said Khalil Al-Qattan, the previous head of Digital Transformation and Innovation at CBK. "Our customers were keen on the flexibility of 24/7 self-banking. Developing such a business model gave us the opportunity to restructure our workforce and place our skilled professionals in efficient and proactive roles, rather than having large numbers of tellers in branches."

The CBK challenge team began the program with the idea of prioritizing the automation of daily desired services using self-service machines. The pilot machines started out with just cheque and cash deposit features. Following feedback sessions with customers when the machines were introduced at CBK's head office, the service has been enriched to include multiple services, such as payments, account opening and video banking.

"After the challenge, our management noticed a significant change in performance between an automated branch and traditional ones," said Al-Qattan. "For customers, waiting times and human errors were reduced, resulting in a streamlined, reliable service."

The KFAS Innovation Challenge is held in collaboration with internationally renowned institutes to bring high quality, tailored learning experiences to the participants. When Al-Qattan attended the program, he was struck by the skills he learnt as a result of the sessions led by the Royal College of Art (RCA) in London.

"KFAS encouraged us to think outside the box through the alliance with the RCA by engaging the art of design into our business to come up with smart ideas," said Al-Qattan. "We were encouraged to explore all options with no limits. We learned that every organization is unique and has its own potential for growth, which helped us think of tailor-made solutions specific to our customers."

Following his enriching experience in the program, Al-Qattan learned to be more creative, agile in his approaches and to think critically. He strongly recommends the KFAS Innovation Challenge for others who want to build their skills and unleash their capabilities in the same way, "It is your chance to build and shape the future of your organisation with the support of management, and contribute to your community and your country as a whole."

Researchers at Dasman Diabetes Institute Participate in Research Published in Nature Journal

Abdullah Alkandari, the co-contributor to the study

A study by the NCD Risk Factor Collaboration, a group of health scientists around the world that publish global studies on obesity, diabetes, cholesterol, and blood pressure, was published in the journal Nature.

Monira Alarouj and Abdullah Alkandari, from one of KFAS' centers, Dasman Diabetes Institute (DDI), joined the collaboration and study titled, "Repositioning of the global epicentre of non-optimal cholesterol."

The cholesterol levels of over 100 million adults in 200 countries were analyzed in the study from 1980 to 2018. Alarouj, a consultant diabetologist, and Alkandari, a postdoctoral fellow, both at DDI, contributed local data to the study.

"We found that high cholesterol was responsible for almost four million deaths around the world and half of these deaths were in East, South, and Southeast Asia," said Alkandari. "The results of the study revealed total and non-HDL [what is considered "bad"] cholesterol levels had fallen sharply in high income nations, particularly those in Europe and North America, while rising in low - and middle -income nations, particularly in East and Southeast Asia."

The results, according to Alkandari, should encourage the governments of countries most affected to draw up policies that will promote healthy lifestyles that include eating well and exercising, as well as improve access to effective medications.

The reason behind the changes in cholesterol levels, according to Alkandari, is a combination of diet and medication.

In addition to diets changing in high-income western countries, people are also prescribed statin, a class of drugs that reduce total cholesterol levels in blood, he said.

"The use of statins isn't common in middle-income and lower-income countries," Alkandari said. "In east and southeast Asia there's been a rise in consumption of animal-sourced foods, refined carbohydrates and palm oil. This has contributed to the large increase in non-HDL cholesterol found in those countries."

In Kuwait, the levels of non-HDL cholesterol fell slightly in both women and men and Alkandari said this could also have been due to the increase of statin use.

KFAS' commitment to support science and foster a culture of research and innovation has paved the way for much of the scientific progress in Kuwait, according to Alkandari.

Our contribution to this study was possible due to KFAS financial backing and partnership," he said. "The support KFAS provides to researchers in Kuwait is invaluable."

More data is freely available here:

By Reham Alawadhi

PHOTO: ALI ALSHAMMARI

Fahd Al Mulla

Exploring the Link Between Genes, Diabetes and COVID-19 Outcomes

Fahd Al Mulla and his colleagues investigate what makes some cases of COVID-19 more severe

A striking feature of COVID-19 has been the variability in outcome, which ranges from silent infection in some patients to fatality in others, as well the 'long COVID' that afflicts some. This variability isn't surprising for a new disease rapidly spreading through a diverse population but understanding what underpins it would be invaluable in figuring out how to cope with the pandemic and mitigate its impact.

Although COVID-19 infections are more likely to be severe in older people, males, and those with underlying medical conditions, these factors alone do not account for the immense variability in outcomes. An international team of scientists hypothesized that the development of life-threatening COVID-19 might be linked with inborn mutations in immune-related genes in some patients. They established an international consortium known as the COVID Human Genetic Effort to test this hypothesis.

This idea has a natural appeal to genomics researcher Fahd Al Mulla of Dasman Diabetes Institute, who has always seen a clear link between diseases and malfunctioning molecules and molecular pathways in diseases. When he and his colleagues heard about the consortium, they were eager to join. "Real success happens in collaboration," he said. The consortium was keen to bring their expertise on board.

Over the past few years, Al Mulla has done significant work to improve the state of genomics data about the Kuwaiti population. To figure out which of the millions of genetic variations in each human genome might be linked to a condition—such as susceptibility to severe COVID-19—scientists use statistical analyses that detect correlations between rare variants and the condition they're studying. However, for this to work, the reference data has to reflect the diversity of human populations. Most genomics data come from people of European descent, but variants that are rare in those populations could be common elsewhere.

By sequencing the genomes of Kuwaitis, Al Mulla has been part of the global effort to redress that imbalance. Using a combination of microarrays and high-throughput sequencing, he has collected genomic data from healthy Kuwaitis and Kuwaitis with chronic health conditions, and the genome sequences are paired with well-characterized medical histories. Using these tools, he has investigated the genomics of cancer and diabetes in the Kuwaiti population, testing how well results from elsewhere can be applied locally.

"We need to study the variation in different populations," he said. "We need to study and understand ways to apply genomic medicine not just in US or Arab or Chinese populations but in all of them, and to do that we need a database that captures all the variation." Diversity in genomic data is especially important when looking for differences in the response to global diseases such as COVID-19.

The consortium analyzed data from 659 patients with life-threatening COVID-19, including people from Asia, Europe, Latin America and the Middle East. The researchers wanted to test whether life-threatening pneumonia from COVID-19 was associated with mutations in three immune genes that are known to be linked with life-threatening influenza pneumonia. They also included ten more loci which are directly connected to the three core genes and have been linked with other viral infections.

By comparing these genomes with those of 534 people with mild or asymptomatic COVID-19, the team identified 118 genetic variants that were more common in patients with severe COVID-19. Experiments showed that most had no significant effect on the function of the gene, but 24 had a deleterious effect. These variants were spread across eight of the thirteen loci tested, leading the researchers to conclude that defects in these genes make a person more likely to develop a severe case of COVID-19 if they get infected.

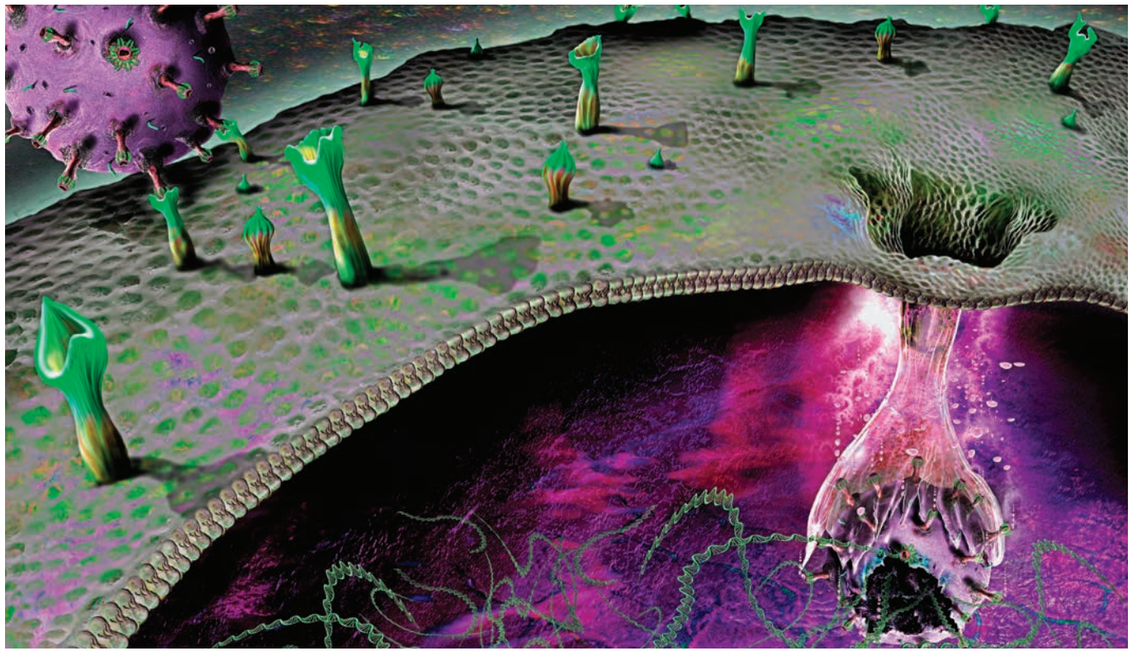
Next, the team tested cells from the patients with these genotypes to see how they would react to infection by SARS-CoV-2, the virus responsible for COVID-19. The patients tested had a mutation in one of the core genes, IRF7, and, as expected, their T-cells had low expression levels of this gene. When exposed to SARS-CoV-2, these cells fail to produce interferons, a type of signalling molecule released in response to viral infections to activate the immune system, and the mutant cells also had higher infection levels than healthy cells. These defects could be corrected by engineering the cells to express the wild type version of the gene.

The researchers found similar results in cells with a mutation in another gene, INAR1. While IRF7 is associated with both type I and type III interferons, changes in INAR1 only affect type I interferons. The researchers measured type I interferon levels in the blood of their patients and found that ten of them had very low levels during the acute phase of COVID-19. Altogether, these results point towards an important role for type I interferons in the response to COVID-19.

"What we realized is that many of the cases of severe COVID-19—people who are dying from the disease—are because of variation in the interferon genes which produces inefficient interferons," said Al Mulla. One implication of this is that administering type I interferons may be a valuable therapeutic tool in some COVID-19 patients.

Al Mulla is also interested in factors besides genetics that drive COVID-19 outcomes. Collaborating with Hamad Ali, his colleague at Dasman

PHOTO: ALI ALSHAMMARI



Coronavirus infecting human cell

Diabetes Institute, Al Mulla has been investigating the link between fasting blood glucose levels and COVID-19 severity. Hyperglycemic patients face a greater susceptibility to infections and complications in general, and diabetes is associated with an increased risk of severe COVID-19.

To date, analyses of the link between the two have incorporated blood glucose either as discrete categories (such as high or low based on a threshold) or as a linear variable. Both approaches are rough approximations that can obscure important information. The former introduces a dramatic change when glucose levels cross the threshold, while the latter treats all changes in blood glucose levels equivalently.

By fitting a smoothly varying curve to the relationship between blood glucose levels and ICU admittance from COVID-19, the new study captures nuances that were missed by earlier approaches. They showed that even a small increase within the normal range of fasting blood glucose was associated with a substantial increase in risk of ICU admission for COVID-19 patients. “This difference can’t be overlooked clinically, and it demonstrates the need to strictly monitor glucose levels upon admission,” said Ali.

The researchers hypothesized that the mechanism linking glucose levels with COVID-19 outcomes may change as glucose levels increase, shifting from energy metabolism affecting viral replication at low glucose levels to chronic inflammation disrupting the immune response at higher levels. Based on these analyses, Al Mulla and Ali, together with Mohamed Abu-farha and Thamer Alessa, have launched a clinical trial of the insulin sensitizer pioglitazone as a treatment for moderate or severe COVID-19.

The results so far are very promising, said Al Mulla, who is eager to see more people take part in the trial, “This is phenomenal progress in our fight against COVID-19. We are saving lives.”

For more

ILLUSTRATION: KEITH CHAMBERS / SCIENCE PHOTO LIBRARY

Towards More Sustainable Concrete

Advanced nanotech analysis helps reduce the environmental cost of concrete

For most people, the word 'nano-technology' probably conjures images of tiny robots or sci-fi gadgetry. But Ali Bumajdad, one of Kuwait's foremost nanotechnologists, has been using his knowledge to research and improve a much more commonplace material: concrete.

PHOTO: BANDELE ZUBERI

Bumajdad's work on concrete is part of his broader interest in environmental applications of nanotechnology. "One of the main applications of nanotechnology is the environment," he said. "Nanotechnology is actually the science of surface phenomena, and the most effective ways of solving environmental issues are connected with surface chemistry." For example, he has done research on purifying water and on developing a catalyst that can reduce toxic gases produced during petrochemical extraction and processing. In both cases, a key aspect of the technology was controlling porosity so the material would have the right pore size and configuration for the desired chemical reactions.

The concrete research project was conceived by Bumajdad's colleague Hasan Kamal, who came up with the idea during a sabbatical at MIT. The overall scope of the project is to improve the sustainability of Kuwait's built environment, and Bumajdad was recruited to approach concrete from a nanotech perspective, studying additives that could improve concrete production and durability.

Funded by KFAS, the project is a collaboration between Kuwait University, the Kuwait Institute for Scientific Research, and MIT. To follow the enormously complex reactions that happen as concrete is mixed, Bumajdad and his collaborators used facilities at some of the US national labs, such as Oak Ridge National Laboratory and the National Institute of Standards and Technology. "These are very, very prestigious, and it's hard to get to do research there," said Kunal Kupwade-Patil, an MIT researcher who collaborated with Bumajdad.

The idea of replacing some of the cement in concrete with additives such as volcanic ash is hardly new: ancient Romans used volcanic ash to make mortar, and it's already being used as a cement substitute. Bumajdad's team wanted to explore whether Kuwait could reduce the economic and environmental cost of concrete by using volcanic from the region. To do that, they had to test the suitability of regional volcanic ash—sourced from Saudi Arabia, where it is problematic waste—and characterize the mixing process so they could optimize the production and durability of the resulting concrete.

Aside from optimizing concrete production and durability, there is also a potential environmental impact to consider. "Producing the cement for concrete causes about 8% of CO_2 emissions in the world," said Kupwade-Patil. "If you can replace some of that cement with natural materials, you can reduce the CO_2 emissions and maybe even make the concrete stronger and more durable."

The collaboration paired Kupwade-Patil's knowledge of civil engineering materials with Bumajdad's expertise in chemistry and nanoscience. Together, they were able to provide an unprecedented view of how concrete forms and the reactions and characteristics that determine its material properties.

"When people see concrete, they see it only at a larger scale, like mixing. We wanted to shift this paradigm," said Kupwade-Patil. "We wanted to understand and characterize concrete at the nano scale or even below that—we went to the Angstrom scale—and we wanted to do it in real time. We mixed the paste and then tracked its evolution so we could characterize how a particular additive affected strength and durability."

The team used a mix of approaches to get a complete picture, said Bumajdad. "We studied the behavior at early stage using certain techniques and at later stage using different techniques. That's important, because sometimes you improve the behavior of early reactions, but you deteriorate the aging of the cement. So, we had to understand both time frames."

To start, the researchers needed to confirm that the Saudi volcanic ash had the right chemical composition to be used in concrete and that it didn't include too many toxic chemicals. Having ensured that it was usable and safe, the team carried out a series of experiments that revealed that

"We discovered that using finer volcanic ash—grinding it before use—led to concrete with better properties. It was denser and less porous

substituting volcanic ash for up to 20% of the cement still produced durable concrete. “Above that, we started getting degradation in the properties of the concrete,” said Bumajdad.

Supplementing the volcanic ash with a material known as silica fume pushed the gains further. Using 10% silica fume in the mixture meant they could go up to 30% volcanic ash and still get durable concrete. That would mean a 40% reduction in cement use, a significant gain. Adding another silica formulation, nanosilica, made the concrete denser. “That’s good,” said Bumajdad. “Denser means less porosity, which means better mechanical properties—stronger concrete.”

Silica fume and nanosilica aren’t readily available in Kuwait, so using them as an additive might not provide the economic and environmental benefits the project envisioned. Fortunately, the research revealed another path to similar improvements in concrete. “We discovered that using finer volcanic ash—grinding it before use—led to concrete with better properties. It was denser and less porous,” said Bumajdad. This also enabled them to boost the proportion of volcanic ash to 30% of the cement and still get durable concrete.

At the end of the project, the researchers organized a major conference at Kuwait University to present their findings. They also published a book through Springer reporting the conference proceedings. In addition to guiding Kuwait towards a more sustainable built environment, this research could also be used to improve concrete production elsewhere in the world. The formulations are specific to volcanic ash sourced in the region, but the research methods and protocols can be used to understand the dynamics and microstructures formed by other additives.

Bumajdad’s team also prepared a detailed report on their findings and presented it to the municipal authorities in Kuwait, together with the conference proceedings. “I hope they will consider it when making their decisions,” says Bumajdad. “They are the decision-makers, not us—we’re scientists.”

For more

Exploring New Breast Cancer Treatments

An improved understanding of a cancer-related gene could lead to new therapies or screening options

Saja Fakhraldeen did not expect to become an expert in cancer biology. She had planned to train as a surgeon after graduating from high school, but a fortuitous path led her to study at one of the best research institutes in the world and eventually make a discovery that could lead to novel breast cancer treatments. Now back in Kuwait, Fakhraldeen and a few other scientists are trying to establish a world-class, high-capacity laboratory, where she hopes to continue her cancer research.

The focus of Fakhraldeen's graduate research centered around a gene called CRD-BP, which is known to play a role in breast cancer. Historically, it was thought that the gene was only expressed in fetuses and tumors, but her research disproved this view and explained why CRD-BP expression had been missed in other tissues. Today, Fakhraldeen is hopeful that further work on CRD-BP might reveal new therapeutic targets.

Fakhraldeen's interest in cancer was sparked by chance at a lab in which she worked as an undergraduate. She joined a project that used a fluorescent readout to assess DNA damage in an engineered mouse model. "We realized that one of the strongest fluorescent readouts was in the pancreas," she said. "That gave us a very easy way of measuring our endpoint of interest, and that basically drew our attention to pancreatic cancer. That's where it all started."

Fakhraldeen was originally interested in medicine. "Coming out of high school, my sole interest was to become a surgeon," she said. Wait-listed for the Royal College of Surgeons in Ireland, she decided to go to MIT, where she had been accepted. "Literally the day I arrived at MIT, I got the acceptance letter to RCSI. But I was already in Cambridge, so I decided to stay there."

It was a fortunate decision. Fakhraldeen said the mentor she had at MIT, a graduate student at the lab where she worked, was a huge influence on her, opening her eyes to her potential and inspiring her to continue in academic research. Her decision to focus on CRD-BP during her graduate work resulted in part from discussions with her mentor, with whom she has maintained a strong friendship.

It was during her graduate career at the University of Wisconsin-Madison that Fakhraldeen worked on her CRD-BP research, which was partially funded by KFAS. CRD-BP is known to bind to RNA and regulate its stability, localization, and/or processing. Because it interacts with the RNAs of cancer-related genes, CRD-BP is an important player in cancer. Fakhraldeen's research showed that the CRD-BP gene encodes two versions of its protein, a short form and a long form. The antibodies which had been used to detect CRD-BP in earlier studies bind to a part of the protein that is missing in the short form. As a result, such reagents can only detect the long form, which is expressed in embryos and tumors. Using different reagents, Fakhraldeen showed that the short form of CRD-BP is expressed in healthy adult tissues.

The research also showed that CRD-BP expression levels are higher in breast tumors than in healthy tissues. Her findings not only correct a misunderstanding about CRD-BP expression but also point towards the possibility that the expression patterns of other proteins with similar characteristics—known as 'oncofetal' proteins—may have also been wrongly characterized.

However, the story does not end there. Fakhraldeen and her colleagues also showed that breast cancer cells lacking CRD-BP were not as good at proliferating and surviving as normal cancer cells. Putting CRD-BP back into these cells, whether the short or long form, restored survival patterns to the same extent.

Together, these results highlight the importance of CRD-BP in breast cancer. "It's too soon to tell, but if one of the targets that CRD-BP regulates is driving the progression or development of tumors, then that specific gene or protein can be investigated as a potential therapeutic target for breast cancer patients," said Fakhraldeen. "If not, then CRD-BP could still be useful for screening, especially if CRD-BP over-expression is shown to be associated with particularly poor prognoses or if CRD-BP over-expressing tumors are shown to be more responsive to particular treatments over others."

Part of the CRD-BP project involved working with a private company to develop a new purification system for molecular complexes made of RNA and proteins. The researchers used this to assemble a list of RNAs associated with CRD-BP and which could serve as targets for further research. "At the end of the day, I'm an engineer at heart, so I love developing new things and solving problems," said Fakhraldeen, who trained as a biological engineer. "If you can come up with a novel way to solve an existing problem and then you can find someone who can help you turn your concept into a tangible and versatile tool, that really is one of the best feelings ever."

That problem-solving spirit is a major element of Fakhraldeen's continuing interest in cancer biology. "I found cancer fascinating because of its broad applicability to almost any organ in the human body. As unfortunate as that fact is clinically, the uniqueness of every case presents a fascinating research problem that has puzzled scientists for a long time," she said. "There isn't a broad umbrella where once you understand the basic principles of cancer, you've solved the problem. If it was that easy, we'd already have a cure for cancer, and we don't. And the likelihood of finding any one cure for all of cancer is not necessarily going to be possible. What is more likely is the formation of tools that will allow for development of individualized treatments built on a case-by-case basis."

Fakhraldeen is also motivated by the enormous impact cancer has on people's lives, especially in Kuwait where cancer rates are very high, screening rates are low, and there is no active cancer research facility—all of which Fakhraldeen and her colleagues hope to address. "All those things make me want to work in this field, to do work that can have an impact on individuals in our society," she said. "Together with the challenges of understanding cancer at the molecular level and coping with its vast diversity, this work is never, ever boring."

For more

PHOTO: BANDELE ZUBERI

الاشتراك السنوي:

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