Qatar University Research Magazine

Issue no 8 - April 2017

POWERING UP: QU RESEARCH TO BOOST LI-ION BATTERIES

Hope for early diagnosis and treatment of male infertility

ExxonMobil, Dolphin Energy, QAPCO and Qatar Rail offer perspectives on relationship with QU

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QATAR UNIVERSITY ANNUAL RESEARCH FORUM 2017

RESEARCH BEYOND BOUNDARIES

May **3 & 4,** 2017
Research Complex, Qatar University

Message from the VP

Partnering to expand research reach

Prof Mariam Al-Maadeed

Vice President for Research and Graduate Studies
Qatar University

In the expanding world of innovations and knowledge, interactions and partnerships are necessary. In this direction, Qatar University is strengthening relations with more international institutions, including regional universities. Qatar University is an international university in terms of global research collaborations, with a total of 1,502 institutes worldwide collaborating with Qatar University from 2011 to 2016.

Last year we initiated the GCC-wide universities' research funding program to facilitate research and provide an easily accessible platform for research training .The program aims to build bridges and break barriers between institutions in the GCC, create a genuine market for GCC challenges, generate more research capabilities and expertise, and further enhance regional research networking.

We are aiming to achieve 'Research beyond Boundaries', the theme of the 2017 Qatar University Annual Research Forum & Exhibition which comes up soon.

The event will feature sessions on 'Future of Research in Qatar', 'Hand in Hand to Optimize Resources', and 'QU-Industry Partnerships - Highlights of Successful Stories'; in addition to Research Posters Gallery and an awards ceremony.

In a bid to protect the outcomes of our research endeavors, we have evolved an innovation strategy to create strong intellectual property infrastructure, guidelines and processes that would promote a culture of innovation in QU.

We are striving to build a formidable graduate community on campus with the strengthening and enhancement of our graduate offerings to foster interdisciplinary research across 34 graduate programs comprising 4 Diploma programs in Education, 25 Master's degree programs, 1 PharmD program, and 4 PhD programs with 15 areas of concentration.

In this issue of the Qatar University Research Magazine there are interesting reports of the successful outcomes of our research endeavors. The cover story is a project on developing Li-ion batteries with stable performances and energy density significantly higher than presently obtainable in devices.

As you flip through the pages you will be engaged with our other regular sections such as Research Issues, Interview with Researcher, Profile, Celebrating Excellence, Student in the Limelight, and News including Our Exclusive stories.

Qatar University
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News

QU, KSU sign MoU to promote research collaboration

QU Vice President for Research and Graduate Studies Prof Mariam Al-Maadeed signs agreement with KSU Vice President for Graduate Studies and Research Prof Ahmed Salim Al-Aameri

A Memorandum of Understanding (MoU) has been signed between Qatar University (QU) and King Saud University (KSU) to strengthen their existing relations and promote research collaboration among institutions in the GCC.

The agreement was signed by QU Vice President for Research and Graduate Studies Prof Mariam Al-Maadeed and KSU Vice President for Graduate Studies and Research Prof Ahmed Salim Al-Aameri in the presence of QU President Dr Hassan Al Derham, as well as officials from both institutions.

The agreement aims to build national human capital, and to strengthen links between researchers and develop research networks in the GCC.

The terms of the agreement include exchange of students and visiting scholars, and collaboration in the area of hosting visiting delegations. Both institutions will also cooperate in establishing joint research projects and cultural programs, as well as internship opportunities.

The agreement will contribute to strengthening the GCC-Wide Universities Funding Program initiated by QU and other universities in the region. The program aims to build bridges and break barriers between institutions in the GCC, create a genuine market for GCC grant challenges, generate more research capabilities and expertise within the GCC, and further enhance regional research networking.

Dr Hassan Al Derham highlighted the importance of the collaboration with KSU, which is one of the most prestigious universities in the region, especially in the field of research and community service.

He also expressed his hope to establish a joint Research Fund to support the research projects, which are conducted by researchers in the GCC.

Prof Mariam Al-Maadeed said: “This agreement will contribute to build trust and strengthen links between institutions in the region. It will also provide excellent research outcomes and resources to develop the national human capital towards building a knowledge-based economy.

“Cross national research projects can only be successfully undertaken when universities join hands and collaborate on such projects. The success of our research outcomes would be deepened when we compare notes and work with colleagues from universities in the region, especially when funding resources are pooled together.”

Prof Ahmed Salim Al-Aameri said: “Today, it is an honor for King Saud University as a comprehensive research university and the first higher education institution founded in the Kingdom of Saudi Arabia, to sign this substantial agreement, aiming at consolidating the joint collaborative relationship between KSU and QU.

“This MoU will document the closer partnership between the two countries and promote research and academic collaboration between the two distinguished institutions. The MoU will also facilitate the exchange of researchers and students and provide a platform to ease accessibility to graduate students in the GCC for the purpose of R&D training, capacity building and increase the number of outstanding researchers in the GCC countries.”

He added: “There is no doubt that universities in the GCC are the "think tank" and the main engine for conducting successful research and achieving sustainable development in the GCC.

“Therefore, these collaborative programs between the GCC universities will establish a strong research culture among university students, improve capacity building and increase the number of Gulf researchers.

“It will also integrate society and industry in the work of universities, and will provide stabile research funding in the GCC countries. These collaborative programs constitute a real opportunity and an urgent need to bond the GCC countries to achieve their developmental goals and overcome the obstacles and challenges they face in the transition to a knowledge-based economy.”

Biomedical Research Center is committed to work with all partners and national stakeholders to support Qatar in achieving a significant role in the interdisciplinary biomedical research that improves human health in Qatar and beyond.

Professor Asmaa Ali Jassim Al-Thani
Biomedical Research Center Director

The Environmental Science Center, the oldest national research entity, is ascending to a new benchmark in its long history of achievements, by conducting innovative research focusing on preserving the natural heritage of the country, and preparing young Qataris to be the future scholars in environment and sustainability.

Dr. Hamad Al-Saad Al-Kuwari
Director
Environmental Science Center

Our Exclusive

QU professor wins UK grant

Dr. Samer Ahmed

A project by Dr. Samer Ahmed, Associate Professor in the Department of Mechanical and Industrial Engineering, College of Engineering (CENG), Qatar University (QU), has been awarded the 2016 UK–Gulf Institutional Links grant funded by the British Council.

The grant is for the project titled: "A combined experimental and numerical investigation of ignition probability of turbulent inhomogeneous biogas-air mixtures".

Commenting on this achievement, CENG dean Dr Khalifa Al Khalifa said: "The research effort at CENG is addressing all the challenges facing Qatari environment and one of them is the utilization of renewable resources to generate power.

"This research project highlights the continuous efforts of the Qatari government to preserve the environment, in line with the pillars of Qatar National Vision 2030."

Dr. Ahmed said the project was conceived when one of the Qatari alumni, who is now a manager of the Waste Treatment Department at the Ministry of Municipality & Environment in Qatar, visited and discussed about environmental challenges at work.

"One of these challenges is that there is a huge production of biogas from the organic waste that pollutes the environment. At the same time, his department spends about QR 12 million annually on diesel fuel for the waste collection trucks.

"I offered to do a scientific project to study the ignition and combustion characteristics of the biogas in order for it to be used as fuel for the trucks instead of the diesel fuel," he said.

"The project is a scientific effort to save the environment in Qatar and the Waste Treatment Department will save the money spent on diesel fuel. In addition, biogas is renewable fuel that is produced from any organic waste; so there will be no issues with any future shortage in the supply of this fuel," he added.

Dr. Ahmed explained that with a key challenge of grand proportion faced by modern society being that of energy supply, and its inextricable link with environmental pollution, biogas has been identified as a renewable low pollution fuel and its applications in industry is becoming increasingly popular.

As its ignition characteristics are yet to be analyzed in detail, he said that the project would concentrate on a combined experimental and numerical investigations of ignition probability of turbulent inhomogeneous (i.e. not fully mixed) biogas-air mixtures. "The experimental investigation will utilize state-of-the-art laser diagnostics and optical techniques to measure the ignition probability and flame structure ensuing from localized forced ignition (e.g. spark). This analysis will be complemented by 3-D Direct Numerical Simulations (DNS) of inhomogeneous biogas-air mixtures. The DNS simulations will offer spatially and temporally resolved data which will provide fundamental physical insights into the parameters which affect the ignition probability. The computational findings will be validated with respect to experimental measurements," he explained further.

"Moreover, the experimental and computational data will be processed to assess existing ignition modelling. Based on this exercise, the most accurate models for the relevant quantities will be identified and new models will be proposed where necessary.

"A thorough understanding of the forced ignition process of turbulent inhomogeneous bio-gas air mixtures will contribute to the design of reliable ignition systems for automotive engine applications and for mitigation of fire and explosion."

Dr. Ahmed said the project would play a significant role in the effective usage of renewable biofuel, which will in turn have a considerable socio-economic impact for Qatar and the UK. It would also lay significant emphasis on the development of highly-skilled research associates who will contribute positively to both the society and economy of Qatar and the UK.

The number of proposals submitted for the grant from all Gulf countries was 172. Only eight projects were awarded as follows: two for Saudi Arabia, two for the UAE, one for Qatar, one for Bahrain, and one each for Kuwait and Oman.

Feature Story

POWERING UP: QU RESEARCH TO BOOST LI-ION BATTERIES

"WE PLAN TO SYSTEMATICALLY INVESTIGATE THE IMPACT OF ELECTROLYTE COMPOSITION ON THE CATHODE RATE PERFORMANCE, CAPACITY UTILIZATION AND CYCLE STABILITY FOR A BROADER RANGE OF CATHODE CHEMISTRIES."

Technology is steadily advancing. New innovations continuously emerge from the labs. Life changing gadgets evolve regularly. There are all manner of gadgets in use now and they must be powered to operate optimally. Researchers in Qatar University strive to keep abreast with the trend. A National Priorities Research Program (NPRP) project is focusing on developing Li-ion batteries with stable performances and energy density significantly higher than presently obtainable in the state-of-the art devices currently available. This has to be because the current progress in increasing the capacity of Li-ion batteries is limited to 2-3% per year and is slowing down.

This project is being driven by Dr. Nasr Bensalah, Professor of Chemistry in the College of Arts & Sciences, and his team members. It is based on the background that in order to maintain key advantages in the future global economy, through the use of modern technologies, improved high power energy storage systems are critically needed.

Members of Dr. Bensalah's project team in Qatar University are Dr. Dorra Turki, Research Associate, and Ms. Hanaa Dawood: Research Assistant. His external collaborators are Prof Gleb Yushin: from Georgia Institute of Technology, Atlanta, USA, and Dr. Khaled Saoud: of Virginia Commonwealth University at Qatar.

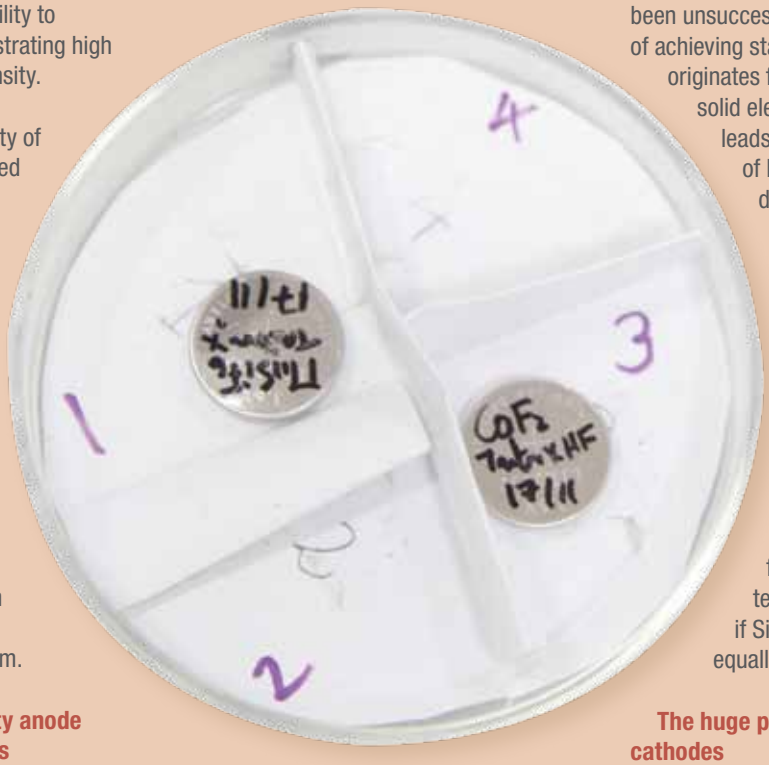
Lithium (Li) - ion batteries have proven to be one of the most effective forms of electrical energy storage devices. They are not only rechargeable, available in a variety of sizes and form factors and capable of storing significant amount of energy per unit weight and volume. They also have the ability to deliver this energy quickly; demonstrating high energy density and high power density.

Dr. Bensalah said the energy density of a Li-ion battery is largely determined by the volumetric capacity of its electrodes (cathodes and anodes). This implies that further improvements in the performance characteristics of Li-ion batteries are largely dependent on the ability to develop novel materials with greatly improved Li ion storage capacities. “Furthermore, it is critical that the cathode, anode and electrolyte utilized in a battery are compatible with each other and offer good stability when tested together in a fully functional Li-ion battery cell,” according to him.

Search for a stable high-capacity anode and potential of Si-based anodes

A stable high-capacity anode is required to push this important technology forward. Dr Bensalah explains that historically the Li-ion anode has been comprised of graphitic carbon. At full lithiation, graphite can intercalate one Li atom per six carbon atoms (LiC6) for a theoretical capacity of 372 mAh•g-1. The volumetric capacity of commercial graphite anodes is ~450 mAh•cc-1. The application of elements that electrochemically alloy with Li at room temperature offers an alternative solution to the high-capacity anode demand.

Si has received particular attention due to it having the highest gravimetric and volumetric capacities for Li and for being available at a low cost. The challenge of achieving stable performance in the Li alloying elements originates from the large volume changes occurring during the Li insertion/extraction processes. The Li-Si system can expand/contract during alloying/dealloying by as much as 300% by volume after forming Li15Si4 with a theoretical specific capacity of 3579 mAh•g-. These cyclical volume changes can generate stresses in the electrode material, forming cracks and reducing electrical conductivity.



In addition, conventional battery construction cannot accommodate electrode volume changes in excess of 6 - 8 %. To mitigate the detrimental effects of volume changes in Si, great efforts have been undertaken to produce nanocomposite electrodes consisting of a high capacity material and various types of carbon (C). Dr.Bensalah further explains that early Si-C composite electrodes were mostly fabricated by the decomposition of C- and Si-containing precursors or through high energy milling and mixing, and have not exhibited acceptable performance due to the limited porosity available for Si volume changes and non-uniform material properties at the nanoscale.

Recent work has demonstrated that significantly better performance could be achieved if the composite materials contain uniformly distributed Si, C, and interconnected pores. Furthermore, it has been demonstrated that both electrolyte and a binder may strongly affect the stability and coulombic efficiency (CE) of the Si-based anodes.

However, the high stability of Si-based anodes has only been achieved during electrochemical evaluation with a Li foil counter electrode with a virtually unlimited supply of Li. The attempts at making stable Li-ion batteries with Si-based anodes and any type of cathodes have been unsuccessful. The greatest challenge of achieving stable performance of Si-based originates from the poor stability of the solid electrolyte interphase (SEI), which leads to the continuous consumption of Li from the cathode and rapid degradation of full cells.

While the volumetric capacity of Si-based anodes may reach ~ 2000 mAh•cc-, the substitution of Si for graphite in the anode may offer only a ~ 40% improvement in the energy density of a full Li-ion battery cell if the same cathodes are utilized in its construction. The full potential of high capacity Si technology can only be achieved if Si anodes are matched with equally high capacity cathodes.

The huge potential of fluoride-based cathodes

Dr Bensalah believes the answer could be found in fluoride-based cathodes. “Fluoride-based cathodes offer an outstanding technological potential due to their very high volumetric capacities approaching ~ 2000 mAh•cc-1 and low cost. Surprisingly, only a few research groups have been primarily focused on and actively pursuing the development of fluoride-based cathodes. The achieved progress in both the fundamental understanding of the Li insertion/extraction process from metal fluorides and their performance stability has been quite promising.

However, additional experimental effort and diversification of the cathode formation approaches in order to investigate the effect of structural parameters of fluoride-based nanocomposites on their electrochemical performance in different electrolytes (in both half- and full- cell configurations) are greatly needed. This is in order to approach the commercialization of

this promising technology in a new generation of high-energy Li-ion battery cells. In contrast to the small structural and volume differences observed during insertion/extraction of Li into/out of cathode intercalation compounds, metal fluorides exhibit dramatic structural changes and significant volume changes accompanying cell cycling.

During Li insertion, a displacement / conversion process takes place, where Li displaces metals (Fig. 1), leading to the formation of LiF and metal clusters, typically only 1-5 nm in size. The size of these clusters could be related to the mobility of metals in intermediate reaction products. Due to the small diffusion distances between these thermodynamically stable structures, reversible Li insertion and extraction becomes feasible. Theoretically, the Li capacity of fluorides is determined by its stoichiometry and the density of the fluoride-forming metal according to:

$$XLI^{+} + xe^{-} + MF_{x} <-> xLif + M$$

Where M is a fluoride-forming metal.

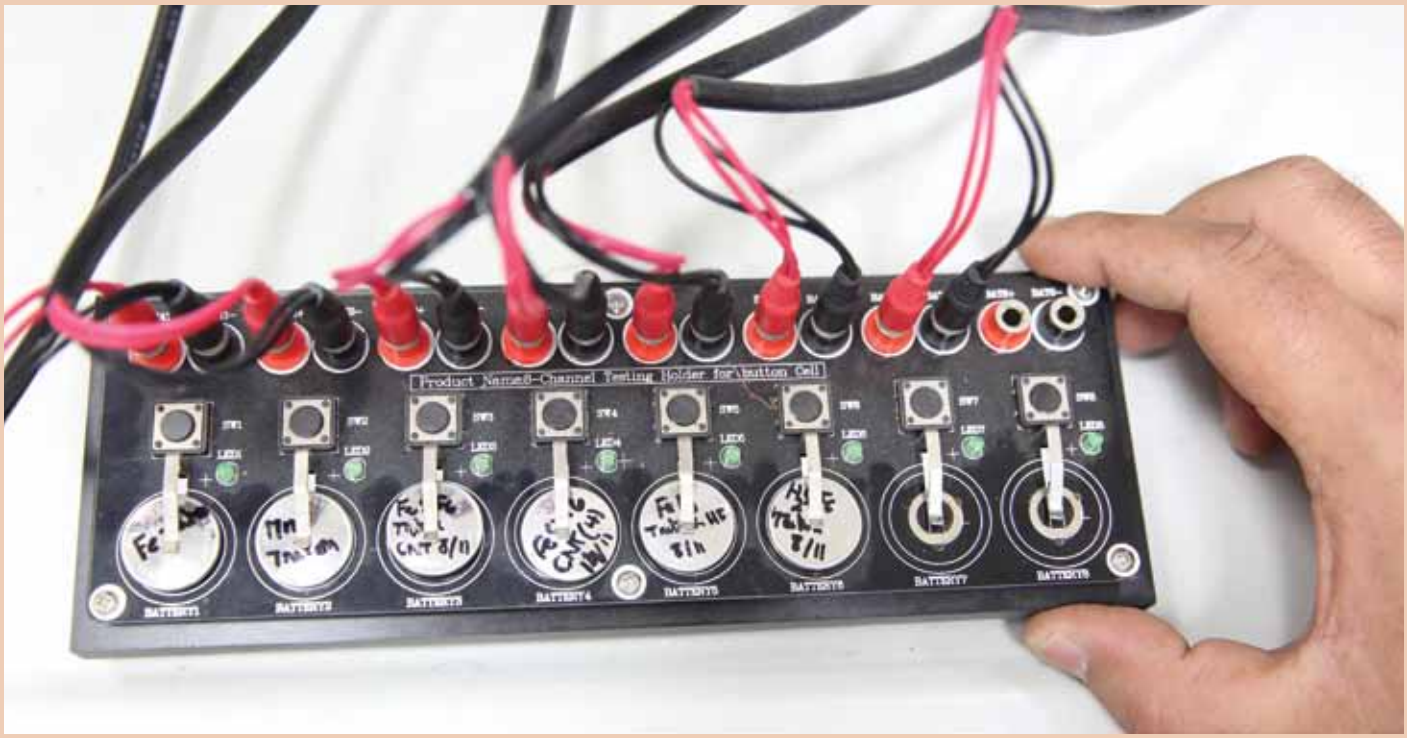
Most fluoride-based cathode materials have been produced via mechanochemical (high energy milling) synthesis routes. While this is a versatile, scalable and promising process, it does not allow sufficient uniformity and control over the microstructure of the produced materials at the nanoscale level, Dr. Bensalah said. "The architecture of the composites as well as the size and shape of their building blocks, the microstructure (structural ordering) of the individual components and their porosity are known to have a profound effect on the electrochemical stability and CE of Si-based nanocomposite anodes. One may expect somewhat similar effects in fluoride-based cathodes, which also undergo significant changes in the microstructure and volume upon insertion and contraction of Li."

Summarizing the scientific details, Dr. Bensalah said prior studies on high capacity Si-based anodes and fluoride-based cathodes in half cells indicated their promise for advancing the energy density of Li-ion batteries.

However, nearly all of the studies reported on both the high capacity Si anodes and high capacity fluoride-based anodes were performed in half cells. While high CE in half cells may indicate electrode stability in full cells, the undesirable and difficult-to-detect side reactions between the electrode and electrolyte may mask the low real values of the CE. He explains that only full cell performance is truly indicative of the stability and compatibility of both electrodes. "The optimal composition of the electrolyte may be different in full and half cells, because for stable half-cell performance, the electrolyte must also form a stable SEI on a Li foil surface. Such a requirement does not exist in full cells. While the chemistry of the polymer binder and its interaction with electrolyte salts and solvents was found to produce a major impact on the structural stability of Si anodes and the

> "The research would significantly advance Qatar's National Priorities Research Program (NPRP) strategic goals."

Dr. Nasr Bensalah with his team members



stability of the SEI on Si and other electrode materials, no studies of the effect of the binder coatings on the fluoride cathode stability have been performed. However, such impact is highly probable, as suggested by our preliminary results," he said. The application of alloying – type anodes (such as Si-based) and high voltage conversion-type cathodes (such as metal fluoride-based) allows one to increase the volumetric capacity of each electrode (Cv) up to ~1500 mAh•cc. However, both materials suffer from several shortcomings, which limit their stability. The most challenging one is the large volume and microstructural changes during insertion and extraction of Li. As a result, the stability of the investigated electrodes has been quite limited even in half cells, Dr. Bensalah and his team found out.

Central hypothesis

The central hypothesis of the project is that significantly better performance of Li-alloy anodes and Li-metal fluorides can be achieved with the nanostructured multi-component systems, where different metals offer synergetic performance enhancements by effectively mitigating the failure of both the materials and their corresponding SEI.

Key objectives

The project has three key objectives. First is that the research team would use a combinatorial approach that would allow the study of a wide range of Si-alloy combinations in thin films to reveal the effect of the composition of Si-containing alloys on their performance in half- and full cells. Thin nanostructured films of variable thickness and composition will be prepared by using magnetron sputtering technique with three (to achieve ternary compositions) separate targets. The films' composition and microstructure before and after electrochemical cycling will be systematically investigated.

Second is the use of similar combinatorial approach to study a wide range of metal fluoride- based cathode combinations in thin films to reveal the effect of the composition and microstructure on their performance in half- and full cells. Thin nanostructured films of variable thickness and composition will also be prepared by using magnetron sputtering technique.

Thirdly, the most promising compositions of both silicon-based anodes and fluoride-based cathodes will be utilized for the formation of nanostructured (e.g. such as shown in Fig. 2) particles with uniform structure and controlled pore volume using solution and vapor-deposition based methods developed by the investigators. The uniformly distributed pores in the composite particles are expected to accommodate the volume changes in the electrode materials during the battery operation and provide channels for the rapid access of electrolyte from the surface to the core of these particles. The carbon backbone will dramatically enhance electrical conductivity of the cathodes. These particles would be mixed with polymer solutions and formed into electrodes using tape casting techniques. The produced electrodes will be investigated in half- and full cells and their performance compared to that of thin films.

Expected contribution to science

In a practical sense, Dr Bensalah explains, the success of this project is expected to allow for a 100-200% increase in the energy density of Li-ion batteries. On a fundamental level, it will generate new knowledge and enhance the basic understanding of the complex interactions of Li with high capacity ternary alloys and fluorides exhibiting large volume changes. By harnessing the nano-scale interactions, the project would contribute to establishing new fundamental guidelines that are expected to facilitate the transformative design of novel ultra-high energy electrochemical energy storage devices.

What does the project mean for Qatar?

According to Dr Bensalah, the research would significantly advance the strategic goals of the

> A stable high-capacity anode is required to push this important technology forward."

National Priorities Research Program set by the Qatar National Research Fund (QNRF). It would accumulate valuable human capital and develop nanotechnology in Qatar. "The bulk of the research work will be carried out in Qatar. The students, faculty, and research staff who will work on the project will develop expertise in an area of importance to the world scientific community as well as within Qatar. These capabilities will remain in Qatar and provide continuing benefit to the nation in helping to solve problems that are critical to the country while bringing international recognition to the nation," Dr. Bensalah said. Li-ion batteries can be manufactured in light industry facilities; with no natural resources needed, it reflects the ease of relocation to Qatar. In addition, it can be considered as part of the technology-based economy/industry which depends mainly on skilled labor. Qatar is currently promoting such a technology-based economy, with emphasis on nanotechnology applications as outlined in the Qatar National Vision 2030.

One of the potential customers, now looking for these kinds of technologies may be Qatar Automotive Gateway which has a vision to build an industrial automotive cluster in Qatar by 2020, in line with the national vision of diversifying the economy and creating knowledge-based industries, and skilled jobs in Qatar.

What would success mean?

Dr Bensalah and his team say that the success of this project is expected to reveal: how and why the composition and microstructure of the specific nanostructured ternary Si-containing alloys and binary Fe-containing fluorides affect the structural stability of these materials, stability of their SEI and the rate of Li insertion and extraction into/from the active particles. The project will further reveal how electrolyte composition and electrochemical processes on both the cathodes and the anodes affect each other and at what particular composition and microstructure the investigated materials would offer the most favorable performance of full Li-ion battery cells. The expected results should provide internationally recognized information to propose a prototype battery based on selected electrode and electrolyte materials. All components will be structured, eventually at the nanometer scale, to enhance the performances in terms of cell potentials, reversible storage capacities and cycle life. A scale-up of the materials elaboration is also scheduled.

Possibilities for expansion

After passing the proof-of-concept stage, the research team aims to expand the study to reveal the impact of electrolytes, temperature and various surface coatings on the cell kinetics and degradation rate. According to Dr. Bensalah, "we further aim to optimize the microstructure of the produced composites to achieve high power and rapid charging capabilities, which are important for using such cells in electric vehicles and grid-scale applications."

Progress so far

He said the first task of the project included preliminary work that was achieved before the experimental phase started including the

Dr. Nasr Bensalah in the lab

safety plan, and installation of necessary equipment. This part took place mainly at Qatar University to establish an equipped laboratory for fabrication and testing coin-cell batteries. Battery testing equipment and materials were obtained from a reputable vendor (MTI Corp.) to meet a variety of test requirements including charge and discharge test under various temperature conditions, storage tests along with EIS and a variety of other battery testing specifications. These included equipment and devices to fabricate numerous test batteries.

Dr.Bensalah says that Qatar University and GT teams have been investigating the performance of FeF2, CoF2, NiF2, BiF2 and their mixtures. In order to avoid the potential impact of carbon additives and a polymer binder, some of the studies have been conducted by depositing metal fluorides directly on a Ni mesh current collector (as shown in Figure 3a and 3b, as an example).

While the achievable capacity is rather short of theoretical projections, very good cycle stability has been demonstrated in selected samples (Figure 3a). The project team explained that mixed metal fluorides have been studied as carbon composites, where higher capacity utilization have been demonstrated. Following previously developed electrode fabrication protocol; typical slurry was prepared by mixing the powder with a polyvinylidene fluoride binder in 1-Methyl-2-pyrrolidone solvent. The currently pre-optimized electrodes include 15 wt. % binder and aluminum foil or nickel foil current collectors. No conductive additives are needed due to high electrical conductivity of the carbon-containing composite powders. After casting, the electrode was dried in a vacuum at 100-150 ºC to evaporate the solvent as well as moisture residues.

> “We aim to achieve high power and rapid charging capabilities.”

“We have successfully demonstrated a positive impact of mixed fluoride formation in terms of achieving higher electrochemical stability of electrodes and reducing voltage hysteresis,” Dr. Bensalah said. Figure 4, for example, compares changes in the electrochemical charge-discharge profiles of pure CoF2 with that of the CoF2-NiF2 fluoride mixture, showing noticeably better electrochemical performance of the mixed fluoride. Figure 5 shows an example of high capacity utilization (theoretical capacity) and promising electrochemical stability achieved with CoF2-NiF2 (1:1) fluoride mixture.

Additional findings so far

The team has also initiated studies on the impact of Li salt concentration in ether-based electrolytes on electrochemical performance of metal fluoride materials. For example, Figure 6 shows that increasing salt concentration from 0.9M to 3.3-4 M solution noticeably increases electrochemical stability of the high energy density metal fluoride – lithium cells.

The Future

Dr Bensalah and his team plan to expand their studies and systematically investigate the impact of electrolyte composition on the cathode rate performance, capacity utilization and cycle stability for a broader range of cathode chemistries.

The College of Business and Economics was successful in recruiting high quality researchers that are active in producing knowledge. College research activities are aligned with Qatar National Research Strategy in contributing to knowledge-based economy and helping in developing high quality training opportunities that support the economic development of Qatar.

Dr. Khalid Shams Al-Abdulqader

Dean of College of Business & Economics

Our Exclusive

Environment and location will influence climate change, says Dr. Alatalo

Dr. Juha Alatalo

The impact of climate will be location-based. For example, the way it rains and how it rains will depend on where you are on the earth. You might get most of the precipitation as rain or snow. Climate change will also affect the seasonal patterns of rainfall.

"In general, you could say climate change will increase both the climate variability and extremes; for example getting more frequent and extreme heat waves. Places which have a lot of water might get a lot more rainfall. While places which are already dry will become dryer," said Dr. Juha Alatalo, Assistant Professor in the Department of Biological and Environmental Sciences, College of Arts and Sciences at Qatar University.

"It you are looking at Qatar, it means that in the future there will likely be longer periods of warm days, and extreme hot days will be more frequent. There will probably be less rainfall because it is already a dry area. So climate change will have severe impact on human wellbeing," he said.

Dr. Alatalo's research focuses on the impact of climate change on arctic and alpine regions, incorporating both above and below ground studies. In his project in Sweden he incorporated taxonomic experts on soil fauna, lichens and bryophytes, genetic analyses of fungi and bacterial communities, together with vascular plant data.

He said there have been very few studies that have species level data on such varied groups in the world, and that the project will allow us to better understand the linkage between above and below ground processes. Dr. Alatalo has one of the longest term climate change experiences in the world. It started in 1993 and there are very few long term experiences running anywhere in the world, he added. The combination of long-term warming experiments and species specific data make a unique combination.

On consensus about climate change, he said there are very few climate change skeptics. "You must remember that climate change or fluctuation in climate is natural. This happens all the time. We have had periods of cooling and warming throughout history. Usually there is quite long term of fluctuating patterns," Dr. Alatalo says.

One way to look at climate change, according to him, is through glaciers in the polar and alpine regions. "They have been expanding sometimes and decreasing sometimes; so this shows it's natural. It's driven by how the earth is tilting, natural emissions from volcano eruptions, and currents in oceans which play huge role in moving energy from warm regions to colder regions. All these have been happening over time. However, the present warming trend is due to emissions caused by human activities. In the future, lots of low lying lands will be threatened by the sea level rise, which is already happening. As a large portion of Qatar is low lying land, it will likely be negatively affected. The oceans are predicted to rise between one to two meters over the next hundred years. So Qatar will be affected," he said.

The College of Education contributes to the aspirations of QNV 2030 by providing excellence in research-led education; faculty and students are actively engaged in research that improves the quality of education throughout Qatar.

Dr. Ahmed Abdulrahman Al- Emadi
Dean of College of Education

Research Issues

Prof. Syed Javaid Zaidi
QAFAC Professorial Chair
Center for Advanced Materials
Qatar University

TRANSFORMING GHG CARBON DIOXIDE WASTE EMISSIONS INTO **VALUE-ADDED CHEMICALS AND FUELS**

GREENHOUSE GAS (GHG) CARBON DIOXIDE MITIGATION IS ONE OF THE MOST IMPORTANT SCIENTIFIC CHALLENGES OF OUR TIME. ONE PROMISING APPROACH FOR ADDRESSING THESE EMISSIONS IS CONVERTING WASTE CARBON DIOXIDE (CO_2) INTO INDUSTRIALLY RELEVANT CHEMICALS AND FUELS.

Thus, transformation of CO_2 into chemicals and fuels is a promising long-term objective as it could allow the preparation of fuels and chemicals from cheap and abundant carbon source and at the same time mitigate CO_2 emission. The main products of CO_2 conversion must be fuels to reduce emission significantly and create great economic value, although some of them (methanol, ethanol, etc.) could be considered in the double role of fuel and chemical. This approach would reduce the carbon footprint associated with the burning of fossil fuels, such as oil, gas and coal, provide new feedstocks for petrochemical production and generate revenue to contribute to economic growth.

Impact of GHG emissions

The consequences of global warming are the climate change patterns across the globe resulting in severe weather conditions, such as storms, hurricanes and drought in some countries, which have serious effects on the people's health and environment. Carbon dioxide is emitted from many industrial plants and processes but fossil fuels for power generation and the transportation industry are contributing the major share. It has been estimated that CO_2 alone contributes more than 70% to the total global warming caused by all the greenhouse gases.

If this trend of greenhouse gas emissions continues it would cause social and economic changes to the region and the whole world. According to a research study, carbon emissions in the Middle East and North Africa have doubled in the last 30 years, with oil-rich countries taking the lead. Although these countries represent a small percentage of global emissions but they lead in the emissions per capita with their people creating 2-10 times the amount of emissions of the average people. Qatar has the highest per capita emissions globally with 55.4 tons of carbon dioxide per person, about 10 times the global average. In the region, Qatar is followed by Kuwait, the UAE and Bahrain, which are ranked third, fourth and fifth in the world. Qatar is endeavoring to address its current and future emissions, and will need to embark on different programs that reduce emissions to appropriate levels for the whole country and develop solutions for the reduction and utilization of waste CO_2. The growing energy demand and consumption result in increasing CO_2 emissions. The main energy consumers in Qatar are the oil and gas sector, flaring, energy and water. With each kilogram of gasoline, natural gas and fuel oil burned, approximately two kilogram of CO_2 is emitted so higher consumption of fossil fuels leads to higher CO_2 emissions. In Qatar manufacturing and construction industries alone contribute to 32 percent CO_2 emissions while electricity production and transport contribute 35 percent CO_2 emissions. So, this problem of abundant waste CO_2 can be converted into an opportunity to exploit this waste into commercial commodity and contribute to economic growth.

CO_2 Conversion and Utilization

Carbon dioxide (CO_2) represents a potential source of C1 feedstock for the production of chemicals and fuels due to its abundant supply. Utilization and conversion of CO_2 to value added chemicals and fuels will help in decreasing the CO_2 footprint, which will help in controlling the worsening global warming problem.

Moreover, CO_2 has also been seen as a plentiful feedstock for the manufacture of many chemicals and transportation fuels such as methanol, dimethyl ether and their useful derivatives. Therefore, a lot of attention has been paid by the scientific community for its conversion into value added products.

It is believed that the reduction of carbon dioxide to useful petrochemical feedstocks and fuels would provide a sustainable solution to the growing emissions problems. In this context, carbon dioxide can be conveniently captured at point sources such as power plants, aluminum plants, fermentation units, chemical plants and cement plants and converted to value added products. From the safety aspects also, CO_2 is an ideal raw material. Carbon dioxide can be used as a reactant or co-feed in various non-catalytic chemical processes and heterogeneous or homogeneous catalytic processes.

Technological Solutions for CO_2 Reduction

Several technologies and processes can be used to convert and reduce waste CO_2 to value added products and fuels. They include dry reforming of CO_2 with natural gas, chemical reduction, electrochemical reduction, photochemical and photoelectrochemical reduction of CO_2 to various chemicals and feedstocks.

Most of these processes are subjects of research in the laboratory, and few processes have reached large-scale production. An array of chemicals can be manufactured from CO2 using these methods. It can be used as the whole molecule in reactions, and it can be used as a carbon source or as an oxygen source. The synthesis of urea from ammonia and carbon dioxide, and the production of salicylic acid from phenol and carbon dioxide are good examples of the large-scale production processes where CO_2 is utilized as a raw material.

Methanol can be produced from CO_2 hydrogenation and is one of the most widely suggested alternatives for chemical energy carrier. These are some of the possible ways to expand the utilization of carbon dioxide in chemical industry. Other than synthetic chemistry CO_2 can be directly used in applications such as carbonated beverages, firefighting, secondary oil recovery and supercritical extraction. The chemical recycling of CO_2 to produce carbon neutral renewable fuels and materials is considered as a feasible and powerful new approach that is at the stage of gradual development and implementation.

Pathways for CO_2 Reduction and Utilization

There are various pathways for the reduction and utilization of waste CO2 emissions, which include both physical and chemical processes. The physical utilization of carbon dioxide ranges from its application as a coolant and refrigerant to uses in fire extinguishers and cleaning processes to its use in the petroleum and natural gas industry for Enhanced Oil Recovery (EOR). The chemical utilization of CO_2 as a C1-building block in synthesis offers the possibility of incorporating it into products and materials.

Electrochemical reduction of CO_2 using abundant solar energy available in Qatar is an attractive alternative approach to produce fuels. Photochemical reduction of CO_2 is also one of the promising routes for CO_2 conversion due to the abundance and free access of sunlight available in Qatar.

Utilization of CO_2 for producing bulk chemicals, as well as increased utilization for manufacturing polymers and fine chemicals is aimed at using CO_2 as a carbon source for chemical production and generating value from a readily available free feedstock.

Various Pathways for CO_2 Reduction and Utilization

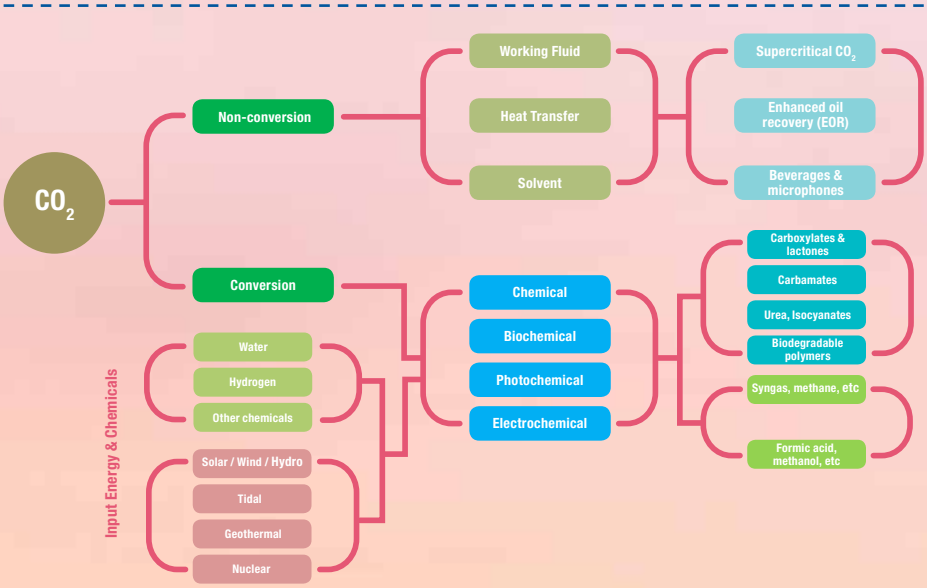
The development of innovative processes and technologies for the reduction of carbon dioxide is very much desired to solve the emissions problem. Several innovative technologies are on the verge of industrial realization. The options for chemically exploiting CO_2 vary with respect to the maturity of the technologies. With existing technologies, carbon dioxide is used as a raw material in numerous important chemical processes.

Currently, the most important applications are for the production of urea, methanol, cyclic carbonates and salicylic acid. There is a need for extensive R&D efforts and investment in research and innovation for the development, deployment and implementation of technologies and processes for CO_2 reduction and utilization suited for Qatar's industrial environment for the benefit of society.

CO_2 Utilization and Conversion Research at the Center for Advanced Materials

A research team led by Prof. Javaid Zaidi, QAFAC Chair at the Center for Advanced Materials (CAM), Qatar University is focusing on the design and development of advanced nanomaterials for CO_2 conversion at ambient conditions and fuel cell materials for clean energy conversion.

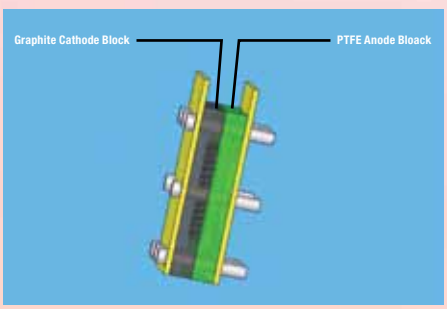
He recently developed novel materials for the solid-state electrochemical reduction of CO_2 to hydrocarbons (methanol and formaldehyde) at room temperature and designed and devised a new method: an electrochemical reactor device for solid-state electrochemical conversion of CO2 to value added chemicals based on the fuel cell experience. Two US patents were granted for this work in 2015 (US patent number 9,109,293 and 9,099,752).



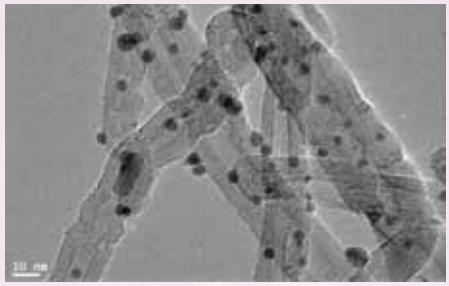
Electrochemical reduction of carbon dioxide

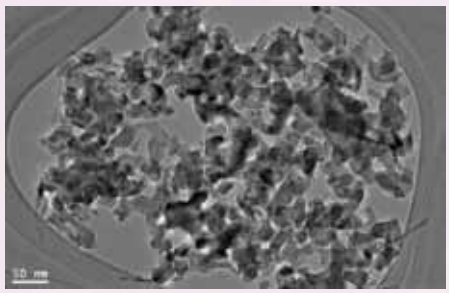
Electrochemical reduction of carbon dioxide (ERC) is one of the most promising methods for CO_2 mitigation because (A) it uses CO_2, a greenhouse gas, and water as feed, (B) it produces high economic value products like methanol, methane, ethylene, formic acid, and synthesis gas, (C) it operates at room temperature and pressure, and (D) it provides possibility of using renewable sources of energy for the process. The process requires electro-catalyst or cathode material to carry out the reaction at low over-potential and with high current density. Products of the ERC include formic acid, methanol, methane, ethylene and carbon monoxide with product distribution strongly dependent on the electro-catalyst and potential. This process is attractive because it can be carried out at room temperature and low pressure. However, to compete with alternative processes successfully, carbon dioxide reduction must take place at low potential with high efficiency and selectivity at high current densities.

A new device have been designed and developed for the electrochemical reduction of carbon dioxide. The new electrochemical device has been based on fuel cell designs and uses a polymer electrolyte membrane to separate the anode and cathode. In this invention CNT and TNT based nano-sized electro-catalyst are developed and used to produce hydrocarbons. This new invention provides a novel catalyst composition and process for the production of hydrocarbon (methanol, methane) from greenhouse gas, carbon dioxide which has negative economic value via electrochemical process. This is a non-noble metal catalyst which in turn is cheap compared to noble metal catalysts. This process provides a process with low temperature and normal pressure operation. A Faradaic efficiency of approx. 40% has been achieved for the conversion of CO_2 to methanol in this device, which is highest so far obtained for a solid-state electrochemical device.



Novel design of Electrochemical reactor for CO2 conversion





Design of Novel materials for Electrochemical CO_2 conversion

Photocatalytic conversion of CO_2

The research team at CAM is also working on the development of photo-catalysts for photocatalytic reduction of CO2 to organic compounds. Presently two undergraduate students and one researcher are working in the lab on a project for the photocatalytic conversion of CO2 to organic compounds. Photocatalytic CO2 conversion has been considered as one of the renewable technologies to obtain short chain hydrocarbons from CO2 reduction to solve the problem of clean energy as well as simultaneously protect the environment, “Hunting two birds with one stone in terms of saving the environment and supplying future energy”. CO_2 reduction is achieved as the oxidation state of carbon changes from +IV to +II, 0, -II and then -IV i.e., from CO_2 to formaldehyde, formic acid, methanol and methane respectively.

TiO2 has recently attracted attention as a wide-band-gap semiconductor material and has been frequently used in the fields of energy conversion because of its low cost, nontoxicity, relatively higher efficiency and excellent chemical stability. But, it suffers from drawbacks of fast electron-hole recombination and limited CO_2 adsorption. Besides appropriate metals and metal oxides, carbon materials such as graphitic carbon, carbon nanotube and graphene have also been applied in CO_2 conversion. Recently, layered materials like Hydrotalcite whose name is derived from its resemblance with talc and its high water content as one of the attracted material regarded as a good alternative to the traditional homogenous base catalysts.

The research team under his supervision is focusing on the design of visible light driven hydrotalcite based catalysts for CO_2 conversion. The main challenges of this research are i) Fabrication of the photo-catalyst with suitable conduction and valence band level by controlling the band structure with optical property ii) less charge recombination of electrons and holes via their spatial separation (iii) Performing CO_2 reduction at low potentials and iii) give out desirable end-products over a long period and the materials should be regenerated. Novel hydrotalcite based heterogeneous catalyst materials are designed and synthesized for reduction of CO_2 to valuable chemicals. These materials show high activity for CO_2 conversion.

Challenges for CO_2 utilization and conversion

The costs involved for CO_2 capture from a manufacturing process, its separation and purification from the gaseous mixture, and energy requirements for CO_2 conversion are some of the main challenges being faced for CO_2 utilization. Moreover, the amount of CO_2 has increased and will continue to increase. Thus, the need for the introduction of the new technology and the change of infrastructure are desired. The rate at which these new technologies would be developed is also an equally important issue compared to the development of these technologies. The important issue would be how to introduce new technology in a small scale and then get them to grow into widespread commercial use. No single new technology will solve the entire problem. There should be an emergence of a number of promising new technologies that could contribute to carbon dioxide emission reduction. All of them will have to overcome challenges of economics, performance, and associated environmental impacts. Performance, cost, safety, regulatory compliance, and low environmental impacts are some of the barriers identified to be able to make a new technology into widespread commercial use.

Introduction of new technology solutions require extensive research and development to identify the current barriers, as well as finding solutions that improve performance, cost, safety, environmental acceptability, and consumer acceptability. Research team at CAM is focusing to develop solutions to overcome some of the above challenges for effective CO_2 utilization and conversion.

News

QU, QF to strengthen their strategic and research collaboration

QU Vice President for Research and Graduate Studies Prof Mariam Al-Maadeed with Qatar Foundation Research and Development (QF R&D) Executive Vice President Dr Hamad Al-Ibrahim at the MoU signing event.

Qatar University (QU) and Qatar Foundation (QF) have signed a Memorandum of Understanding (MoU) to strengthen their existing strategic and research collaboration.

The agreement was signed by QU Vice President for Research and Graduate Studies Prof Mariam Al-Maadeed and Qatar Foundation Research and Development (QF R&D) Executive Vice President Dr Hamad Al-Ibrahim, in the presence of QU President Dr Hassan Al Derham, as well as other officials from both QU and QF.

Under the terms of the agreement, QF will collaborate with QU in the evaluation, protection, maintenance, commercialization and/or licensing of QU inventions, and provide periodic reports of all changes and Key Performance Indicators (KPIs).

QF will also collaborate with QU in its strategic planning in research tools and methods developed by QF R&D, such as pillar diagnostics, KPIs, portfolio analysis, and landscape and hotspot analysis.

As both institutions collaborate on creating a National Knowledge Management Information System, QU will provide QF with access to its database of research activities funded through direct funding, an overview of potential national and international collaborations, and research white spaces.

QU will also contribute to the analysis and development of policy frameworks and regulations.

The terms of the agreement also include collaboration on co-recruiting professional staff in the areas of intellectual property strategy and management, data analysis, and research and development policy development.

Commenting on the agreement, Prof Mariam Al-Maadeed said: “This agreement will serve to advance QU research, inventions and intellectual property rights, and to establish an information management system that will make research knowledge readily accessible by the community, industry and researchers.

“It also highlights QU’s continuous efforts to build collaborations and strategic partnerships with local and international institutions from the private and government sectors and to promoting quality education and research in Qatar and the region.”

Dr Hamad Al-Ibrahim said: “Collaboration between institutions and across sectors, allowing knowledge and expertise to be shared and resources to be maximized, is essential to advancing Qatar’s research and development enterprise, defining strategic direction, and creating tangible impact in the form of commercially-available innovations.

“Through this agreement, the methods and tools developed by QF R&D to support strategic planning and comprehensive research analysis will have wider application, for the benefit of Qatar, and potential new collaborations and avenues of research opportunity will open up.

This strengthening of the existing connection between QF R&D and QU will enable both parties to leverage each other’s capacity and intellectual infrastructure to enhance their contribution toward making Qatar a world-class hub of research and innovation.”

“We seek the consolidation of legal research, as well as developing the analytical and critical skills of future legal competencies; with the objective of supporting the legislative and regulatory movement and strengthening the principles and fundamentals of rule of law.”

Dr. Mohammed Abdulaziz Al-Khulaifi
Dean of College of Law

Student in the Limelight

Biomedical students, Rola and Zainab

contribute to knowledge about Major Depression (MD)

> “Dr. Rizk gave us faith in ourselves and our work. His positive and encouraging comments and points unlocked our potential.”
>
> - Rola Salem and Zainab Kabir

Most of us see depression as just a mood, a form of disappointment or a state an individual will simply get over in time. There is a lack of understanding that Major Depression is a severe illness. It is actually one of the most commonly encountered forms of psychological illness worldwide. Scientifically it has been determined as a complex multifactorial disease. Ground breaking research is underway at Qatar University (QU) and undergraduate students are being given the exciting chance to collaborate in producing it.

Two students of biomedical science at the College of Health Sciences, Rola Salam and Zainab Kabir, are co-producing professional standard research into the genetic factors involved in Major Depression among Qataris under the supervision of Dr. Nasser Rizk, an associate professor of Biomedical Sciences at QU.

The gene variants being tested have never been studied among Qataris or Arab populations making this research both novel and important. The project looked at genetic factors involved in Major Depression (MD) among patients in Qatar. Specifically the focus is on the association of Serotonin Transporter Gene Polymorphism (5-HTTLPR) and depression among Qatari Arab patients.

Rola Salem and Zainab Kabir

Rola and Zainab have been working and continue to work on MD patients in Qatar. They note that many studies have demonstrated an association between MD and genetic variations (5-HTTLPR and rs25531) in the serotonin transporter gene (SLC6A4) and that the results of their project will have a great influence and impact on the medical field in Qatar. Their research is helping to understand the nature of molecular genetics in psychiatric disorders among the Qatari population.

Additionally, they note, it could help to identify subjects at risk of developing depression and help to discover the role of genetic factors in depression among patients. This in turn may help in the future to implement new pharmacogenetic approaches for treating depression alongside potentially individualizing the drug therapy based on the genetic factors of patients.

The students noted that a study published by Dr. Taher Shaltout last year showed that among the three most common psychological disorders found in Qatar, MD had the highest rate (18.31%). They had the opportunity to work under the supervision of Dr. Rizk, an associate professor of biomedical sciences, who has more than 40 publications in different journals and his articles have been cited more than 300 times according to Google scholar.

Alongside working with Dr. Rizk, they also had the chance to work with Ms. Sumbul Bushra , a teaching assistant in Biomedical Sciences in the College of Health Science, who provided them with incredible support, help, guidance and encouragement during the project work.

Additionally, they would like to thank Dr. Abdulrahman Elgamal of Biomedical Sciences Department for helping them with lab work and senior lab technician Ms. Mooza Al-Khinji for her enormous support.

Rola and Zainab described their role within the project as encompassing all aspects of the research process, including; study preparation, samples and data collection, analysis and manuscript preparation. They were accountable for doing all the laboratory work (DNA extraction and genotyping procedure - including polymerase chain reaction (PCR) work, restriction fragment length polymorphism (RFLP) and gel electrophoresis).

Also, they were involved in the patient recruitment and sample collection process from the psychiatry hospital based on certain criteria beside the recruitment and screening of controls. They estimate that alongside their studies, they spent at least 20 hours weekly on this research.

They describe how their professional performance was greatly enhanced as a result of working with professional level supervisors and people in different clinical settings such as patients, nurses and physicians. Meeting personally with Dr. Rizk on a weekly basis was a great opportunity to enforce their sense of professionalism and responsibility.

He taught the students how to follow appropriate, ethical, and confidential matters when dealing with all study subjects and in all the steps involved in their project. They commented that “Dr. Rizk gave us faith in ourselves and our work. His positive and encouraging comments and points have unlocked our potential. Dr. Rizk has demonstrated a high level of quality both academically and personally.”

In respect to key findings, Rola and Zainab said that the project is still ongoing and they

> Exposure to the clinical ward and research labs in Qatar University gave us a sense of research habits."

are currently working to complete it. From the data collected so far, they found that there is no evidence of association between the polymorphisms of SLC6A4 and the occurrence of MD among a sample of Arab patients in Qatar. They recommend further study using a larger sample size, DNA sequencing of polymorphisms at 5-HTTLPR and exploring other SNPs in SERT gene in order to generalize the findings.

The young researchers described their personal impact on the study coming especially from their "passion, curiosity, initiation and hard work which helped us to accomplish this project in such short period of time."

They continued "at a personal level, Rola has excellent skills in oral and written communication and I'm (Zainab) good at graphics and making presentations. We think as beginner undergraduate researchers, these qualities had a good impact on our research.

"We are looking forward to sharing this research through publications and presentations at conferences and in journals. So far, we did poster presentation in two conferences at the World Congress on Undergraduate Research in Qatar University, and at the International Neuroscience and Biological Psychiatry Regional ISBS Conference "Stress and Behavior: Yokohama 2016" in Japan."

Rola and Zainab also shared their wishes for an impact beyond the project goals. They want their research to not only expand knowledge of genetic mutations in depression among Qatari populations but also draw attention to the importance of research in Qatar and encourage others to get more involved in future research projects. This they hope will help attract excellent students towards research careers and help the community solve Qatari problems in various areas of life.

Conducting research like this was challenging at times. "Yes, the project was difficult and challenging but really interesting at the same time," they said. Sample collection from the psychiatry hospital was especially hard. We were trying our best to explain our research in a simple way to the patients in order for them to voluntarily agree to join us and then collect their blood and data.

Additionally, it was really challenging during the laboratory work. Optimization of all experimental conditions in DNA extraction, polymerase chain reaction (PCR), restriction fragment length polymorphism (RFLP) and gel electrophoresis took about 2 weeks for each process to fully satisfy our goals and expectations. The facilities in QU made this possible as they commented that the "College of Health Sciences at Qatar University has modern, well-equipped laboratories that support research and graduate study activities.

Exposure to the clinical ward and research labs in Qatar University gave us a sense of research habits and the spirit of a research team. Simply, the College of Health Sciences at Qatar University offers a rich experimental atmosphere and support to conduct projects/studies."

The two young researchers explained that one of the best aspects of their project was that they were able to communicate with people in different environments and at different levels.

They mentioned that "we built a large network with faculty beyond the classroom and university. Additionally, we gained many fruitful skills and morals during this project. Personally, we learned how to be more responsible, confident, patient, and good time managers. For our personal career, the lab skills we obtained will help us a lot in the future. We are now able to withstand high workloads; can dare to challenge and able to think critically when facing any problem or when solving any dilemma."

Our Exclusive

Prof. Safieh-Garabedian on the nervous system, immune system and neuro degeneration

Prof. Bared Safieh-Garabedian

Prof. Bared Safieh-Garabedian of the College of Medicine at Qatar University is an expert in neuroimmunology, inflammation, pain and neurodegeneration, according to Google Scholar. He has been devoting his energy researching on the interactions between the nervous system and the immune system and the role they play in the functioning of the brain. With interest in the field starting at the beginning of his academic career, his works have greatly focused on neuro degeneration and neuro genesis. The result is a patent that has gone to clinical studies.

"When I started my academic career, I was interested in studying the interaction between the nervous system and the immune system which at that time was still a field in its infancy. During those years of researching into how the brain and the immune system communicate with one another, we discovered that these interactions are really important during inflammation.

"One aspect of it which we could measure was pain behavior. Subsequently, we studied those interactions. We realized that when it is uncontrolled, it results in pathological states, especially the difficult type of pain in the sense of treatment like neuropathic, chronic pain," he said during an interview.

So Prof. Safieh-Garabedian and his team based on their interest in studying inflammation in the brain, developed a model for studying conscious animal. He said the whole idea was to control inflammation by studying its impact in the brain, which is difficult to assess or measure.

"The hypothesis on which I am basing my research is how by controlling inflammation we can actually treat some pathological states like neuro degeneration. This is very problematic because it manifests in aging populations and as life expectancy increases the probability of neuro degeneration diseases also increases," he said during an interview. "The most common of these neurological disorders are Alzheimer's disease, Parkinson's disease and other neuro degenerative diseases. The whole area is big because there are many different aspects of these diseases."

Prof. Safieh-Garabedian and his team have developed a peptide which has proved to be very strong and able to control inflammation with a completely new mechanism of action. In a country like Qatar, he says, there is priority for such new therapies towards understanding how to treat neuro degenerative diseases. The burden of looking after the patients would be on the government, he said. His research is currently based on using models of inflammation to try to control the processes; targeting and disrupting them to see if such an approach could result in a new therapy, or new paradigm of treatment.

"We have a new approach. At the end of the day neuro degeneration involves death of brain cells. Brain cells die but we also know that brain cells regenerate through a process known as neuro genesis. We are working to link inflammation and neuro genesis because recent data show that these inflammatory processes can also inhibit neuro genesis in the brain. It's like a vicious circle and how to disrupt that circle is another aspect of our research," he adds.

In the last 20 years of his career, Prof. Safieh-Garabedian has been working with team members in various countries. Now, he is focusing on establishing a laboratory in the medical school at Qatar University. "My priority at the moment is to set up a laboratory, assemble a team and make it the center of my research," he says. Most of Prof. Safieh-Garabedian's results have been published. He presently has three medical students in his laboratory learning and getting exposed. "The students are really interested in what I am doing. That's why they chose to do research," he said.

We are aligned with the Qatar National Vision with our expertise at the Nano scale. Our current concern is water and how to purify it at this level.

Dr. Nasser Abdullah Alnuaimi
Director
Center for Advanced Materials

Interview with Researcher

Prof. Siham Yousuf AlQaradawi,
Professor of Organic Chemistry, Department of Chemistry & Earth Sciences, College of Arts & Sciences, Qatar University

I wish I could contribute to improving QU's ranking."

She has spent all her working life so far at Qatar University educating the younger generation, conducting research and contributing to knowledge. In the course of her work and to actualize her vision, Prof. Siham Yousuf AlQaradawi has set out goals. In the short term, she aspires to participate in prestigious international conferences and publish her research outcomes in highly ranked journals. On the long term, she expects to get a registered patent and build a state of the art nanomaterials lab that can accommodate lots of undergraduate research and faculty research projects. "In that case I will be helping in building capacity in the Qatari society," she says.

Researcher Profile

Prof. Siham Yousuf AlQaradawi is currently professor of organic chemistry at Qatar University. She received her undergraduate degree in chemistry with high honors from Qatar University in 1981 and her PhD from University of Reading, United Kingdom in 1992. She served as Dean for College of Arts & Sciences for five years. During her deanship, she guided the College towards a number of significant milestones such as the accreditation of the chemistry program by the Canadian Society of Chemistry and accreditation of the Biomedical program by the National Accrediting Agency for Clinical Laboratory Science (NAACLS) in addition to the establishment of the College of Pharmacy.

Prof. S. AlQaradawi received the prestigious William Fulbright Award as visiting scholar at Temple University, Pennsylvania, USA in 2010/2011 and the German Academic Exchange Service award (DAAD) in 2003. She is a member of several prominent associations and societies as: American Chemical Society (ACS) and Canadian Society for Chemistry (CSC) and a Fellow at the Royal Society of Chemistry (RSC).

Prof. S. AlQaradawi has received various competitive grants as principal investigator from the Qatar National Research Fund (QNRF), including five National Priorities Research Program fund (NPRP) and Undergraduate Research Experience Program (UREP) projects. Her research interest is mainly about carbon dioxide conversion, organic solar cells and lithium battery. She has authored over 35 peer-reviewed publications with many in leading in international journals. Currently, her Elsevier's Scopus h index is 11 with more than 500 total citations. Furthermore, she presented her research work in many national and international conferences and was an invited speaker in many symposia and conferences. She supervises many students, research assistants and postdoctoral fellows in her lab. She has acted as a reviewer for many chemistry journals such as Journal of Molecular Structure, Journal of Molecular Liquids and Journal of Spectrochimica Acta.

Prof. S. AlQaradawi has been teaching at Qatar University for over 35 years. She has contributed immensely in the academic and professional development of QU students. She has taught several organic chemistry courses, including photochemistry and research projects.

Do you see research and innovation in your field lasting into the future? What are the prospects?

Yes, my research is mainly in the area of carbon dioxide emission, which is a great challenge. Given the fact that Qatar has the highest world carbon dioxide (CO_2) emission per capita and the adverse environmental effects of CO_2 as a greenhouse gas as well as the need for fuels derived from renewable energy sources, there is an immense need to discover and implement technologies that enable the capture and conversion of CO_2 into fuel, which could help alleviate the environmental issue and turn this cheap and common feedstock into valuable source of energy.

My research is aimed at an efficient use of sun light to drive the conversion of CO_2 into fuel molecules through the development of excellent CO_2 reduction photocatalysts based on abundant and cheap materials in the nanoscale. This will involve the design synthesis, characterization and testing of these photocatalysts.

Under the proposed work, our goal will not only be to achieve excellence in the academic world but also to provide insights towards the solutions to technological applications in the real world. We aim at the design of a prototype system for the CO_2 conversion into useful fuels

What do you like most about your current job? What are the challenges? Which of your projects tickles your interest most?

My key responsibility is teaching; specifically undergraduate students. I believe that teaching provides an opportunity for continual learning and growth. One of my hopes as an educator is to introduce a love of learning to my students, as I share my passion for learning with them.

I believe that the teacher's role is to guide and to provide access to information rather than acting as the primary source of information. If the students' search for the knowledge they will learn how to find answers to their questions.

Actually, my ultimate goal is to teach my students what's behind the theoretical lectures; to connect them with the real-world problems where they implement the theory to get the final applied result. Moreover, I am always trying to promote students' interest in scientific research.

However, there are lots of challenges in going to this approach as there is a specific syllabus and I need to finish it during the semester. In addition, the research space and facilities are very limited.

Furthermore, the current approach in teaching is the student-centred approach. In this case, we have to create many activities to involve the students in teaching and learning.

Does your work have correlation with the objectives of Qatar National Vision 2030?

Yes, my research is totally matching with the Fourth Pillar in Qatar National Vision (QNV) 2030 – the Environmental Development Pillar. "As the State of Qatar seeks to preserve and protect its environment; accordingly, development will be carried out with balancing the needs of economic growth and social development with the conditions for environmental protection. Dealing with the anticipated changes will require coordinating efforts to tackle problems that arise."

As Qatar is one of the largest natural gas producers, the severe adverse effects resulting from the combustion of natural gas made Qatar to have the highest world carbon dioxide (CO_2) emission per capita. To this end, the direct solar energy conversion to storable fuels offers a promising route toward less reliance on fossil fuels.

The aim of my research is to design assemblies that can achieve high photoconversion efficiencies. The generated energy can be directly utilized or stored in the form of chemical energy which will play a key role in protecting our environment. My research may lead to major technological advances in solar energy with major impacts on Qatar.

What major breakthroughs have you achieved since joining QU? What major assignments have you handled?

I joined QU in September 1977 as undergraduate student. Therefore, I can summarize my achievements as follows: Graduating with excellent grade in 1981 when I received the first place at the College of Science level and the second at QU level in the fifth batch. I went on to obtain my PhD from a very good University in the United Kingdom.

I received the prestigious William Fulbright Award as Visiting Scholar at Temple University, Pennsylvania, USA in 2010/2011.

"My goal is to build a state of the art nanomaterials lab that can accommodate lots of undergraduate and faculty research projects."

I had earlier received the German Academic Exchange Service Award (DAAD) in 2003.

During my tenure as Dean of College of Arts & Sciences, I initiated the setting up of the College of Pharmacy.

Accreditation for the chemistry program from the Canadian Society for Chemistry was achieved during my tenure. I have been awarded five National Priorities Research program (NPRP) research grants worth more than five million US dollars from Qatar National Research Fund (QNRF). I have published more than 35 academic papers in high impact factor journals.

Looking ahead, what are your future ambitions and expectations?

I am planning to apply for the exceptional NPRP and some international funds. Also one of my dreams is to get patent and to publish in Nature or Science so I can contribute to enhancing QU ranking. Moreover, I would like to apply to some prestigious Prizes.

How were you motivated to go into your choice of career?

I liked chemistry from the first class in the secondary school. So I decided to study chemistry in the university; although several friends advised me to go to the medical school, but my interest was chemistry.

My father always encouraged us to study any subject that we could be innovative in the area even if our choice was home economics or Islamic fashion design.

What contributions or impact have your research been making to the Qatar society?

I hope my research can help in minimizing the carbon dioxide amount in the atmosphere as the increased levels of greenhouse gases in the air because of burning the fuels have resulted in global warming and climate change.

Qatar, which has the highest GDP per capita in the world, is ranked first in the world for CO_2 emissions per capita. Therefore, in order to build a sustainable future, we should invest in renewable energy production and its storage, which would decrease CO_2 emissions and contribute substantially to the Qatar economy.

My specific aims are to convert CO_2 into other useful gases and the second aim is to shift from fuel powered vehicles to electric vehicles which will help also in the reduction of CO_2 levels in the air.

In addition, other air pollutants such as SOx, NOx from the exhaust of internal combustion engines can be eliminated and help in the improvement of the quality of air. The electric vehicles powered by batteries can help to overcome the severe air pollution experienced in many cities of the world including Qatar's capital.

It is worth mentioning that most of this research has been conducted by five post-docs over the years. They have been so dedicated despite lots of difficulties and challenges,

Our Exclusive

QU steps up on intellectual property, innovation

Dr. Husam Younes

Qatar University (QU) has ramped up its drive to safeguard intellectual property and promote innovation with the creation of the Innovation & Intellectual Property Office which functions under the Research Planning & Development Office within the Office of the Vice President for Research & Graduate Studies.

Its major role is to create an innovation ecosystem and support the exchange of knowledge and technology between Qatar University, industry and other government entities. The office provides information and inspirational activities, guidance and advice on issues relating to utilization of research, innovation and entrepreneurship.

It will as well create awareness about the importance of intellectual property, patenting and innovation in the service of society and government.

According to Dr. Husam Younes, Director of Research Planning & Development, one of the objectives of the current QU innovation strategy is to create strong intellectual property infrastructure, guidelines and processes at Qatar University and "foster a culture of innovation and embed it within the scholastic fabric of the university."

He said the Research Planning & Development Office established the Innovation and Intellectual Property Office to handle commercialization processes, revamp and streamline all the relevant policies and procedures; and in so doing promote and spread Intellectual property awareness.

In furtherance of this, the office in collaboration with internal and external parties organized a two-day event on April 26 and 27 to celebrate the World Intellectual Property Organization (WIPO) Day under the theme: Innovation – Improving Lives.

The event was held in conjunction with the College of Law and College of Business and Economics at QU, Ministry of Economy & Commerce, Qatar Scientific Club and the IP and Technology Transfer office of Qatar Foundation.

The World Intellectual Property Day is observed every April 26. The occasion is used to learn about the role that intellectual property rights (patents, trademarks, industrial designs, copyright) play in encouraging innovation and creativity.

This year, the focus was on how innovation is making our lives healthier, safer, and more comfortable, turning problems into progress.

It explored how the intellectual property system supports innovation by attracting investment, rewarding creators, encouraging them to develop their ideas, and ensuring that their new knowledge is freely available so that tomorrow's innovators can build on today's new technology.

News

QU, QEWC to collaborate on water treatment and related technologies

Prof. Mariam Al-Maadeed and Mr. Fahad Bin Hamad Almohannadi at the MoU signing event

Qatar Minister of Energy and Industry H.E. Dr Mohammed Bin Saleh Al-Sada honored the signing ceremony of a research memorandum of understanding (MoU) between Qatar University (QU) and Qatar Electricity and Water Company (QEWC).

The MoU was signed by QU VP for Research and Graduate Studies Prof Mariam Al-Maadeed and QEWC General Manager and Managing Director Mr Fahad Bin Hamad Almohannadi, in the presence of H.E. Dr Mohammed Bin Saleh Al-Sada, QU President Dr Hassan Al Derham, QU VP for Academic Affairs Dr Hassan Alfadala, QU Center for Advanced Materials Director Dr Nasser Abdullah Alnuaimi, QEWC Chief Executive Officer-Ras Abu Fontas Mr Abdul Rahman M Nasrallah, QEWC Business Development Director Mr Abdul Sattar Mohammed R Al-Rasheed, QEWC Finance Manager Mr Jimmy Chung, QEWC Executive Officer - Events and Activities Mr Mohammed Saad Almohannadi, and QEWC Public Relations Coordinator Mr Mohammed El-Tayeb, as well as QU officials, faculty and staff.

The MoU aims to establish collaboration between QU and QEWC in the field of water treatment and related technologies.

In the terms of the MoU, QU and QEWC will collaborate on building a knowledge base for seawater desalination and on developing a membrane based water purification such as Reverse Osmosis (RO). Both institutions will also cooperate on building local capabilities in the field of water treatment and on promoting research and innovation in the drinking water sector and related activities.

Other areas of collaboration include the development of training programs and the transfer and implementation of technology for water purification.

Commenting on the MoU, H.E. Dr Mohammed Bin Saleh Al-Sada said: "This MoU has a special importance as it underlines the collaboration between Qatar University and Qatar Electricity and Water Company. Both are national and prestigious institutions that complement each other.

Qatar Electricity and Water Company provides electricity and water which are the two essential components of life and social development, while Qatar University is a key partner in the field of education and research in Qatar.

This MoU aligns with Qatar University's research strategy and contributes to building partnership between the University and Qatar Electricity and Water Company in various research areas."

Dr Hassan Al Derham said: "This MoU contributes to promoting sustainable development and water security in Qatar and to building national research capacities in the field of energy and water.

In this context, Qatar University continues in its efforts to strengthen links with industry in line with the national research priorities. I would like to thank Qatar Electricity and Water Company for its trust in Qatar University and we look forward to the outcomes that will emerge from this collaboration."

Mr Fahad Bin Hamad Almohannadi said: "The development of a membrane based water purification such as Reverse Osmosis (RO) is a new technology used in Qatar and we need partners such as Qatar University to promote research in this field."

The Office of Research Support (Grants and Contracts) serves as an effective intermediary between faculty and research funding. We help in research proposal submission and in identifying funding opportunities through working closely with funding agencies, industry, government and international partners.

Dr. Aiman Erbad
Director of Research Support

News

QU launches Pharmacy Postgraduate Society

Pharmacy Postgraduate Society executive members with QU faculty

The Office of Graduate Studies at Qatar University (QU) launched the Pharmacy Postgraduate Society (PPS) at a ceremony recently held at the Research Complex. The event was attended by QU Vice President for Research and Graduate Studies Prof Mariam Al-Maadeed, QU College of Pharmacy (CPH) Dean Dr Mohammad Diab, and Acting Dean for the Office of Graduate Studies at QU Dr Ahmed Elzatahry, as well as QU officials, faculty and students. The program featured an informative panel discussion chaired by CPH Assistant Professor Dr Daoud Al-Badriyeh, and presented by CPH Dean Dr Mohammad Diab, CPH Associate Dean for Research and Graduate Studies Dr Feras Alali, PharmD alumni Dr Sara Hayder and senior MSc student Loulia Bader. Discussions focused on CPH's experience throughout the processes involved with the establishment of the Pharmacy Postgraduate Society. It also included presentations delivered by CPH Assistant Dean for Student Affairs Dr Alla El-Awaisi and PPS President Ms Dina Abushanab. They respectively highlighted the leadership and commitment exemplified by PPS founding executive members and the various steps that were undertaken to establish the Society. The event followed a graduate student workshop on "Thesis/Dissertation Submission and Approval" organized by the Graduate Academic Support Unit at the Office of Graduate Studies and delivered by QU Graduate Advisor Dr Mary El-Mereedi.

Prof Al-Maadeed noted that the Pharmacy Postgraduate Society, the first of its kind on campus, represents the interests and concerns of postgraduate students at the local and international levels. "The society aims to support postgraduate students to achieve the highest academic standards and to promote a competitive and productive learning environment among students through a diversity of programs and activities", she said, adding, "Its mission is to represent the views of its members, to enrich the lives of postgraduate students, and to advance their interests academically, culturally, and socially."

Dr Mohammad Diab said: "QU College of Pharmacy supports The Pharmacy Postgraduate Society (PPS) and is dedicated to fostering a mutually beneficial relationship in research and academia. The Pharmacy Postgraduate Society is evidence of Qatar University's alignment with Qatar National Vision 2030 and Qatar's national research priorities. It reflects the institution's commitment towards empowering its students to achieve optimal results by offering them supportive opportunities and resources that enable them to advance their research interests."

Ms Dina Abushanab said: "We have put a lot into this endeavor, and we are very proud of the outcome; furthermore, we hope to collaborate with graduate students in other colleges to share this success story." Dr Elzatahry said: "The graduate student voice is a welcome addition to the QU community. PPS represents the collective voice of graduate students in the college and it will serve as a powerful example for graduate students in other programs as well."

At the College of Medicine, our faculty are actively engaged in research. Developing a mindset of critical inquiry lies at the core of our education system; our students are encouraged to become lifelong learners and even researchers who seek continuous development and work to address the community's needs.

Prof Egon Toft
Vice President for Medical and Health Sciences
Dean of College of Medicine

Profile

Name:
Aisha Al Saygh

Major:
Master of Material Science and Technology program

Occupation:
Master student at Qatar University. I work at Qatar petroleum as safety officer in quality laboratories.

Since I began working in the lab **I've not thought of leaving** - Aisha Al Saygh

What are the major influences that have affected your academic background and research?

My background is chemistry. For my undergraduate studies I worked on polymer nanocomposites. I like the field of improving materials, fabricating and using them for applications. I have also worked in the refinery.

I am interested in looking at new materials to prevent corrosion and also to improve mechanical properties.

After working in industry I decided to continue with my studies.

What practical experience did you gain in industry?

I work in a laboratory and we have been doing some practical experiments that are related to my studies.

Is your master's program related to your work?

It is related but not exactly the same.


CAM
Center for Advanced Materials
جامعة قطر
QATAR UNIVERSITY

“I like to work in the lab and I developed new electronic nose.”

Do you think within your field research and innovation will last into the future?

Yes, because research helps us to improve and to discover new things. For example, in industry we need to prevent pipelines from corrosion by adding corrosion inhibitors and by coating. We studied this in the material science program and we have been research on it.

I am working to make a pressure sensor and vapor sensor to detect hazardous vapors. So I can use this material in the future in my work.

Can it improve sustainability?

Yes it is sustainable as it saves energy.

What are the possible future benefits?

For example, in industry corrosion can be a problem and my research can help with this.

What is a typical day like for you in your research lab or research space?

I like working in the laboratory and that is why I choose to work in the environment. I also study in the laboratory. The whole day I am in the lab. I derive pleasure and satisfaction from working with materials and equipment. I like to know how the equipment works as I conduct my research. When I enter the lab I feel like discovering new things. I meet with different people to see how they conduct their work. I like to see what other people are working on too.

Currently, I am preparing my samples for my graduation project. The project is about fabrication of novel pressure sensors with good mechanical properties from polymer nanocomposite.

We found out that this material can detect vapors that can be used as electronic nose. This project is supervised by Prof. Mariam Al Maadeed.

Have you been involved in any major projects?

As an undergraduate I was involved in a study that was also about materials. It was about how to make nanocomposite material; creating composite of polymers with clay to make wells for petroleum and other similar things. This was the first project. Then after this I also worked on a European project with Dr Khalid Al-Saad.

After I graduated I began work on my current thesis and practical work with Prof. Mariam Al Maadeed. During this work I wrote a paper that is in the process of being published and in sha Allah (God willing) in the future I will publish more papers.

Did you achieve any other awards?

We made a pressure sensor material that can detect pressure in a project that was supervised by Prof. Mariam Al-Maadeed. The project was the runner up (second place) at Fikra: Rising Stars of Plastic Industry contest that was held in Dubai. This is related to the Qatar National Vision 2030 and is also novel. The material contains Polymer PVDF with fillers inside.

I studied its properties and made additional materials.

The second project got to stage 2 of the Shell 360 competition with the cooperation and support of Dr. Deepalekshmi Ponnamma. The idea was about fabricating light weight and flexible, ultrafast charging batteries with long life and self-powering; integrating a PVDF nanocomposite containing metal-graphene hybrid combination into electronic devices. It is interesting to generate energy by performing mechanical activities on the device.

What do you like most about your job?

I like to work in labs and I am also a safety officer in Qatar Petroleum. The safety officer always wants to improve the laboratory and add new equipment to make it safer. I take the skills I have learnt from my studies and apply them in this role.

Do you face challenges?

Yes. They are always asking me to improve the lab so it is a hard job. You have to work to satisfy expectations.

Does your work have correlation with the objectives of the Qatar National Vision 2030?

My work is in tandem with the Qatar National Vision 2030 as it also focuses on human development and Qataris are expected to improve on themselves and build their capacity.

We are also expected to take academic strides and get graduate degrees. Now I have completed my degree and I am continuing with research.

I look forward to encouraging other people to complete their studies. The vision is also about improving research in Qatar and I am working hard on this. The National Vision includes reducing Qatar's energy consumption and the material that we use in the project does this because it consumes low energy.

Looking ahead, what are your future ambitions, in 5 years for example?

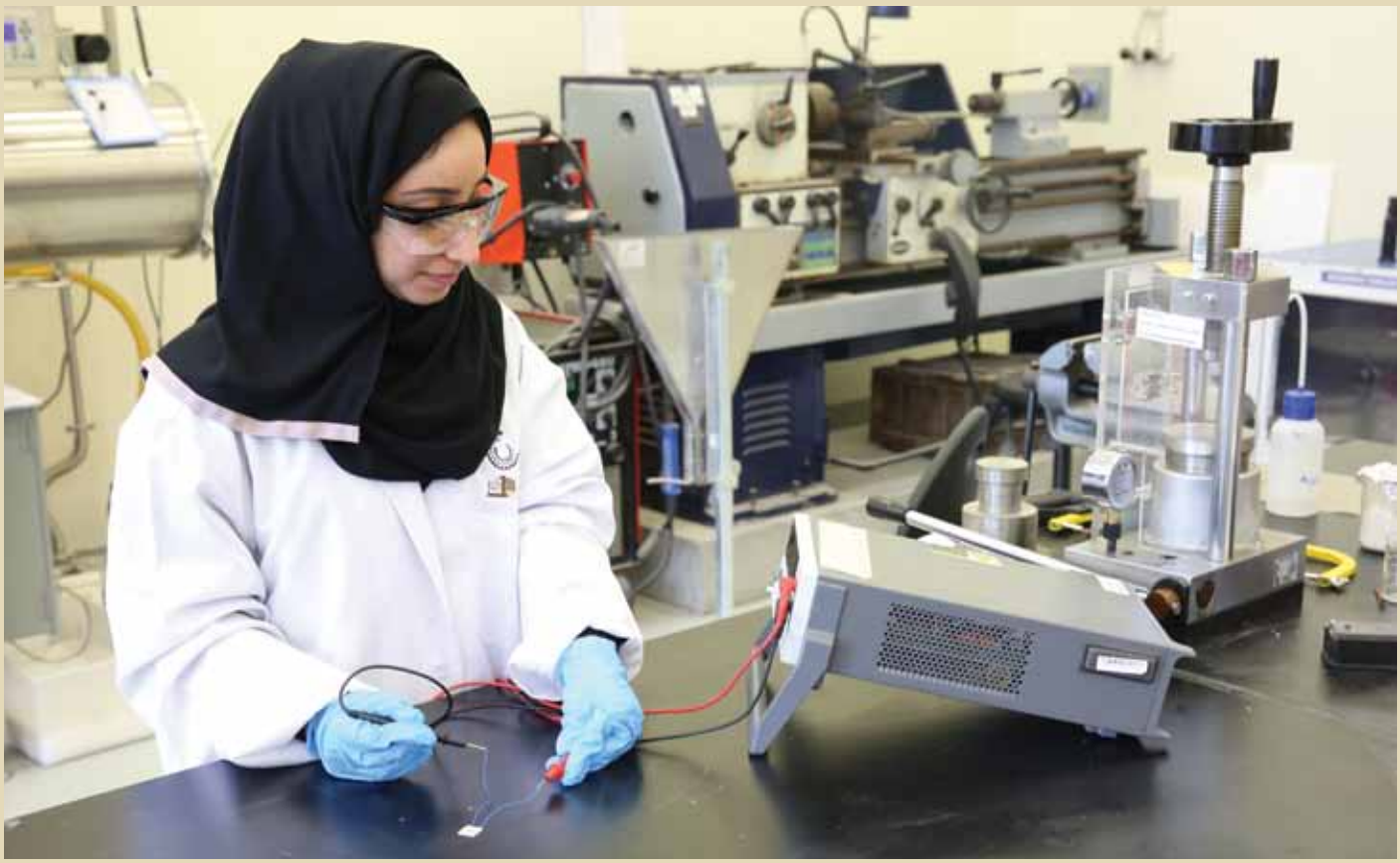
I need to complete my studies to get a PhD God willing. I need to also improve my research thesis that I am currently working on so that it becomes a reality and not just an idea.

> "When I enter the lab I feel like discovering new things. I meet with different people to see how they conduct their work."

What made you think that working in a laboratory is the best thing for you?

The laboratory is not like an office where you just go in and sit. It is physical because you need to go around. You feel that you are working and seeing new things all the time. Since I began working in the lab I have not thought of being away from it.

Also my family encouraged me because they felt it was good and made me feel happy. So they allowed me to continue and encouraged me to complete my studies.



News

QU research labs achieve accreditation renewal

QU researchers in a lab

Qatar University's (QU) research laboratories at Environmental Science Center (ESC), Center for Advanced Materials (CAM), Central Laboratory Unit (CLU), and Gas Processing Center (GPC) have been awarded renewal of their ISO/IEC - 17025:2005 accreditation status from the American Association for Laboratory Accreditation (A2LA), re-affirming their status as world-class facilities complying to international standards and best practice. The labs initially obtained accreditation status from A2LA in April 2010. Since then, A2LA has been conducting audits regularly to evaluate the quality management systems at QU's research labs.

This accreditation demonstrates that the labs are completely in compliance with the accreditation requirements spelled out in ISO/IEC - 17025:2005. It also demonstrates technical competence and operation of a laboratory quality management system of ISO-ILAC-IAF and management system requirements of ISO 9001: 2008 standards. As one of the essential requirements of accreditation, QU research labs are participating successfully in the proficiency testing programs with ASTM (USA), MAPEP (US Department of Energy), LGC Standards (UK), Schema (Greece), and ERA (USA). To enhance the technical competence of its employees, QU has a series of training programs run by internationally-recognized organizations such as A2LA (USA) and UKAS (UK). Commenting on this achievement, QU Vice-President for Research & Graduate Studies Prof Mariam Al-Maadeed said: "The renewal of accreditation underlines QU's commitment to world-class research, as well as its adherence to the highest levels of international best practice in all its research processes and lab systems and procedures. It is also an evidence of the quality and competence of quality management systems, the personnel involved and equipment used at QU research laboratories."

QU Quality Manager Dr Mohammed Maqbool said: "The quality assurance system at QU research labs ensures the competence of staff, equipment and procedures by regularly conducting internal quality control checks, participating in proficiency testing programs, and conducting internal audits and required training for its staff." A2LA Auditor Justing Cheng expressed satisfaction with the functioning of both management and technical systems used in the labs, saying: "During the assessment, I found out that the staff know their tasks very well and have performed tests correctly. All of them are very professional and efficient." ISO/IEC 17025 is the single most important standard for calibration and testing laboratories around the world and is used in developing the management system capable of producing accurate and reliable results. Laboratories accredited to this standard have demonstrated technical competence and ability to produce precise and accurate test data. The A2LA is a prestigious body offering programs for the accreditation of testing laboratories across the world. Accreditation is a voluntary, third party-reviewed process in which a laboratory's quality management system is thoroughly evaluated on a regular basis by authorized accrediting agencies to ensure continued technical competence and compliance with ISO standards.

“Animal research continues to play a vital role in nearly all major medical discoveries that benefit human and animal health ranging from immunization to organ transplantation. Qatar University has a first class laboratory animals research center to support scientific and medical research in Qatar.”

Dr. Hamda Al-Naemi
Director
Laboratory Animals Research Center

“We pursue that the Faculty of Sharia and Islamic Studies becomes a civilized and cultural bridge between our ancient heritage and contemporary culture. The college adopts a moderate and equitable approach, as we continually seek to promote dialogue and openness to the other without compromising Islamic constants.”

Prof.Yousif Mahmoud Al-Sidiqi

Dean Of College Of Sharia and Islamic Studies

Research lies at the root of the College of Health Sciences as we consider it very important to build a healthier society. Our faculty and students are actively engaged in various research projects in the areas of biomedical science, public health and human nutrition, and produce large number of international publications.

Professor Asmaa Ali Jassim Al-Thani

Dean of College of Health Sciences

Research on Health & Wellbeing

QU RESEARCH ON MALE INFERTILITY GIVES HOPE FOR EARLY DIAGNOSIS AND TREATMENT

“OUR FINDINGS PROVIDE DEFINITE EVIDENCE THAT PLC-ZETA IS THE PROTEIN RESPONSIBLE FOR INITIATING A NEW LIFE DURING HUMAN FERTILIZATION.”

- DR. MICHAIL NOMIKOS

Research coming out from Qatar University (QU) indicates there is hope for men with infertility issues to conceive naturally. This can be possible with future medication developed by this research. The research has been led by Dr Michail Nomikos, Assistant Professor of Biochemistry in the College of Medicine at QU. The research team found that injecting the amount of PLC-zeta protein present in infertile men into mouse eggs resulted in no fertilization, but increasing the amounts of the protein successfully triggers a normal fertilization process. The research has enabled scientists to overcome a genetic deficiency in sperm which prevents fertilization. All along, men with an ineffective protein called PLC-zeta struggle to conceive with their partners despite the most aggressive IVF treatments.

"Our ultimate goal is to use the tools that we are currently developing not only to treat, but also diagnose, the cases of male infertility associated with absent or dysfunctional PLC-zeta protein in human sperm,” said Dr Nomikos. "We believe that our research can eventually give hope to many infertile couples in the near future.”

Dr. Nomikos joined the College of Medicine (CMED) at Qatar University (QU) as, in September 2016, after a two-year Marie Curie Intra-European Fellowship (FP7-2013-IEF) from the European Commission to perform his research in the College of Medicine at Cardiff University, UK. Dr. Nomikos has published over 34 high-impact factor papers in international peer-reviewed, biomedical journals (including two book chapters).

His leading role has been maintained and evidenced by his first and corresponding authorship on a series of important papers. Moreover, he has also contributed novel ideas by publishing several authoritative reviews in the highly-competitive scientific field of intracellular calcium signaling. He has a strong research background and extensive training in biochemistry, molecular and reproductive biology, protein biophysics, as well as translational biology.

Notably, Dr. Nomikos was the sole recipient of the prestigious 2013 'Fertility & Sterility Investigator Achievement Award', an accolade that was presented at the Annual Meeting of the American Society for Reproductive Medicine (Harvard Club, Boston, USA).

The award citation described his instrumental research discovery and high-profile publication in the medical journal, Fertility and Sterility as the lead author of the research article entitled 'Phospholipase Cζ rescues failed oocyte activation in a prototype of male factor infertility'.

Dr. Nomikos' research focuses on understanding the process of cytoplasmic calcium signaling during mammalian fertilization, with the translational aim of developing the potential treatment of certain types of infertility.

His research interests also involve the elucidation of the molecular mechanism by which mutations in different calcium binding proteins lead to cardiac arrhythmias and early onset sudden cardiac death.

Support from senior researchers

For this breakthrough and in his research endeavors, Dr. Nomikos has enjoyed tremendous support from some of his senior colleagues who have demonstrated abiding interest in his success. He recognizes the continuous support of Professor Egon Toft, the Vice President for QU Medical and Health Sciences and Founding Dean of the College of Medicine at Qatar University.

"I feel very privileged to have been given the opportunity to be part of the newly-established College of Medicine at QU, a very friendly and dynamic environment, which aims to provide world-class education and deliver highly competitive biomedical research," Dr Nomikos said.

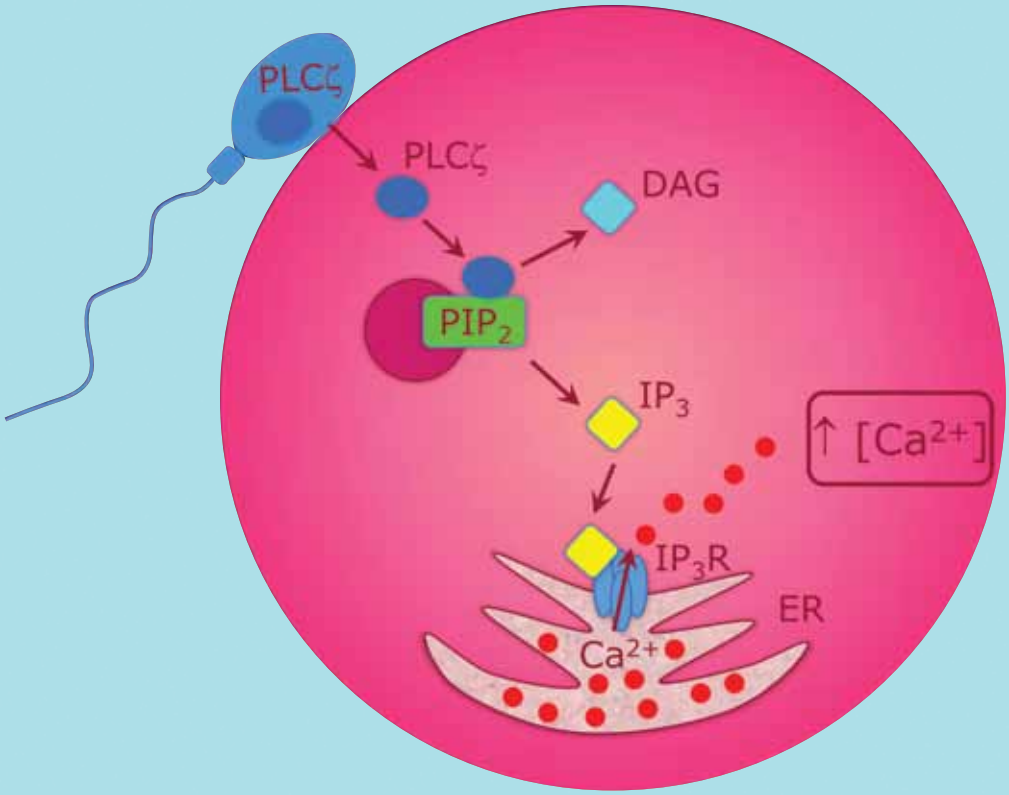
Another world-leading researcher who has made lasting impact on his career is Professor F. Anthony Lai, the Chair of the Ionic Cell Signaling Laboratory in the College of Biomedical and Life Sciences at Cardiff University (UK).

"Since I started my PhD studies, in a Calcium Signaling laboratory, in the College of Medicine at Cardiff University (UK), 16 years ago, I have been fascinated by how cellular changes in calcium ion concentration control almost everything that we do.

From how we move, how our hearts beat and how our brains process information and store memories. This versatile and universal signaling agent even controls the generation of a new life at fertilization, but uncontrolled changes can also result in the end of a life.

"I have been very lucky all these years to work closely and learn from one of the top world-leading Calcium signaling biomedical researchers, Professor F. Anthony Lai, the Chair of the Ionic Cell Signaling Laboratory in the College of Biomedical and Life Sciences at Cardiff University (UK).

In our latest publication, published March 2017 in the Biochemical Journal (https://doi.org/10.1042/BCJ20161057), and which had a worldwide media exposure



> I look forward to continuing this exciting research together with Dr Nomikos in Qatar University."
>
> - Prof. F. Anthony Lai

(including Daily Telegraph, UK), we delineated the molecular mechanism showing how a genetic mutation in the gene encoding a sperm-specific protein, termed Phospholipase C zeta (PLC-zeta) results in male infertility.

"Our findings provide definite evidence that PLC-zeta is the protein responsible for initiating a new life during human fertilization and we propose that such cases of male infertility can be rescued by medical assistance and the use of recombinant PLC-zeta protein synthesized in the laboratory via standard IVF procedures."

Vital role of sperm Phospholipase C zeta at fertilization of human eggs

When a sperm fertilizes an egg it delivers not only a package of genes from the father, but it also sends a direct 'message' to the egg that it should begin development.

We have known for many years that the message from the sperm results in a very dramatic increase in cytosolic calcium concentration in the egg, which occurs as a series of calcium oscillations that persists for several hours and stop at the time of pronuclear formation.

This calcium increase is vital for all the early events of fertilization and early embryo development. Many theories had been proposed to explain the generation of calcium oscillations during mammalian fertilization, but over the last decade, accumulating scientific and clinical evidence suggest that the fertilizing sperm causes the calcium oscillations by introducing into the egg cytosol, a sperm-specific protein, termed Phospholipase C zeta (PLC-zeta). Sperm PLC-zeta, which was discovered by Prof. Lai and his team in 2002, triggers the calcium release in mammalian eggs through a distinct signaling pathway.

Sperm-delivered PLC-zeta catalyzes the hydrolysis of its membrane-bound phospholipid substrate, phosphatidylinositol 4,5-bisphosphate [PI(4,5)P2], triggering the cytoplasmic calcium oscillations through the inositol 1,4,5-trisphosphate (InsP3) signaling pathway (see Figure X).

Recent clinical studies have highlighted the importance of PLC-zeta at human fertilization, reporting that sperm from infertile patients, who exhibited failed fertilization even after the most powerful in vitro fertilization techniques, such as Intracytoplasmic sperm injection (ICSI); (Figure Z), contained either reduced amounts or abnormal (mutated) forms of this protein.

Interestingly, we recently showed that recombinant PLC-zeta protein that we synthesized in the laboratory, can rescue an experimental model of such a case of male infertility.

Clinical significance of this research

A recent genetic study by Escoffier et al. identified a mutation in the PLC-zeta gene of two infertile brothers from Tunisia, which is of clinical significance because this indicates that male infertility can be genetically inherited.

Interestingly, this was the first male infertility-linked PLC-zeta mutation to be reported within the C2 domain of PLC-zeta, a region known to be essential for PLC-zeta function, but whose exact role still remains unclear.

Dr. Michail Nomikos conducts a test

Our current study extends the important findings of Escoffier et al. by identifying the molecular mechanism for how this PLC-zeta mutation leads to male infertility.

This study reveals the novel binding characteristics of this C2 region that might help it to be precisely targeted towards a specific compartment(s) within the egg.

We also showed that although this mutant protein at physiological levels is unable to start fertilization, microinjection into mouse eggs of significantly higher amounts of this mutant protein than normally found within a sperm, can rescue infertility leading to normal fertilization.

This suggests that PLC-zeta gene defects, in addition to causing male infertility, could also be associated with cases of male subfertility. Our findings further support the vital role of PLC-zeta at human fertilization.

In addition, unravelling the novel mechanism of PLC-zeta action within the fertilizing egg should facilitate the early diagnosis and treatment of such cases of male infertility.

The ultimate goal is to use PLC-zeta both diagnostically and therapeutically in a clinical setting, enabling IVF clinics to treat such cases of male infertility/subfertility by laboratory-made, recombinant PLC-zeta protein.

The expert viewpoint of Professor Sir Michael Berridge, FRS

Commenting on the research, Professor Sir Michael Berridge, FRS, University of Cambridge, a renowned expert in calcium signalling, said:

“A new life begins when the sperm fuses with the egg to inject an enzyme that initiates pulses of calcium that is responsible for activating egg development.

What Nomikos and colleagues have done is to show that a mutation in the enzyme, which has been identified in infertile men, fails to initiate the calcium signals that trigger development. This provides definitive evidence that this is the enzyme responsible for initiating a new life.”

PLC-zeta, the putative egg-protein and potential links with female infertility

The study suggested that the male infertility-linked mutation on the C2 domain of PLC-zeta affects its interaction with liposomes containing PI(3)P and PI(5)P, two phoshoinositides that strong biochemical evidence has suggested participates in significant molecular interaction with PLC-zeta.

"We are currently trying to understand the exact physiological role and significance of this interaction. However, it is also possible that this mutation affects the interaction of PLC-zeta C2 domain with another, currently unidentified egg protein or a "PLC-zeta receptor", resulting in this infertile phenotype," Dr. Nomikos said.

"The eventual identification of such an egg protein should provide a breakthrough in the fertilization field as it potentially may lead to identification of currently unknown causes of female infertility.

Collaborative efforts between QU and Cardiff University are currently in progress, trying to investigate and identify the potential binding-partner of PLC-zeta within the fertilizing egg."

Future directions to diagnose and treat PLC-zeta-associated male infertility

Infertility represents a global public issue. The World Health Association has recognized infertility as a disease of the reproductive system. It is estimated that infertility affects at least 1 in 7 couples worldwide. It has been reported that ~30% of all infertility cases is due to male infertility.

A study conducted at Hamad Medical Corporation (HMC) reported that the male infertility clinics in Qatar receive ~8,000 cases every year. Currently, the number of these male infertility cases that is due to deficiencies of PLC-zeta protein is not yet known.

According to Dr. Nomikos, this necessitates the development of tools to diagnose such cases of male infertility associated with absent or dysfunctional PLC-zeta protein in human sperm.

"We are currently developing monoclonal antibodies against PLC-zeta protein and sensitive detection protocols, which will enable us to screen infertile males for PLC-zeta deficiencies.

Furthermore, the identification and characterization of another male infertility-linked PLC-zeta mutation necessitates that we begin to consider the use of recombinant PLC-zeta protein in a clinical setting, with the aim being to rescue such cases of egg activation failure.

Our ambitious goal is to achieve the successful pregnancy and delivery of a baby using PLC-zeta-mediated enhancement of existing in vitro fertilization techniques.

This medical and scientific advance will emphatically lead to an improvement in the existing clinical practice of artificial reproductive technology.

Developing the utility of PLC-zeta protein as a potential therapy in cases of male infertility should enable many infertile couples to have the chance of a family. We believe that our research can eventually give hope to many infertile couples in the near future," he said.

Collaboration and funding

The research study was carried out as a collaboration between Qatar University, Cardiff University and the National Center for Scientific Research "Demokritos" in Greece.

It was funded by an EU-FP7 Marie-Curie Intra-European Fellowship to Dr. Nomikos, an Institute for Molecular and Experimental Medicine Research Scholarship (Cardiff University) and partially by a research grant from Cook Medical Technologies.

Words from Prof. Lai and Prof. Toft

Prof. Lai said: "The innovative research by Dr. Nomikos that has led to the exciting conclusion that PLC-zeta is the sperm protein that initiates embryo development from the fertilized egg, demonstrates the power of persistence in the face of adversity.

Although it was another talented research team that first identified the novel PLC-zeta mutation, the unrelenting tenacity and spirited determination of Dr Nomikos in tirelessly working many long hours in the laboratory, provided the breakthrough results.

I look forward to continuing this exciting research together with Dr Nomikos in Qatar University and sincerely hope that we can make further important discoveries that should help to alleviate the terrible burden of infertility that is suffered by many couples in Qatar and worldwide."

> "We at Qatar University take pride in Dr Nomikos' "spark of life" breakthrough discovery."
>
> - Prof. Egon Toft

Prof. Toft said: "We at Qatar University take pride in Dr Nomikos' "spark of life" breakthrough discovery. Due to that, the lens through which male infertility was viewed will be gloriously changed. This is definitely a fruitful outcome of serious dedicated inquisitive work.

Qatar University works to foster excellence in research and education and contributes for the health needs of Qatar, in line with the national healthcare strategy.

Our Exclusive

Gulf Studies Center project to produce first ever book on Shura Councils

Dr. Luciano Zaccara

The Gulf Studies Center at Qatar University (QU) is collaborating with the Regional Office of Konrad-Adenauer-Stiftung in the Gulf States on a research project that would lead to the publication of the first ever book on the Legislative/Shura Councils in the Gulf Region, taking a look at their political and legislative performance.

It is a pioneering effort being sponsored by Qatar University to conduct original research on the subject in the region.

The project is being coordinated by Dr. Luciano Zaccara, Assistant Professor & Research Coordinator in Gulf Politics, at the Gulf Studies Center in Qatar University.

According to Dr. Zaccara, it aims at addressing the political and legislative performance of the Shura councils and parliaments in the Gulf region, focusing on the six Gulf Coordinating Council (GCC) countries of United Arab Emirates, Bahrain, Saudi Arabia, Oman, Qatar and Kuwait; and Iran, Iraq, Kurdistan and Yemen.

He said the study would assess and compare both the attributions granted to the legislative and consultative bodies (at national and regional levels), the mechanisms/procedures employed to appoint or elect members, as well as the citizens' role in the electoral/legislative process.

"The project will also assess the impact of the legislative/consultative processes on the overall political performance in this region," Dr. Zaccara added.

The main research questions being addressed are: To what extent are the legislative/consultative bodies able to initiate, approve or veto new legislation? How is their relationship with the executive and judicial powers? What are the existing accountability mechanisms? Are the councils representative of societies? And, how do citizens regard these bodies?

The first workshop on the project that was held at Qatar University discussed previous research conducted on each country, developed the research proposals of each participant, and agreed on research questions, fieldwork to be conducted, expected outcomes and coherent publication. The second workshop that was held in September was used to present and discuss the findings of the research conducted, as well as provide the researchers with constructive feedback.

Papers produced are expected to be presented at relevant academic conferences and publication of results will be in the form of an edited book, including an introductory chapter on research objectives, theoretical and methodological frameworks, and chapters on the councils in each country.

A special event will be held at Qatar University to launch the book, to which some internationally recognized scholars who did not participate in the project would be invited to discuss the work. The research team consists of 10 scholars, one from each of the Gulf countries being studied, to cover the case studies. Additionally, five researchers (from inside and outside the region) participated as discussants in the second workshop.

According to Dr. Zaccara, available literature on legislative powers mostly relates to the role and performance of the chambers in democratic context, disregarding the function and performance of the chambers in authoritarian and semi-authoritarian context.

"One of the objectives of this project is to assess the role of those chambers independently from the fact that they are performing in authoritarian/semi-authoritarian context in order to explore which role and function they have been attributed by the government and constitution, and if that role is performed accordingly. It will also explore which function is attributed to them by the citizens, and in the case of elective bodies, why the citizens vote in legislative elections," he said.

He added further that it was not the objective of the project to elaborate a taxonomy of all the cases based on the criteria of representation and actual legislative capacity, but to analyze their political weight within every political system.

“By diversifying our graduate studies’ offerings in both the arts and sciences fields, research synergies between faculty members and students flourish thereby fostering research excellence and productivity.”

Dr. Rashid Al-Kuwari
Dean of College of Arts and Sciences

QATAR UNIVERSITY ANNUAL RESEARCH FORUM 2017

The Qatar University Annual Research Forum and Exhibition is the meeting point for students, researchers and academics from the University's nine colleges, centers and institutes; including partners and stakeholders, to assess and review the institution's research enterprise.

This year we are encouraged by the support we have received from our sponsors. We are glad to have ExxonMobil Qatar as Platinum Sponsor; and Qatar Rail, Dolphin Energy and QAPCO as Silver Sponsors.

The high profile event features theory grounded discussions, and original research presentations. It is an occasion to demonstrate new tools, report on the implementation of new programs, collaborations, innovations and other relevant projects that take bearing from the QU Research Roadmap 2014 - 2019, Qatar National Research Strategy and Qatar National Vision 2030.

With the theme on 'Research Beyond Boundaries', we are breaking barriers in efforts to expand the research enterprise as QU takes strides to foster interdisciplinary research and graduate programs, and enhance regional funding for global research; unify efforts and optimize resources. We have had an outstanding success in our relationship with stakeholders and partners in industry, the government and community, to take the research enterprise to lofty heights.

“The Annual Research Forum & Exhibition offers Qatar University the opportunity to address the community’s challenges through research anchored on a vibrant partnership with industry and various other stakeholders.”

- Prof. Mariam Al-Maadeed

VP for Research & Graduate Studies

Dr. Mohamad Al-Sulaiti

Research Director
ExxonMobil Research Qatar

1. Please give us background information about your organization; its mission and objectives and core values.

ExxonMobil Research Qatar (EMRQ) was established in 2009 to conduct research in areas of common interest to the State of Qatar and ExxonMobil, including environmental management, water reuse, LNG safety and coastal geology. The center is located in the Qatar Science and Technology Park (QSTP), and is a full research and development center that includes offices, laboratories and training facilities.

Since its establishment, EMRQ has collaborated with local and international partners to conduct scientific research needed to develop key technologies that will benefit the oil and gas industry in Qatar and around the world, and ensure that it functions in a safe and environmentally responsible manner.

A very important component of EMRQ's work is related to protecting people, preserving Qatar's environment and marine life, including its iconic dugong population and surface and coastal geology.

2. What are the factors that define your relationship with Qatar University? Is research a big factor?

EMRQ and Qatar University (QU) have shared a commitment to advancing science and technology in Qatar through research and development since 2006.

Together, we promote and nurture academic excellence through strategic investment in human capital, innovative technology and state-of-the-art facilities.

As far as research is concerned, we have cooperated on several research projects during our 8 years of partnership. An example of this is a 12-month, QR 2.2 million study we formalized in 2012. The study was part of a water reuse research program to develop technologies that will utilize industrial water in ways that are beneficial to Qatar. In 2009, the Environmental Studies center of Qatar University and EMRQ jointly conducted an ecological baseline survey to investigate an area north of Ras Laffan Industrial City (RLIC) and south of Ar Ruwais.

In 2014, EMRQ entered a tri-party partnership with QU and Texas A&M at Galveston (TAMUG), with support from Natural Reserves Directorate of the Private Engineering Office and the Ministry of Municipality and Environment to further environmental research and marine mammal initiatives. Our objective was to develop a detailed research, education and conservation program to better understand Qatar's dugong population and how we could help protect it; and efforts are ongoing.

We also launched the Qatar University ExxonMobil Research Scholars Program in 2015 to promote academic and industry relations, to foster innovation, and to facilitate the development and use of state-of-the-art technology, helping prepare students for success in a dynamic and changing global economy.

Also in 2015, we signed an exclusive three-year sponsorship of an academic chair in science and technology education at the university. The ExxonMobil Chair in Science and Technology works closely with QU's College of Education to explore methods that provide teachers with an improved educational experience in the fields of science and technology, and help encourage a larger number of students to pursue STEM career pathways.

3. How is your organization contributing to the sustainable development of Qatar in line with the Qatar National Vision 2030?

We support the Qatar National Vision 2030 by driving human development, contributing to Qatar's thriving society, and supporting responsible and sustainable development. In particular, we work with an extensive network of partners to strengthen educational and professional development across the country.

We are committed to creating a workforce in Qatar that is highly skilled, motivated, and educated, as outlined in the QNV 2030. This workforce is also the foundation for the knowledge-based society in Qatar His Highness the Emir, Sheikh Tamim bin Hamad Al-Thani's envisions for Qatar's future.

In order to accomplish this, we maintain successful long-term partnerships with various entities locally and internationally, including our important partnership with Qatar Foundation for Education, Science and Community Development; Qatar Science and Technology Park; Qatar National Research Fund; and the Ministry of Municipality and Environment. In addition to our valued partnership with QU, we have established partnerships with other high-profile local universities.

Through these partnerships and the projects conducted with these entities, we support the development of human potential and help ensure the existence of a pool of qualified national individuals by providing access to ExxonMobil's industry knowledge and experience as a major global company with operations across six continents.

To this end, we have Tamayoz, a professional training program that was established by ExxonMobil Qatar in 2012 and housed at EMRQ. The program offers free courses for our partner Qatar Petroleum (QP), and joint ventures Qatargas and RasGas throughout the year across a number of focus areas. Again, this is an example of how ExxonMobil Qatar is committed to building the capacity of individuals in the energy sector and other critical sectors.

Teachers take part in a hands-on activity during the Qatar University ExxonMobil Teachers Academy

4. Are there ongoing collaborative research projects with Qatar University? Are there projects or programs you are sponsoring in QU? If yes, please explain?

In addition to what I already mentioned, we also support programs such as Life is Engineering that inspire young engineers; and the Qatar University ExxonMobil Teachers Academy, which provides a valuable opportunity for math and science teachers from independent schools to learn new skills and in turn impact educational change in Qatar.

We recently participated in QU's 5th International Gas Processing Symposium as its elite sponsor, and have committed to being part of the QU Annual Research Forum as its platinum sponsor this May.

5. Do your human capacity building and human resources policies have a place for Qatar University graduates? Have you been able to take them on as interns? Any numbers?

ExxonMobil Qatar built an internal taskforce in 2006 – the University Liaison Committee -- to facilitate more effective student outreach and increase Qatarization efforts within the company. The committee is dedicated to attracting high caliber graduates for careers with ExxonMobil Qatar by increasing the company's visibility and awareness with Qatari students, university faculty and staff members.

Through the committee, ExxonMobil Qatar offers fully funded undergraduate scholarships and summer internship opportunities to qualified candidates from various universities and colleges. Since its inception, the committee has provided more than 140 Qatari students with academic sponsorship, in addition to more than 155 internship opportunities at ExxonMobil Qatar.

EMRQ also provides training opportunities to university students during the summer. In addition, we provide tours of our facilities to students of all ages and levels. Every year, for example, we support QU's Science, Technology, Engineering and Math (STEM) Adventure week, and invite students taking part in the program to visit EMRQ, where they can interact with our scientists and researchers and gain an understanding of the actual work we do at the center on a day-to-day basis.

6. How would you assess academic-industry collaboration in terms of contributing to national growth and development? Are the prospects bright? How are you contributing to this?

Collaboration is at the heart of everything we have done and continue to do in Qatar with regards to our business and community engagement activities. Delivering quality programs, particularly in education and research and development, requires collaboration between government, academia and industry. This three-way collaboration has been called the Triple Helix model.

Our cooperation has resulted in many successful outcomes and represents the progress that can be made when government, academia and industry work together with a shared vision. Together, we are tapping into the potential of Qatar's youth and professionals so that we can create a dynamic knowledge-based economy that is capable of sustainable economic growth.

ExxonMobil Qatar representatives at Qatar University's fifth International Gas Processing Symposium

“CENG’s research effort directly addresses issues related to Qatar's projects, helps find solutions to today's challenges and contributes to Qatar's knowledge-based economy.”

Dr Khalifa Al-Khalifa
Dean of College of Engineering

Dr. Mohammed Yousef Al-Mulla

Managing Director & CEO
Qatar Petrochemical Company (QAPCO) Q.S.C

1. Please give us background information about your organization; its mission and objectives and core values.

Based in the State of Qatar, Qatar Petrochemical Company (QAPCO) Q.S.C. is one of the world's-largest and most successful producers of low-density polyethylene (LDPE).

The Company produces a wide range of LDPE grades that are suitable for all thermoplastic processing techniques, which are used for various applications.

In addition to its core business, QAPCO has invested directly and indirectly in four associated ventures that contribute to the development of Qatar's downstream petrochemicals sector.

We are also involved in a number of joint ventures, including Qatar Vinyl Company (QVC), Qatofin Company Limited, and Qatar Plastic Products Company (QPPC), thereby, producing various petrochemical products and making QAPCO a regional petrochemical powerhouse.

VISION
PROSPERITY THROUGH INNOVATION

QAPCO envisages dynamic and sustainable growth targeting the prosperity and wellbeing of our employees, society and to contribute to Qatar's ever-growing economy.

MISSION

Excellence through sustainable growth driven by innovation, talent and responsible care

QAPCO is determined to achieve its Vision through sustainable growth driven by innovation in processes, products, research and development achievable only through a developed talented workforce while safeguarding health, safety, and the environment.

OUR VALUES
PEOPLE

The heart and soul of the organization is built on the dedication of our people and their commitment to exceed the expectations of our community and customers. We seek to retain talent, and foster a collaborative and supportive environment.

SAFETY

We persistently ensure the safety of our employees, contractors, assets and communities; taking a pro-active approach to safety, we relentlessly seek ways to improve our safety performance.

INTEGRITY

Acting ethically and honorably wins loyalty. Our behavior is matching our words and we take accountability and responsibility for our actions.

INNOVATION

Innovative processes, creative ideas, research and development that bring together various novel ideas in a way that shall have an impact on society.

STEWARDSHIP

Building a strong and durable company for future generations, meeting our commitments to stakeholders, fostering freedom to act, and helping improve communities and the environment.

2. What are the factors that define your relationship with Qatar University? Is research a big factor?

QAPCO believe that industry and academia collaboration should go hand-in-hand and we are proud to support Qatar University with their research values and philosophies and look forward to strengthening our partnership with them.

We currently have two professional Academic Chairs at Qatar University:

- Chair of Math Education
- Polymer Chair at the Center for Advanced Materials

Supporting Research & Development is vital as these Chairs have resulted in positive research outcomes through published journals and articles, several QNRF funded projects and academic instruction offered to students completing their Masters.

3. How is your organization contributing to the sustainable development of Qatar in line with the Qatar National Vision 2030?

Engagement and innovation are the key elements of successful sustainability management. Measuring and understanding the impact that our operations has on our stakeholders is an ongoing and deliberate objective of our sustainability management program in line with the Qatar National Vision 2030.

As a company, we are moving forwards with our vision of creating "prosperity through innovation" and that objective drives us to dive deeper into the operational and engagement opportunities that we have as a company to improve not only our own performance but also our impact on others.

For QAPCO, sustainability is a catalyst for success as it connects our short and long term actions with the needs and expectations of our stakeholders. Stakeholder engagement is thus a critical part of our success in improving our long term strength and continuing to innovate towards sustainability. Stakeholders are our starting point – through daily engagement, direct communication and formalized interactions, we are working to understand the expectations and priorities that our key stakeholders have on our business.

4. Are there ongoing collaborative research projects with Qatar University? Are there projects or programs you are sponsoring in QU? If yes, please explain.

At Qatar University, collaboration with Professor Krupa, the QAPCO Polymer Chair, has helped advance research in energy saving materials. For example Prof Krupa, has completed pioneering research on palm waste that is the focus of innovative research at the Center for Advanced Materials (CAM).

QAPCO also has a groundbreaking agreement with the Center for Advanced Materials (CAM) at Qatar University for the creation of a new international scientific journal. The journal will be a multidisciplinary, peer-reviewed publication concentrating on materials science and technology. It will consider all original research papers on different aspects related to materials, polymers, energy harvesting, coating and green materials.

The benefits of this new journal are numerous and include improving scientific research in this field to enable the petrochemical community to open up discussion and debate.

It also demonstrates how QAPCO and CAM are leaders in this field as there is no other journal focusing on materials related to petro-materials, making this journal unique on an international level.

These projects form a part of QAPCO's overarching goal of research and development for sustainability. Through collaboration on innovative research projects, QAPCO aims to develop materials that will further differentiate its products from its competitors, creating value for the Company, its stakeholders and the State of Qatar.

Also, QAPCO sponsors the Annual Materials Science and Engineering Symposium in collaboration with TAMUQ and Qatar University.

This event brought together experts from academic institutions, research centers, industry and government organizations to discuss the latest advances in materials science and engineering.

5. Do you have capacity building opportunities for QU researchers and academics? Are there any instances?

We fully support and are committed to assisting researchers and academics develop their knowledge.

Our Research & Development Manager and the QAPCO Polymer Chair participated in GPCA Plastics Excellence Awards and won an award for Best Researcher category. Also we supported QU students working on a research project that won first prize in GPCA Plastics Excellence Awards FIKRA Category. Plus we supported Qatari students at local universities with research guidance, samples and testing facilities to execute their projects and develop their skills.

6. Do your human capacity building and human resources policies have a place for Qatar University graduates? Have you been able to take them on as interns? Any numbers?

Each year we provide an eight week Internship Program for 20 College of Engineering Students in the fields of Chemical, Mechanical and Electrical Engineering. Plus we offer 4 Environmental Students the opportunity to attend the same program but in our Environmental Department.

Our Internship program is well regarded by students and academics as it enables students to experience at first hand the practical applications and processes that they study in the classroom.

Our team of experienced Training Specialists deliver an intensive program that challenges the student to learn and to perform therefore maximizing their time in the Plant.

> “QAPCO sponsors the Annual Materials Science and Engineering Symposium in collaboration with TAMUQ and Qatar University.”

7. How would you assess academic-industry collaboration in terms of contributing to national growth and development? Are the prospects bright? How are you contributing to this?

Academic-industry collaboration in terms of contributing to national growth and development is vital for the success of the Qatar National Vision 2030 (QNV 2030). QAPCO is strongly committed to the continued growth and development of Qatar as it works towards realizing the ambitious goals of this vision.

Our wide-ranging social responsibility and engagement programs focus on three core themes: Education, Environment and Sport and Health. Each theme is underpinned by our commitment to the four pillars of the QNV 2030, and to developing Qatari Nationals and local capacities.

Collaboration with QU

Our college prides itself in conducting meaningful and impactful research across a number of health areas, while in close collaboration with industry partners as a synchronized effort, to meet Qatar's National Vision 2030.

Dr. Mohammad Diab, Ph.D.
Dean, College of Pharmacy
Qatar University

Mr. Jassim Al Jasmi

SVP Technical Services
Dolphin Energy

1. Please give us background information about your organization: its mission and objectives and core values.

Dolphin Energy Limited strives to be a leading and reliable supplier of clean energy in a socially responsible manner. The company supports the development of substantial long-term new industries throughout the region, creating sustainable wealth, economic growth and employment opportunities for the citizens of the region far into the future.

Dolphin Energy's mission is to produce, process and supply substantial quantities of natural gas from offshore Qatar to the United Arab Emirates and Oman over a period of 25 years. Our values are Fiscal Responsibility, Integrity, Respect, Social Responsibility and Teamwork for Excellence.

2. What are the factors that define your relationship with Qatar University? Is research a big factor?

Indeed research is one key factor that defines the company's relationship with Qatar University (QU). Our aim is to enrich the academic field of the university and in the long term enhance the performance of our facilities by employing young talented national engineers that have been developed by QU and entered the job market.

As a consortium member of the Gas Processing Center, Dolphin Energy has already engaged with QU to work jointly on research projects, to perform studies and help solving operational issues.

We also have an annual cooperation agreement with QU through which the company sponsors and supports a number of activities. These include CENG Engineering Week, STEM on Wheels, Life is Engineering Project, Road Safety Ambassadors, Senior Design Contest, High School Wooden Bridge Contest, Transportation and Road Safety Conference and International Gas Processing Symposium.

In addition, through our Human Resources Department, we sponsor a number of QU national students each year via our training programs such as Internship & Summer Training. The company also participates in QU's career fairs and exhibitions. Finally, our associate engineers are QU graduates.

3. How is your organization contributing to the sustainable development of Qatar in line with the Qatar National Vision 2030?

Dolphin Energy's approach to sustainability management is aligned with the Qatar National Vision 2030 and strongly committed to its four pillars: economic, human, social and environmental development. This position is also strongly reflected in the company's annual sustainability report, which also complies with the Qatar Energy and Industry Sector Sustainability Program (QEISS).

Our focus is to continue our efforts on maintaining a strong sustainability performance at all times. We have embedded sustainability principles into our operations and report our performance on an annual basis to help demonstrate our commitment.

Recently, Dolphin Energy won the 'Best Sustainability Report' Award at the Abu Dhabi Sustainability Group (ADSG) Sustainable Business Leadership Awards Ceremony.

For the second time in three years, Dolphin Energy has won the award, demonstrating the dedication the company has displayed in deepening its commitment to sustainability and helping endorse and drive the wider sustainability agenda in the communities where it operate.

4. Are there ongoing collaborative research projects with Qatar University? Are there projects or programs you are sponsoring in QU? If yes, please explain.

We engage with QU through a number of platforms such as the Gas Processing Center (GPC), the Engineering College and the Center for Advanced Material Research to explore the possibility of conducting research on mutually beneficial. For instance, we are currently involved in discussions with GPC to research on the quality of injected water in onshore wells as well as the different sizes of particulates.

In addition, Dolphin Energy is utilizing QU's laboratory to examine different types of chemicals to ensure the adequacy of these chemicals to be used at our gas processing plant at Ras Laffan Industrial City.

Furthermore, Dolphin Energy has already provided technical support to the QU laboratory in defining the right design for the pilot CO2 capture program, which is being developed by the university.

5. Do you have capacity building opportunities for QU researchers and academics? Are there any instances?

Yes. For instance, qualifying new types of chemicals such as corrosion inhibitor can be done by using the QU laboratory. In addition, there is potential for further research that can enhance our processes, identify corrosion issues and find effective solutions.

6. Do your human capacity building and human resources policies have a place for Qatar University graduates? Have you been able to take them on as interns? Any numbers?

Each year, Dolphin Energy sponsors a number of QU students on different fields as part of its Internship Program. In 2016 and 2017, the company supported 12 QU intern students.

7. What procedures, processes and plans do you have in place to encourage student researchers?

In line with our commitment to education, the company's CSR program and in coordination with our Talent Management Team, QU students can meet the company's management team from relevant departments and get all the necessary support for their studies and research.

Each year Dolphin Energy hosts a number of national summer trainee students, who are motivated enough to actively engage into our day-to-day activities. Summer intern students also learn a great deal from our talented workforce. Each summer trainee is assigned a dedicated coach to ensure the learning process is maximized.

"Our focus is to continue our efforts on maintaining a strong sustainability performance at all times. We have embedded sustainability principles into our operations and report our performance on an annual basis to help demonstrate our commitment."

Mr. Khalifa Hassan Al Jehani

Chief of Corporate Support

Qatar Rail

1. Please give us background information about your organization; its mission and objectives and core values.

Established in 2011, Qatar Rail is leading one of the largest rail projects in the world which will help meet the demands of Qatar's dynamic and growing population. The company is responsible for the design, construction, commissioning, operation and maintenance of the entire rail, and will manage Qatar's rail network once operating. Its mission is "To build, encourage and invent new ways of moving" and it has five core values which helps guide its actions; Accountability, Transparency, Teamwork, Safety & Environment and Customer Focus.

The state-of-the-art railway network will consist of three interconnected projects, 1) Doha Metro, an underground and elevated rail network, servicing the city and suburbs of Doha. Doha Metro Phase 1 will have 75 trains running along three lines.

Doha Metro has the initial capacity to carry more than 8,000 passengers per hour per direction on each line, 2) Lusail Tram, a light rail system with four lines and 28 trams that connects the city of Lusail. Each line can initially service up to 1,200 people per hour in each direction.

The Lusail Tram connects with Doha Metro at Lusail and Legtaifiya stations, and 3) Long Distance Rail, a high speed passenger and freight network connecting the main cities in Qatar with GCC countries.

In line with Qatar National Vision 2030, the integrated railway system will be affordable, reliable and convenient, changing people's lives forever while helping to build and support the country's growing economy.

2. What are the factors that define your relationship with Qatar University?

Qatar Rail will provide the infrastructure that will literally bring the people of Qatar closer together – connecting communities, building neighborhoods and creating a soul for the city. As the "Corner stone of a connected Nation", Qatar Rail is committed to supporting and initiating local initiatives that will benefit the community.

A vital part of this is working with the country's younger generation and supporting their educational and career

aspirations. As Qatar's national university, building a strong working relationship with Qatar University is a key component of this. We are extremely proud to support Qatar University's Annual Research Forum & Exhibition 2017.

This is a vital platform to promote research projects and efforts at Qatar University and all of which helps deliver a knowledge based society in line with Qatar National Vision 2030.

How is your organization contributing to the sustainable development of Qatar in line with the Qatar National Vision 2030?
We expect that the integrated railway system which we are responsible for delivering will have far-reaching effects on the very fabric of the country.

It will promote sustainable public transport and provide numerous benefits to the nation which include less traffic on our roads as people will shift from using their cars to Doha Metro. With this shift, road safety will be greatly enhanced and quality of life improved as people will get to spend less time in traffic..

This will result in shorter journey times, less congestion, less CO_2 emissions and less urban pollution including noise and dust.

For example the distance from Msheireb area to Al Rayyan Stadium is estimated at 39 minutes by car, compared to 23.5 minutes by metro, while the approximate quantity of carbon dioxide emission saved by metro transport for this distance is 2.8 kilograms – enough energy to light a lamp for 850 hours.

3. Are there ongoing collaborative research projects with Qatar University? Are there projects or programs you are sponsoring in QU? If yes, please explain.

Qatar Rail is sponsoring the Qatar University Annual Research Forum & Exhibition 2017. We believe in the importance of building productive relationships between industry and academic and supporting this significant event in line with Qatar National Research Strategy and Qatar National Vision 2030 is a great way to build that closer, collaborative relationship.

4. Do your human capacity building and human resources policies have a place for Qatar University graduates?

Qatar Rail workforce is comprised of a number of diversified skilled employees coming from all horizons and representing uniquely condensed expertise in rail projects from across the globe.

However, we are equally committed to increasing the number of home grown talents working within our organization and are increasingly looking to recruit Qatari nationals that want to have a role in what will be a transformative project for the nation in the field of transportation.

We recognize that there is a wealth of talent at Qatar University and look forward to attracting those individuals to join the Qatar Rail team; giving them the necessary training and development plans to further their careers.

5. How would you assess academic-industry collaboration in terms of contributing to national growth and development? Are the prospects bright? How are you contributing to this?

We are committed to working with local academic institutions, such as Qatar University, to both make the next generation aware of our projects and their expected long term effects on the citizens and resident, as well as supporting students' academic endeavors so that they can reach their full potential.

Identifying and recognizing our country's brightest talents and helping to further develop their skills and opportunities is an important way we will be contributing to national growth.

Our aim is to make Qatar Rail among the top organizations that the Qatari nationals look forward to working in. We support and motivate them in all functions and at all levels within the organization.

“Identifying and recognizing our country's brightest talents and helping to further develop their skills and opportunities is an important way we will be contributing to national growth.”

News

QU-BRC signs contract for Biosafety level three facility

Human health is threatened by a wide variety of pathogens transmitted from wild and domesticated animals. New pathogens continue to emerge and zoonoses constitute up to 75% of the newly emerging infectious diseases in humans. The emergence of MERS-CoV in Qatar in 2012 raised the alarm about the importance of preparedness planning to ensure adequate responses to emerging infectious disease cases or outbreaks.

To serve that purpose, the Biomedical Sciences Center (BRC) at Qatar University (QU) has signed an agreement with Al-Balagh Trading & Contracting Co. W.L.L. to establish Biosafety Level Three facility manufactured by CERTEK.

Laboratories that handle infectious agents are categorized into four Biological Safety Levels (BSL1-4) according to the risk level of the pathogens being studied. BSL-3 laboratories are designated for handling infectious agents, endogenous or exotic, which are transmitted through inhalation route and may cause serious or potentially lethal diseases. Examples of such pathogens include: Highly pathogenic influenza viruses (H5N1), MERS and SARS coronaviruses, and mycobacterum tuberculosis (TB).

Currently, there is only one BSL-3 laboratory in Qatar at the Hamad Medical Center (HMC). It is specified for TB diagnosis and research. Accordingly, the Qatar University Biomedical Research Center has been vigorously seeking to acquire and operate a BSL-3 laboratory to face the several challenges concerning communicable diseases that threaten human and veterinary health.

QU-BRC plans to have the facility fully functioning within a year and it will be used for diagnostic and research activities.

The facility will operate under international safety standards in terms of engineering designs of the lab space; closed and controlled air flow stream to prevent the spread of infectious agents, and also have private airtight compartments, well-ventilated to conduct experiments inside. The facility will be certified based on international standards and will function according to the regulations of the Center for Diseases Control and Prevention (CDC) as well as World Health Organization (WHO). It will also provide training for lab personnel on security procedures and practices to deal with this advanced level of bio-safety level.

The Biomedical Research Center looks forward to collaborating with all stakeholders to support research environment in the Qatar.

Social and Economic Survey Research Institute (SESRI) is an interdisciplinary center that aims to contribute to the development of society by providing high-quality survey data to guide policy formulation, priority setting and evidence-based planning and research in the social and economic sectors.

Dr. Hassan Al-Sayed
Director of the Social and Economic Survey Research Institute (SESRI)

Our Exclusive

3-step process for treatment of processed water developed

Dr. Muftah El-Naas

A novel, patent-pending process has been developed for the treatment of highly contaminated industrial wastewater.

The research, led by Dr. Muftah El-Naas, QAFCO Chair Professor in Chemical Process Engineering at the Gas Processing Center, College of Engineering, Qatar University, was carried out through two phases and lasted for six years.

The first phase involved laboratory-scale experiments to assess the effectiveness of different wastewater treatment processes and led to the development of a novel process, involving three different treatment technologies.

The main novelty of the process was the use of electrochemical technology as a pre-treatment step for destabilizing suspended, emulsified, or dissolved contaminants in the wastewater by introducing an electrical current into the water.

As a second step, Dr. El-Naas said a special type of bacteria was isolated and used to degrade soluble hydrocarbons that are very difficult to remove. The bacterial cells were immobilized (fixated) on a polymer gel and contacted with the contaminated water in a specially designed reactor system.

In the final step, the process utilized Date Pits, which is a common agricultural waste in the Gulf region, as a source of activated carbon for the adsorption of the remaining organic contaminants.

The three-step process was able to reduce the concentrations of all

hazardous organic contaminants by more than 97%, Dr. El-Naas said.

The second phase of the research project focused on the design, fabrication and testing of a pilot plant, based on the results of comprehensive experimental and theoretical studies that were conducted during the first phase.

The pilot plant, consisting of the most efficient integrated treatment system, with a maximum operating capacity of 1.5m3/hour, was built in Japan by Koike Tech at an estimated cost of $1.2 million.

The pilot plant was transported to the United Arab Emirates and then installed and operated in a petroleum refinery for about 10 months to evaluate its performance under real operating conditions.

The results obtained from the pilot plant clearly showed that the treated water fulfills the stringent discharge limits in accordance with the national environmental regulations.

The developed process can allow oil and gas companies to recycle the treated water, utilize it for irrigation or safely discharge it to nearby water bodies.

> “Implementation of the process will certainly have positive impact on the oil and gas industry and society as a whole in terms of health, economic, and environmental aspects.”

“Implementation of such a process will certainly have positive impacts on the oil and gas industry and society as a whole in terms of health, economic, and environmental aspects,” Dr. El-Naas.

“Treatment of the potentially harmful and contaminated processed water would protect the environment and lessen the chances of exposure to harmful contaminants that may find their way to the main source of potable water in the region (desalinated water), if this waste is disposed of untreated into the Gulf waters.”

Recycling the treated wastewater in irrigation and other useful applications would reduce the need for large amounts of desalinated water and hence reduce the costs associated with water desalination, he further said.

Already, as Dr. El-Naas said, a patent application for the innovation has been filed in the United States, Canada and the United Kingdom.

Research in Video Games

DO YOU FIND ENGINEERING DIFFICULT? HELP COMING THROUGH ANIMATION VIDEO GAMES

"WITH THE GAME SOFTWARE MARKET EXPECTED TO HIT $100 BILLION BY 2018, THIS IDEA CAN BE GENERALIZED IN UNIVERSITIES AND SCHOOLS TO CREATE SPECIFIC VIDEO GAMES FOR ALL SUBJECTS ESPECIALLY THOSE THAT ARE SCIENCE-BASED BECAUSE MOST STUDENTS EXPERIENCE DIFFICULTIES IN UNDERSTANDING THEM."

Dr. Samer Ahmed

According to a study, under normal circumstances students' attention and concentration span in most cases during lectures is likely between 10 and 15 minutes even though university classes last between 50 and 90 minutes. Coming into play are factors like motivation, emotion, enjoyment and time of day, the study found out. In consequence, students have been discovered not to retain much of the lectures they attend.

Both students and faculty also agree that the traditional methods usually used in class are not enough to attract students' attention. For engineering and science courses, especially, it is necessary to attract students and young people to a specific topic in order for them to like, enjoy, and fully understand it.

This could be achieved through developing scientific animation video games designed for specific engineering courses as in a project being undertaken by Dr. Samer Ahmed, an associate professor in the Mechanical & Industrial Engineering Department of College of Engineering at Qatar University, and Mr. Mohamed Bassiony, a research assistant at the same department. The games will be similar to the common Xbox and PlayStation animation games that many young people like, which involve airplanes, racing cars…etc.

Dr. Samer Ahmed with Mr. Mohamed Bassiony

The idea started when the Combustion Institute, the main international organization for experts and all people interested in combustion science, called for new ideas to attract students to study and do research in combustion. There were suggestions such as establishing a summer school for students where they would be taught the fundamentals of combustion.

However, Dr. Ahmed felt that such an idea would only benefit the few students who could attend the summer school. It was then he proposed the idea to create scientific animation video games of combustion engines such as the jet engine used in the airplanes, spark ignition engine used in cars and motorbikes, and diesel engine in trucks and ships.

Then, in the game, the user has to understand certain scientific fundamentals presented in a simple way in order to adjust some operating conditions and select suitable designs to perform well and win the game.

"Conventional teaching methods are not adequate any more to attract student attention and help them understand the important fundamentals of mechanical engineering courses, as one of the important fields in Qatar and worldwide," Dr. Ahmed said. "Moreover, there is a global interest to attract more young people to do research in the area of fuels and combustion."

Solution

The solution is about developing scientific animation video games to attract undergraduate engineering students and young people for enhancing their understanding of the scientific concepts of their course, or any other engineering course, with an attractive and enjoyable, engaging-learning method, Dr. Ahmed said.

It may involve story telling about engineering issues that need to be solved and throwing up challenges that need to be eased out to get to the goal. The students will explore the game by some environmental challenges. According to Dr. Ahmed, students will be challenged to design, customize and select the proper components from spark ignition engines, the basic fundamentals of internal combustion engines to solve puzzles and environmental and geographical challenges in the route of the game.

Spark Ignition Engine (SIE)

The game will involve five types of Spark Ignition Engines: 4 cylinders-inline, 8 cylinders-V shape, 12 cylinders-W shape, 8 cylinders-supercharging and 8 cylinders-turbocharging. The models can be Toyota, Nissan, Ferrari, Rolls Royce and Broche.

Several criteria came into play while Dr. Ahmed considered the video game approach. First of all, it is considered as an easy way to reach as many students and young people as possible because of its enjoyable approach to attract young people to the field of combustion.

It will attract the attention of students to

the importance of the combustion field by linking the science part with the common transportation methods that they see and use all the time.

Again, since most of the video games of young people involve cars, motorbikes, airplanes, etc. therefore, it will be easy to get their interest to the combustion science by creating games that involve the engines of these machines.

These animation video games can also be used as an activity part in combustion courses that are taught to undergraduate mechanical engineering students. These games will encourage them to understand the fundamentals of this science in an enjoyable way instead of poring over lectures and movies that do not involve any interaction with the students.

By showing the different components of these engines in the animation video games, the students can be prepared for the experimental part of the combustion courses in a safe and fun way. Dr. Ahmed said this idea can be generalized in universities and schools to create specific video games for all subjects especially the science ones which most of the students find difficult to understand.

He said three animation video games would be developed in the initial stage in the chosen media centre for the jet engine, the spark ignition engine and the diesel engine.

Economic and social benefits

The animation games are expected to play a significant role in attracting young people to study and do research in the combustion field. That is because they simply link very important transportation means in daily life with the science and combustion fundamentals in enjoyable games.

This is very important to the Qatari economy as it mainly depends on the oil and gas industry. That is why one of the vital missions of the College of Engineering at Qatar University is to attract more high school students to study engineering and in particular mechanical engineering. The proposed games will help significantly achieve this goal.

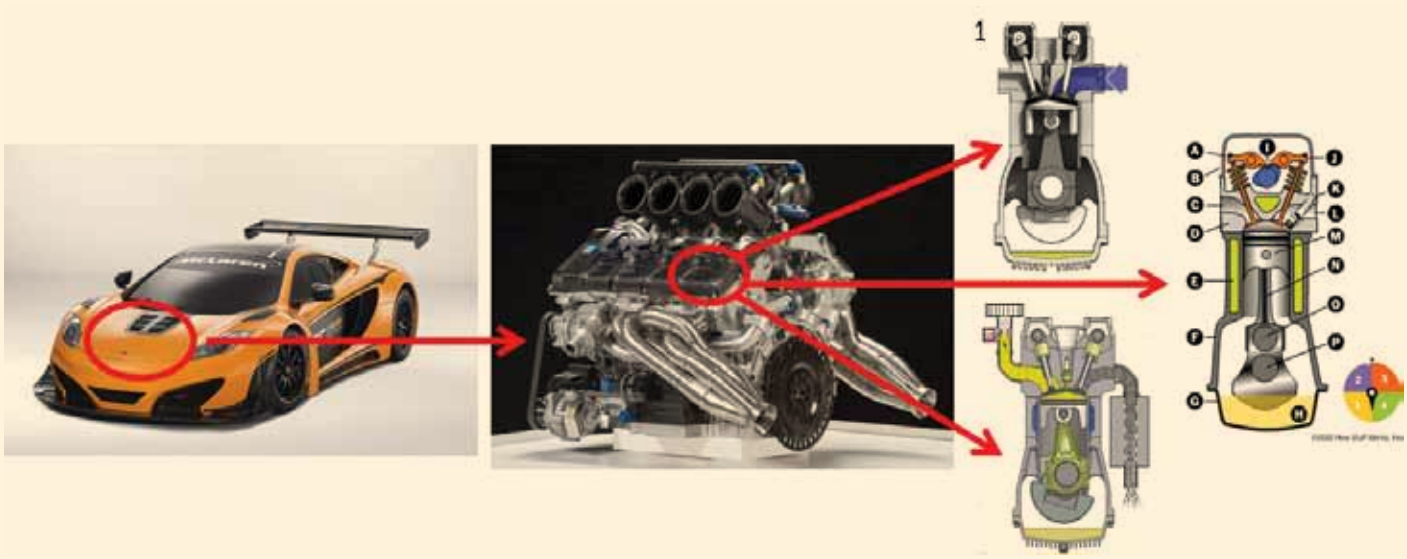
In addition, as mentioned in the supporting letter of the Combustion Institute, there is an international interest to attract more young people to this field because of the huge impact it would make in improving energy efficiency and reducing emission in the world.

The project team consists of Dr. Ahmed, the team leader who initiated the idea, and a research assistant who helps in preparing the required materials for developing these games.

Dr. Ahmed is a specialist in the combustion field. He has taught a number of undergraduate and graduate combustion courses. He currently

> “Games will encourage them to understand the fundamentals of science in an enjoyable way instead of poring over lectures and movies that do not involve any interaction with the students.”

supervises the MSc thesis of three graduate students in combustion related topics. In addition, he has a recognized published track in top journals and international conferences in the field of combustion. The research assistant is one of the top graduates in the field of combustion. He is currently involved in a



number of research projects in engines and combustion.

The animation video game is an easy way to reach as many students and young people as possible. It is an enjoyable way to attract young people to the field of science and engineering, in general.

It will attract the attention of students to the importance of these fields by linking the science part with everyday life applications.

These animation video games can also be used as activity part in courses for undergraduate engineering students. They will encourage them to understand the fundamentals of the course in an enjoyable way instead of just poring over lecture notes and movies.

By playing these games, the students can be prepared for the experimental part of the courses in a safe and fun way. With the game software market expected to hit $100 billion by 2018, this idea can be generalized in universities and schools to create specific video games for all subjects especially those that are science-based because most students experience difficulties in understanding them, Dr. Ahmed said.

Funding for the development of the project idea was provided by the Qatar Science & Technology Park (QSTP) under project no QIPA1-0701-14013.

Commendation by the Combustion Institute

After coming out with the video game idea, Dr. Ahmed was commended by the Combustion Institute. A letter signed by Katharina Kohse-Höinghaus, president of the institute read: “Thank you for your very interesting initiative to develop animated video material for undergraduate students in energy and combustion science as well as in the general natural science and engineering disciplines. As we understand from your plans, the aim is to make students understand the importance of design variables in combustion engines, for example regarding energy efficiency. Appreciating and learning such fundamental strategies is of preeminent importance in the global energy scenario of the future. Your proposed activity is particularly innovative in that it offers to use video games for the student target groups. They may learn from such animations with both pleasure and scientific curiosity.”

“Our mission at CLU is not to be only a professional analytical model complex but also a cutting edge research platform for students and researchers as well as industry and to be highly recognized as a leader for the attainment of Qatar National Vision 2030 in terms of economic and social development of the whole community.”

Dr. Saeed Al-Meer
CLU Director

Celebrating Excellence

Success is all about being **creative, active and team work** - Prof. Hamouda

Team work, believing in yourself, hardworking, and availability of resources are critical for success. If you set out for a goal without the assurance that all that is needed is available, then you can be sure that the objective is stuck. Counting the cost in terms of material and human resources is critically necessary. For researchers, it is a sine qua non. They need their colleagues for breakthroughs. This is the foundation upon which success stories are built and anchored.

Global higher education changed during the past 10 years, networking, internationalization and teamwork are essential ingredients for success. These days there is more international collaboration and universities are becoming more global. Today, one-third of all papers have authors from more than one country. Recently, there is a lot of focus on interdisciplinary science, which is what is needed because the solutions to many of the world's most pressing issues do not lie in single disciplines.

This has played a great role in the research endeavors of Prof Abdel Magid Hamouda, Associate Dean for Research & Graduate Studies, College of Engineering at Qatar University, who was honored with the Research Excellence Award at the Qatar University Annual Research Forum 2016.

In any competitive environment, nothing is taken for granted. You have to do it yourself and believe in yourself. For him, success can only be measured in terms of hardworking, availability of research funding and teamwork. Without these, it would have been difficult for him to have recorded the successes he has had. Even with the diversity of research funding available through the Qatar National Research Fund (QNRF) as well industry, he said he could not have been able to achieve much without the contributions and support of his team members.

Interestingly, Prof. Hammouda said the award should not have been attributed to him alone as the narrative goes beyond him and involves people and expertise from other disciplines and subject areas. “My research spans across areas. I don’t work alone because I don’t believe in it. I believe in teamwork. Even this award should be more to my team than me,” Prof. Hamouda said. Dr. Hamouda is hopeful that Qatar University may develop an award for the team rather than an individual. “If you want to encourage multidisciplinary teamwork, that should be the way forward.

I think the days of single authorship are over. It is very much narrow. You cannot discuss by yourself. Ideas come through cross fertilization of ideas,” he further said. He is optimistic about the future; believing that Qatar University can confidently compete with its more established Western counterparts and “I am even more confident in taking on the Ivy Leagues”. He enjoys mentoring and being mentored and believes in learning from others, sharing knowledge and experiences. “Seniority is not about rank or admin position. It is about engagement; interacting with others.

Seniority is about how you can make the team work together and lead the team to do the right thing,” he said. Prof. Hamouda looks forward to seeing mentorship as core business in the universities such that professors and researchers become role models to students and research assistants, encouraging them to start building their careers. “You have to have a culture of feeling good when your student’s paper is published in a good journal. Everybody has to be rewarded for what they do. They need to be appreciated. We celebrate success when a good paper is published.You encourage them to get published in the leading journals. You set the standard for them so that they don’t go for the very low quality journals,” he said. He encourages having papers reviewed several times before they are finally submitted for publication, although having a paper reviewed for more than once is sometimes tedious and most researchers do not like doing it several times. He said it is important to encourage students to embrace the practice, because “when you want to publish in a leading journal you don’t expect easy feedback after sending your paper for publication.”

Prof. Hamouda said he had never responded to reviews alone as he has had to share them with his students and team members. “This enriches their experience and knowledge. That is how to build a strong team,” he added. His research focuses a lot on engineering materials and design even as he collaborates with colleagues in other areas like quality and reliability engineering; playing a supportive and complementary role as “diversity is strength”. But this could also be a source of weakness to others who do not feel comfortable working with their colleagues.

“Having a partner to work with is very important in research”, Prof. Hamouda further reinforced. Accordingly, he has been lucky to have worked with a lot of experienced colleagues.

Prof. Taher Ahmed Al-Sahaf, VP for Research, Kuwait University awards Prof. Abdel Magid Hamouda

Celebrating Excellence

Science is fun, says Sadaf winner of 3 MT competition

Dr. Sadaf Riaz, graduate student in the College of Pharmacy won the 3 Minute Thesis (3MT) competition at the Qatar University Annual Research Forum 2016 (QUARF 2016). Having developed profound interest in science and its benefits for the society, Dr. Riaz believes that everything about this area of knowledge is fun and should be related to as such. It is in this light that she said the award provided her the opportunity and ability to distill her research and find the key points for her story.

"I was able to present my research to a non-specific audience and see what other people think about it. Moreover, it was a lot of fun and I believe that's how science is supposed to be! I am extremely honored and appreciative for receiving this significant award which boosted my confidence as a researcher to go further and take up more challenges," she said in response during an interview.

Prof. Mariam Al Maadeed, QU VP for Research & Graduate Studies awards Dr. Sadaf Riaz

She loves being challenged to explore and discover new things. "I love how at the end of the day I have a physical result of my work and the satisfaction that the work I do could be instrumental in saving a life one day." But beyond this, she said it is also important to have passion and dedication for the work that one does.

"As a researcher, you would be spending a big chunk of your day tackling your research so make sure that it is what you love. A combination of passion, hard work and, perseverance are my recipe for success," Sadaf discloses.

She is quick to point out that she could not have been successful without the contribution and mentoring of her supervisor, Dr. Fatima Mraiche, Assistant Professor and Chair of the Pharmaceutical Sciences Section at the College of Pharmacy, Qatar University. According to Sadaf, Dr. Mraiche has successfully managed to build up a very well-equipped and highly productive laboratory in a few years.

"I was fortunate enough to be accepted in her laboratory under her mentorship for my Master's research project. Her mentorship was central and paramount in providing a well-rounded experience. She encouraged me to not only grow as a researcher but also as an independent thinker. She allowed me to develop my own individuality and self-sufficiency by being allowed to work independently.

All of these qualities are critical to have when you move ahead into your PhD studies. I have been extremely lucky to have a supervisor who was so resilient and who was always available for her students. Her guidance, spirit of perseverance, and wisdom will always serve as a guiding light wherever I go," Sadaf said as she extolled the qualities of Dr. Mraiche.

The winning thesis project was focused on the cardiovascular system, specifically on the increase in heart size which in scientific terms is known as cardiac hypertrophy. If it is left unresolved it leads to heart failure and sudden death. This increase in heart size occurs when there is an uncontrolled destruction and damage to the heart and to the surrounding support structure.

"In our research we found that certain cells that are involved in the maintenance of the heart and surrounding structure were being up regulated in the pathological condition. Interestingly, we found that when we blocked or inhibited these cells we were able to regress the heart cells back to their normal size!" Sadaf pointed out. The World Health Organization (WHO) predicts that by 2030, 23.3 million people can die of cardiovascular diseases with heart failure being the leading cause of death amongst them. In Qatar, heart diseases contribute to a large share of deaths annually. Hence, there is an immediate need to address this issue regionally as well as globally.

"We believe that our discovery is highly significant because currently, there are no medications or therapies that can cure the increase in heart size. Many treatments are available that can only improve the symptoms at most or slow down the pathological process.

We now believe that these pathologically up regulated cells which are scientifically known as "Cathepsin B" are a potential therapeutic target for the treatment of a specific kind of cardiac hypertrophy," the 3MT winner said.

She advises young women to pursue excellence in all they do. "Dream big, work hard, stay focused and surround yourself with good people. Don't fall into the expectations of others.

Own it and make it happen! And most importantly, don't forget to stay humble," she admonishes, adding, "The branch that bears the most fruit bends itself thankfully towards the ground."

Young people have to get involved in **research communities** - Khaled

He encourages young people to work hard towards success and accomplishment and learn how to integrate and become involved in research communities through participating in seminars, workshops, professional development sessions, and conferences. He also believes that young people should endeavor to benefit from all the opportunities that are offered to them and also importantly, enjoy what they do.

These words of encouragement were offered by Khaled Hassan Rabie, Teaching Assistant in the Department of Civil & Architectural Engineering at the College of Engineering, Qatar University, who won the Outstanding Thesis Award during the Qatar University Annual Research Forum 2016.

Speaking on what does the award mean for him, Khaled said receiving the Qatar University Outstanding Thesis Award was a great honor for him and would definitely help him in doing the best for his academic future and the society. "It reflects the high level of education that graduate students receive at the College of Engineering of Qatar University. One of the main factors that attracted me to enroll for graduate studies at Qatar University is the research opportunities offered by colleges and departments. Since I joined the master of Civil Engineering Program, I looked out for opportunities for excellence in research by doing something that would contribute to the knowledge and benefit the society. Winning Qatar University's outstanding thesis award for the 2015-2016 Academic year ensured that I was in the right track," he said.

His thesis on "Drained residual shear strength of fine-grained soils and soil-solid interfaces at low to medium effective normal stresses: analyses and applications", was an embodiment of an extensive experimental program as well as a comprehensive analytical and numerical investigation to fill a clear knowledge gap, he said. "The findings contribute to advancing the knowledge on parameters needed for the design of energy (oil and gas) off-shore and on-shore pipelines, and the stability analysis of shallow soil slopes. " Khaled said that due to the great amount of work, importance of findings, and the high level of data presentation, the results of this thesis have been published in top international geotechnical engineering journals from USA, Canada, and UK. The journals are International Journal of Geomechanics, Engineering Geology and Canadian Geotechnical Journal.

According to him, the developed equations and charts from the study could also be utilized by civil engineering practitioners as well as undergraduate and graduate students. On his motivation and philosophy for success, Khaled said he has had a passion for learning more about the area of geotechnical engineering since he joined the civil engineering profession. "When I like something, I enjoy it no matter how difficult it is. I was motivated by the great scholars in the area of geotechnical engineering such as Karl Terzaghi who was recognized as the Father of Soil Mechanics, and so many others. I always wanted to be like them as they have always been a source of inspiration for me. My family also provided me with the ultimate support towards success," he said.

Khaled paid tribute to his thesis supervisor, Dr. Hisham T. Eid, Professor of Civil Engineering, whom he said he was indebted to his valuable support, guidance and encouragement during the experimental work, analysis of the results, and the preparation of the thesis manuscript. "Without his assistance and patience, the thesis would not have been possible," he further said.

Prof. Mariam Al Maadeed, QU VP for Research & Graduate Studies awards Mr. Khaled Hassan Rabie

News

Opportunities for prospective students at QU Grad Open Day

QU President Dr. Hassan Al-Derham with VP for Research & Graduate Studies Prof. Mariam Al Maadeed and Dean of Graduate Studies Dr. Ahmed Elzatahry

Qatar University (QU) organized its Graduate Open Day event recently. it aimed to provide information to prospective graduate students on the vast number of diverse graduate programs offered at QU and to familiarize prospective students on admission requirements and registration procedures.

Visitors to the various stands had the opportunity to meet with program faculty, graduate staff, and current graduate students to learn about graduate programs and graduate life at QU.

The event featured information and activities spanning 34 graduate programs comprising four Diploma programs in Education, 25 Master's degree programs, 1 PharmD program, and four PhD programs with 15 areas of concentration.

There was opportunity for the visitors to learn about the many research centers associated with graduate study and graduate research at QU.

They were also able to network with current QU faculty and researchers, industry specialists from various sectors (i.e. Health, Energy, Social Sciences, Information Technology, etc.) and other prospective graduate students.

Commenting on the event, QU VP for Research and Graduate Studies Prof Mariam Al-Maadeed said: "We are happy this opportunity will enable students to choose the right courses and follow their career paths knowing that every individual deserves high quality education and that educational opportunity is a basic human right.

"It demonstrates QU's commitment to high-quality graduate education in areas of national priority; especially with respect to the development of the people of Qatar to

Dr. Mahjoob Zweiri

enable them sustain a prosperous society as articulated in the Qatar National Vision 2030."

QU Acting Dean of Graduate Studies Dr. Ahmed Elzatahry said: "The Graduate Open Day Event is all about bringing to the forefront the diverse graduate programs and the vast array of graduate research and academic support services available at Qatar University.

Dr. Ali Al-Kubaisi

Graduate Studies is dedicated to cultivating a strong graduate community as well as a positive graduate student experience, and we feel strongly that commitment begins with supporting the university's recruitment efforts to attract high-caliber graduate students to our programs."

Dr. Mahjoob Zweiri, Chair, Outreach Committee of Gulf Studies Program, said it is unique in the whole world and follows the interdisciplinary approach as the students will be studying history, economics, politics, media and everything about the Gulf in the Gulf.

He said the MA and PhD programs are in line with the Qatar National Vision 2030 with regard to serving the community, the region and the world.

For the Department of Computer Science and Engineering in the College of Engineering, its participation enabled it to "valorize our programs to let people know more accurately the content of the program and mainly the scientific background, achievements and success stories of our programs," said Dr. Ali Mohamed Jaoua who represented the department at the Graduate Open Day.

Ahmad Ahmadi, Graduate Assistant in the Department of Biological & Environmental

Dr. Ali Jaoua

Sciences, encouraged new students to apply for master and PhD programs to see and prove that "environmental sciences touch our lives as students can apply what they study. This is a major attraction."

Dr. Ali Al-Kubaisi, assistant professor for e-government at the Social and Economic Survey Research Institute (SESRI) at QU, said for students, SESRI has a weekly clinic.

"We help out graduate students with designing their survey instruments and implementing their survey studies. It's an extra service we provide for graduate students. That's one of the reasons we are participating to reach out to students and make them know about the clinic we have. We extend our services not to serve only government bodies but also graduate students in Qatar University."

> "It demonstrates QU's commitment to high-quality graduate education in areas of national priority; especially with respect to the development of the people of Qatar to enable them sustain a prosperous society as articulated in the Qatar National Vision 2030."
>
> - Prof. Mariam Al-Maadeed

Ahmad Ahmadi

Our Exclusive

Interest in sport science heightened at ISAFA meet

QU Virtual reality lab manager Mr Mohamed-Ali Hammami awarded for providing solutions to football training in 3D

Qatar University College of Arts and Sciences (QU-CAS) Sport Science Program recently hosted the International Science and Football Association's (ISAFA) Workshop and Conference in collaboration with major partners from sport, research and education sectors within Qatar and beyond.

The partners included Anti-Doping Lab Qatar (ADLQ), Aspetar, Aspire, Social and Economic Survey Research Institute (SESRI), Qatar Olympic Academy, ISMAI Portugal, and several football clubs from Qatar and abroad such as Al-Jaish FC, Al-Saylia FC, Al Wakrah FC, Benifica Lisboa Portugal and Corinthians Brazil. ADLQ, AD-Instruments, Human Kinetics and Al Rayyan Water sponsored the event which was attended by HE Ahmet Demirok, Turkish Ambassador in Qatar; Dr Khalid Mohamed Al-Khanji, Vice-President for Student Affairs at QU; Dr Eiman Mustafawi, Dean, CAS; Dr. Mohamed Ahmedna, Associate Dean for Research and Graduate Affairs at CAS; and Mr Khalid Al-Mohannadi, Assistant Secretary General, Technical Support at Qatar Olympic Committee.

QU President Dr Hassan Rashid Al-Derham said: "QU is always proud of leading the way to cutting edge events, where academics and scientists could share best practices and apply their theories to impact societies and the end users. The ISAFA meet is with no exception, a unique event, where academics from different parts of the globe exchanged their knowledge towards building the future generation of football professionals and modelling the coming stars in the run-up to the FIFA World Cup 2022 in Qatar and beyond".

The conference, which opening was led by Dr Monèm Jemni, chair of ISAFA and Qatar Olympic Committee professorial chair in Sport Science Program, and Dr Ruben Goebel, Director, Sport Science Program, brought together experts and leaders in football and science from both academia and coaching practice. It was the first time the conference had been hosted in an Arab country after two previous editions in Portugal and Italy. In the run up to the FIFA World Cup 2022 in Qatar, the event provided

a unique opportunity for delegates and attendees to network with policy makers, governing bodies, practitioners, coaches, administrators, and medical specialists,.

It included five days of practical workshops, theoretical lectures, applied seminars, clinics, and two full days of an international academic conference. In total 34 presenters delivered a wide range of content that included practical intervention, oral presentations, keynote speeches, seminars and panel discussion. Additionally, 61 abstracts were accepted after the reviewing process; 41 abstracts were presented orally, with 20 presented as posters, which included three young investigator awards. Accepted abstracts were published as a book of proceedings with ISBN number.

Some of the significant topics covered included the 'Landscape of injuries in football', 'Psychological perspectives in youth soccer', 'Current trends in football fitness coaching', 'Anti-doping program in Qatar' and 'Football's role in global geopolitics'. They sparked great debate, and identified potential future collaboration and research opportunities to improve the landscape of football for Qatar 2022, and beyond.

A number of the delegates and student attendees offered feedback on the success of the event. "It was a great pleasure to attend and deliver a presentation. From the questions received and the interest expressed by the audience I got the impression that this was a high level congress. Congratulations to Qatar University and to ISAFA," said Dr George Nassis, Lead Physiologist, National Sports Medicine Program, Excellence in Football Project, Aspetar. Atharva Tere, attendee from India, said: "I had an absolute blast over the seven days, and really learned a lot as well. I hope to be part of such events in the future again."

Professor Andrew Jones, keynote speaker from University of Exeter, UK, congratulated the organizers on the success of ISAFA 2016, which he said was tremendous. Professor Robert C. Schneider, coordinator of Sport Management Program, The College at Brockport, State University of New York, said it was a wonderful conference in the city of Doha which he hoped would continue to grow into one of the premier cities in the world as 2022 approaches.

Souad Marasstani, Sport Science Program student from CAS, described the conference as an outstanding achievement.

Some of the attendees asked for opportunities to enroll into a PhD program in sport science at QU. Among them was Mr Dan Wixey, who gave a short oral presentation.

As a result of the success of ISAFA 2016, faculty members from the Sport Science program at QU have been invited to deliver talks and keynotes in other conferences, seminars and events in other countries while others joined multi-disciplinary projects with Aspetar and Aspire. Also, because of the success of the virtual reality lab, some delegates and attendees indicated interest in doing some consultancy work.

"It was a great pleasure to attend and deliver a presentation. From the questions received and the interest expressed by the audience I got the impression that this was a high level congress. Congratulations to Qatar University and to ISAFA."

- Dr George Nassis

Research Success Story

QU RESEARCH TEAM TACKLES TWO ENVIRONMENTAL PROBLEMS WITH ONE SMART SOLUTION

A research project conducted at Qatar University and funded by Qatar National Research Fund (QNRF) under the National Priorities Research Program (NPRP) scheme has addressed two global environmental issues, namely carbon dioxide emissions into the atmosphere and desalination concentrated brine discharge into the Arabian Gulf.

Mr. Karam El Ahmed in the lab

Carbon dioxide, a green-house gas, has been identified as one of the probable causes of global warming given the massive quantities emitted globally from industrial activities. Well known research centers across the globe have been monitoring the concentration of carbon dioxide in the atmosphere for decades and found that it has been increasing rapidly in the past few years. Scientists have concluded that planet Earth is struggling to absorb into natural sinks the massive quantities of CO2 emitted from industrial activities.

The United Nations established the Intergovernmental Panel on Climate Change (IPCC) in the late 80's to assess the socio-economic impacts of climate change and through the various working parties of the IPCC, studies were conducted to establish the most probable causes of climate change as well as propose mitigating measures. Amongst these mitigating measures, carbon capture and storage was given a high priority. This gave an impetus for more scientific research on carbon capture techniques and means to dispose of captured CO2.

Given the huge quantities of CO2 emitted, underground storage was identified as the most promising solution. However, to store large amounts of CO2 underground safely for thousands of years, the injection sites must have the right underground geology. These could be depleted oil and gas reservoirs, deep saline aquifers for instance. Unfortunately these suitable sites are not available everywhere in the planet and some geologies may be challenging, thus raising prospects of leaks that no one would be prepared to accept responsibility for.

Faced with such dilemmas, researchers started to look into alternative solutions to underground storage of captured CO2, even if it means dealing with smaller quantities than the globally emitted. It has to start somewhere. These alternatives options for carbon management were given the attractive name of "carbon utilization", which suggests that CO2 may not always be considered as a waste but as a potential valuable resource. Unfortunately the CO2 molecule is very stable and would require a great deal of energy to convert it into other harmless or more valuable compounds unless some "smart" chemistry is involved.

This challenge to convert captured carbon dioxide into harmless or more valuable compounds inspired Qatar University College of Engineering professor of chemical engineering, Farid Benyahia to invest his creativity in carbon conversion solutions. Through thorough literature studies and involving undergraduate students to test his ideas in graduation projects, he was eventually led to submit a research proposal to the QNRF under the NPRP funding scheme. The research proposal was prepared after years of low cost testing bench scale chemistry involving a chemical reaction between carbon dioxide gas and salt in brine solutions in the presence of ammonia. Remembering that carbon dioxide and concentrated brine are considered as environmental issues in Qatar and indeed in most countries that rely on desalination for freshwater supplies, this chemical reaction scheme proved to be worth researching further. The research proposal submitted to QNRF promised to tackle two challenging environmental issues in one solution which is based on chemical reactions. The detailed research proposal was evaluated by international experts for its relevance and merit and eventually awarded in late 2009. The funded project had several deliverables that included research capacity building, creating new knowledge and possibility of creating intellectual property for carbon management.

From the project fund, a research assistant, Mr. Karam El Ahmed, who graduated in

chemical engineering from QU was hired and encouraged to enroll in the newly established QU Environmental Engineering Master Program with full financial support from the NPRP fund. The team led by Professor Benyahia worked hard over the duration of the project to study the intricacies of the chemical reaction between carbon dioxide and salt in desalination reject brine in the presence of ammonia. One of the challenges faced was the economic feasibility of the proposed carbon management process. In order to address this challenge, the researchers designed state of the art chemical reactors where captured carbon dioxide is converted into a valuable solid product called sodium bicarbonate and ammonia recycled almost 100% while a second product called calcium chloride in solution is produced.

The reactions conditions were meticulously investigated for optimum conditions. In simple terms, Prof Farid Benyahia's team invented a two-step process where carbon dioxide mixed and reacted with brine in the presence of ammonia is recovered in excellent yield and ammonia is recovered almost 100% and recycled in the first step with the benefit of producing calcium chloride solution.

Given the importance of the invention and the positive technology assessment generously provided by consultants commissioned by Qatar Science and Technology Park (QSTP), Prof Benyahia disclosed and filed for an invention patent with assistance from QU legal adviser and US based intellectual property attorneys. The patent application assigned to Qatar University has now been published under US 20160074806 (details published on http://www.freepatentsonline.com/y2016/0074806.html).

The invention was also recognized by QSTP as an excellent example of innovation for a potential business incubator in Qatar in its well-known training program Technology Innovation and Entrepreneurship Program (TIEP) (http://www.qstp.org.qa/tiep/projects/current-projects.html).

The intellectual property arm of QSTP is currently assisting in marketing the invention globally. In summation, Prof Benyahia said: "I take great pride in leading this environmental project funded by the QNRF and supported by Qatar University. Working hard to find potential solutions to challenging environmental problems like carbon dioxide emissions and desalination brine reject in Qatar and the region is gratifying.

My dream is to see the process I developed deployed in Qatar and elsewhere in the world. With the global climate change consequences due to greenhouse gas emissions, we need to channel our efforts in building a strong capacity in relevant applied research. I would like to sincerely thank the QNRF for funding this work and Qatar University for offering infrastructure and various forms of support."

On his part, Mr. El-Ahmed the research assistant, who worked with Prof. Benyahia, said: "I have been fortunate to work on such interesting and relevant project which gave me an opportunity to develop my research skills.

Contributing towards the solution of two major environmental issues like carbon dioxide emission and brine reject is really fulfilling. I take pride in being part of the solution. I also gained considerable valuable laboratory experience, especially about safety.

This has helped me a lot in my career in the civil defense as a hazardous materials engineer. I look forward to seeing the solution deployed on a large scale in Qatar and the GCC".

> "Unfortunately the CO_2 molecule is very stable and would require a great deal of energy to convert it into other harmless or more valuable compounds unless some "smart" chemistry is involved."

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