UNITED ARAB EMIRATES
MINISTRY OF EDUCATION

INNOVATION@UAE

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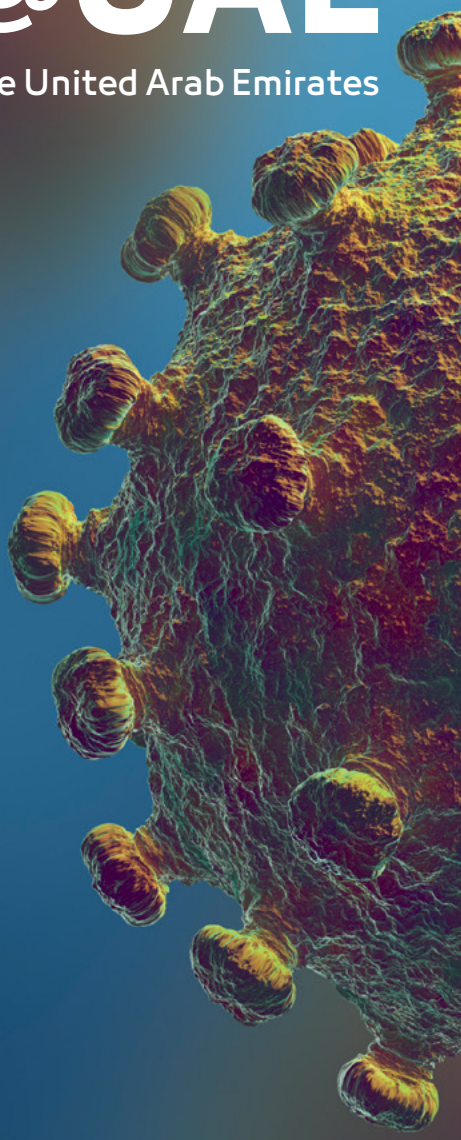

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THE MINISTRY OF EDUCATION IS PROUD TO LAUNCH THE INNOVATION@UAE MAGAZINE

The release of this first issue of the Innovation@UAE Magazine at the end of 2020 comes as the UAE, led by the visionary leadership of His Highness Sheikh Khalifa bin Zayed Al Nahyan, President of the UAE, and His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE, Ruler of Dubai, embarks on its next 50 years ahead of the UAE Centennial in 2071.

Many ambitious goals have already been set for the coming period and beyond, like the UAE Water Security Strategy 2036, UAE Energy Strategy 2050, National Food Security Strategy 2051, and the Mars 2117 Program. These strategies are all focused on uplifting the nation through scientific research and innovation.

That is why the Ministry of Education continues to focus on the higher education sector's research capacity-building, funding, collaboration, and quality outputs. We recognize that academic research plays a critical role in the development of national innovative capacity. The innovation ecosystems that have produced scientific breakthroughs and game-changing technologies are the indirect and direct output of universities that guide, train, and develop young people into researchers, technicians, scientists, and entrepreneurs. The investment we make today in improving and uplifting the UAE's academic research landscape will play an integral part in achieving our nation's many strategic goals.

Given the importance of research to the UAE's future, we are proud to launch the Innovation@UAE Magazine, which will highlight and advance the noteworthy research taking place in the UAE's higher education institutions. For those already working in research, it can show them new ideas and present opportunities for collaboration, and for those young people still charting their paths, this magazine and its stories can inspire them towards the science-based fields that will be integral to the UAE's long-term strategic goals.

His Excellency Hussain Ibrahim Al Hammadi
Minister of Education of the UAE

WELCOME TO THE MINISTRY OF EDUCATION'S INAUGURAL ISSUE OF THE INNOVATION@UAE MAGAZINE

This publication seeks to highlight some of the noteworthy research taking place in the UAE's accredited universities.

Research is how new knowledge is gained and the boundaries of science are advanced. Academic research helps inspire and train young people to become researchers, scientists, and technicians. It is also the avenue through which many researchers are granted the funding, facilities, and support to explore subjects that may not have any obvious economic applications, but still have the potential to reveal new findings and future research paths. That is why it is so important to highlight research taking place in the UAE. It does not only increase our shared appreciation of academic research, but also sparks the interest of young people, attracts the attention of potential collaborators, and even supports innovation through further collaboration and commercialization.

We invite all accredited UAE universities to share their upcoming events, recent research news, and high-impact academic publishing, and nominate their noteworthy researchers. We hope you enjoy this first issue of Innovation@UAE Magazine. Help spread interest in and awareness of research in the UAE by sharing our magazine and its stories with your colleagues and families.

His Excellency
Dr. Mohammad Al-Mualla
Undersecretary for Academic Affairs of the Ministry of Education of the UAE

ZAYED UNIVERSITY PROFESSOR PATENTS CEREBRAL BLOOD VESSEL DISEASE DETECTION PROGRAM

Dr. Fatma Taher, Associate Professor and Assistant Dean for Research and Outreach in the College of Technical Innovation at Zayed University, has patented a method for detecting changes in the brain's blood vessels using a new algorithm technology that leverages artificial intelligence and machine learning.

Her new program could help diagnose diseases such as high blood pressure, strokes, aneurysms, and dementia even before symptoms appear. This is crucial to the timely detection and treatment of such conditions, which the World Health Organization estimates to have caused the death of 5.5 million people worldwide in 2001 alone.

Analyzing blood vessels in the brain to detect disease is a very time-consuming process. It requires the segmentation of highly detailed images that are captured using a technique known as Time-of-Flight Magnetic Resonance Angiography (ToF-MRA), which visualizes the flow of protons within vessels and tissues. Dr. Taher's automated approach to cerebrovascular segmentation will reduce the amount of time it takes to analyze brain scans, therefore accelerating the diagnosis process.

In addition to diagnosis, cerebrovascular segmentation also aids in surgery planning, research, and monitoring.

"For neurosurgeons, analyzing the brain scans manually takes a long time and a lot of effort," Dr. Taher explained. "With the aid of bio-engineers and computer engineers, several computer-aided diagnostic (CAD) systems have been developed to analyze cerebrovascular structures, taking into consideration that any CAD system needs accurate segmentation of the cerebrovasculature from the surroundings. This is the main motivation behind developing our approach."

More information about Dr. Taher's patented technology can be found on the **US Patent and Trademark Office website under US Patent #10,768,259.**

Dr. Fatma Taher
Associate Professor and Assistant Dean for Research and Outreach in the College of Technical Innovation at Zayed University

Source: https://www.zu.ac.ae/main/en/news/2020/April/em-prof-pat.aspx

UNIVERSITY OF SHARJAH AWARDED SANDOOQ AL WATAN GRANTS TO COMBAT COVID-19

SANDOOQ AL WATAN IS A PRIVATE SOCIAL INITIATIVE THAT SEEKS TO SUPPORT NATIONAL DEVELOPMENT, AND EARLIER THIS YEAR IT LAUNCHED A PROGRAM TO SUPPORT COVID-19 RESEARCH

The University of Sharjah (UOS) and Sandooq Al Watan, a private social initiative that supports national development, signed research cooperation agreements for two grants to aid in the battle against COVID-19.

Earlier this year, Sandooq Al Watan launched an initiative to support COVID-19 research under its Applied Research and Development Program, which awarded grants to two research projects from UOS.

The first project, led by Dr. Sameh Soliman with co-investigators Dr. Ahmed Almehdi, Dr. Rania Hamdy and Dr. Mohamed Haider from the UOS College of Pharmacy, aims to design a dual-action antiviral drug against SARS-CoV-2, the coronavirus strain that causes COVID-19. The proposed drug intends to discourage the existence and transmission of the virus, as well as provide a platform to overcome any drug resistance or evolved future viral outbreaks.

The second project, led by Prof. Rabih Halwani with co-investigators Prof. Qutayba Hamid, Prof. Rifat Hamoudi, and Dr. Zainab AlShareef from the UOS College of Medicine, aims to provide a rapid and non-invasive COVID-19 diagnosis. The team will develop a portable biosensor that relies on nucleotide or peptide sequences called aptamers, which can detect the presence of the virus in samples collected from a nasopharyngeal swab. Results will be ready in minutes, and it will be able to distinguish between the SARS 2002 virus and COVID-19. Its input slides can be reprogrammed to detect a new disease, and the device can be used in public spaces.

Sandooq Al Watan's Acting Director General His Excellency Ahmed Fikri and UOS Vice Chancellor for Research and Graduate Studies Prof. Maamar Bettayeb signed the contracts in the presence of UOS Chancellor His Excellency Prof. Hamid M.K. Al-Naimiy.

Source: https://www.sharjah.ac.ae/en/Media/Pages/news-details.aspx?mcid=768&clt=en

NEW CLUES TO THE ANCIENT HISTORY OF THE UAE AND OMAN UNCOVERED BY NYUAD-SPONSORED TEAM

A team of researchers from New York University Abu Dhabi (NYUAD), the University of Pennsylvania Museum of Archaeology and Anthropology (Penn Museum), and Michigan State University have uncovered new details about the prehistory of the UAE and Oman at the Bat archaeological site, an ancient oasis settlement and necropolis in Oman's Hajar Mountains.

Under the Bat Archaeological Project (BAP), extensive field research has been underway at the site since 2007. Excavations explore the Umm an-Nar period (2600-2000 BCE), when modern UAE and Oman were known collectively as "Magan."

Working with the Ministry of Heritage and Tourism in Oman, researchers discovered a new settlement area away from the site's center. Despite being far from any oasis, homes appear to have been organized around an above-ground water source – the first time such a settlement pattern has been observed. The finding means researchers must think differently about how the environment shaped ancient civilization, and it offers many lessons about sustainability that can be applied to modern society.

The project was co-directed by Eli Dollarhide, Humanities Research Fellow at NYUAD, Jennifer Swerida, Visiting Assistant Professor at the American University of Beirut and Consulting Fellow at the Penn Museum at the University of Pennsylvania, and Charlotte Marie Cable, Research Fellow at the University of New England and Research Fellow at Michigan State University.

Together with New Bulgarian University's Prof. Petranka Nedelcheva, the BAP has begun a new study of stone tools from the site, which are the oldest type of artifact found in the region. Other artifacts reveal Bat's connections with its ancient neighbors in Arabia and beyond, suggesting that even in prehistory, Southeastern Arabia was part of wide trade networks spanning the Arabian Peninsula, the Middle East, and South Asia.

THE FINDING MEANS RESEARCHERS MUST THINK DIFFERENTLY ABOUT HOW THE ENVIRONMENT SHAPED ANCIENT CIVILIZATION, AND IT OFFERS MANY LESSONS ABOUT SUSTAINABILITY THAT CAN BE APPLIED TO MODERN SOCIETY

Source: https://nyuad.nyu.edu/en/news/latest-news/arts-and-culture/2020/august/bat-project-eng.html

MBRU RESEARCH FINDS SALIVA TESTING TO BE EFFECTIVE ALTERNATIVE TO NASAL SWAB IN COVID-19 DETECTION

Researchers from the Mohammed Bin Rashid University of Medicine and Health Sciences (MBRU) have completed a collaborative study confirming that saliva is an effective alternative to the nasopharyngeal swab for COVID-19 screening.

Led by Prof. Abiola Senok, Professor of Microbiology and Infectious Diseases in MBRU's College of Medicine, the study was a first in the UAE and the Middle East and North Africa region and a close collaborative effort between the public and private sectors and academia. MBRU's research team was joined by teams from Dubai Health Authority (DHA), Unilabs, Cleveland Clinic Abu Dhabi, New York University Abu Dhabi (NYUAD), and the National Reference Laboratory.

Saliva and nasal swabs were collected from 401 adults who had tested positive for COVID-19 at Al Khawaneej Health Center, 50% of whom were asymptomatic. The samples were tested for the virus at Unilabs Dubai. The team found that saliva was just as effective for detecting COVID-19 as the nasal swab, with 70% sensitivity and 95% specificity.

The use of saliva could exponentially widen the testing network for COVID-19, simplify community testing, and reduce the risk to frontline healthcare professionals. Patients collect their own saliva specimen in sterile containers, without the need for a healthcare professional to be present, and the samples do not require any preservatives to be transported to the laboratory. This means saliva testing could present a cost-effective method for mass testing.

The study is one of the first studies in the UAE to receive approval from the Emirates Institutional Review Board for COVID-19 Research.

A paper on the study was recently published in the peer-reviewed journal *Infection and Drug Resistance*.

Prof. Abiola Senok
Lead Investigator of the study and Professor of Microbiology and Infectious Diseases in the College of Medicine at MBRU

THE STUDY IS ONE OF THE FIRST STUDIES IN THE UAE TO RECEIVE APPROVAL FROM THE EMIRATES INSTITUTIONAL REVIEW BOARD FOR COVID-19 RESEARCH

Source: https://www.mbru.ac.ae/news/mbru-research-uncovers-saliva-testing-as-effective-alternative-to-nasal-swab-in-covid-19-detection/

UAEU RESEARCH FINDS LINK BETWEEN COMMON VIRUS AND 250,000 CASES OF CANCER

Researchers from United Arab Emirates University (UAEU) and the University of Washington (UW) have discovered that more than 250,000 cases of cancer are caused by the common Epstein Barr virus (EBV).

Members of the research team include Dr. Gulfaraz Khan, Professor of Viral Pathology at the College of Medicine and Health Sciences of UAEU, Dr. Luai Ahmed, Associate Professor at the Institute of Public Health, Dr. Christina Fitzmaurice, Adjunct Assistant Professor in the Department of Health Metrics Sciences at UW, and Dr. Mohsen Naghavi, Professor of Global Health at UW. A paper on their research was recently published in the *British Medical Journal* (BMJ Open).

About 90% of people around the world are infected with EBV, and most of them never develop any serious complications or disease. In a very small segment of the affected population, however, it can cause autoimmune disease and even cancer.

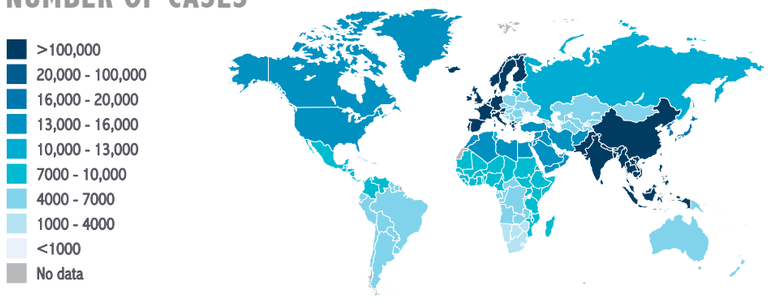
Cancer is one of the leading causes of death worldwide. Prevention is a key component of reducing the huge toll that cancer takes on humanity, and understanding the causes of this complex disease is where prevention begins.

The UAEU and UW team's research sought to contribute to this understanding by estimating the global burden of cancers linked to EBV. The study was the first of its kind to "quantitate the global and regional incidence, mortality, and disability-adjusted life-years of EBV-attributed malignancies by age, sex, geographical region, and social demographic index," explained Dr. Fitzmaurice.

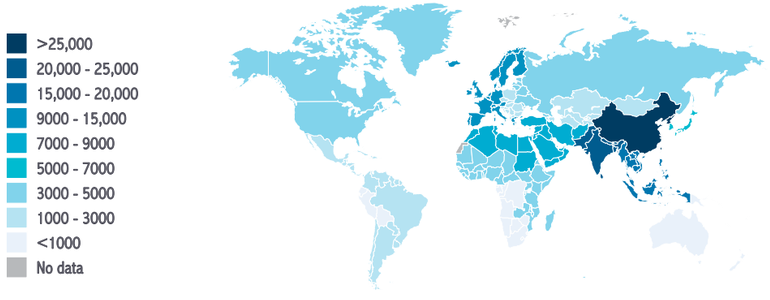
The study revealed that stomach cancer and nasopharyngeal cancer accounted for more than 80% of all the EBV-associated cancers, and both of these cancers were most prevalent in East Asia. As the global population and life expectancy are on the rise, the research team postulates that EBV-linked cancers are also likely to continue increasing.

GLOBAL BURDEN OF ESPTEIN-BARR VIRUS ATTRIBUTED MALIGNANCIES (2017)

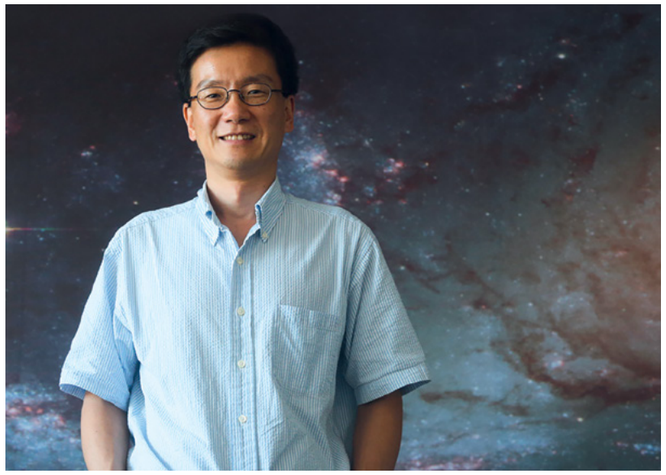
NUMBER OF CASES



NUMBER OF DEATHS



Source: https://www.uaeu.ac.ae/en/news/2020/sept/a-common-virus-is-responsible-for-causing-more-than-250000-cases-of-cancer-a-new-study-shows.shtml



Dr. Yong-Ak (Rafael) Song
Associate Professor of Mechanical and Biomedical Engineering at NYUAD

NYUAD RESEARCHER DEVELOPING MICROFLUIDIC DEVICE TO RAPIDLY EXTRACT AND DETECT COVID-19 DNA AND RNA

Dr. Yong-Ak (Rafael) Song, Associate Professor of Mechanical and Biomedical Engineering at New York University Abu Dhabi (NYUAD), is working to develop a microfluidic device for DNA detection to enable rapid and reliable tracing of the biomolecules of SARS-CoV-2, which causes COVID-19.

Dr. Song's project seeks to detect the presence of virus molecules faster, easier, and more reliably than current testing methods using a microfluidic device. These devices – also referred to as "labs-on-a-chip" – are advanced instruments that can test minute amounts of fluid for the presence of specific molecules or pathogens. His research was awarded one of NYUAD's 10 COVID-19 research grants, as well as the Applied Research and Development program "SWARD" grant from Sandooq Al Watan.

The tests typically used to detect small amounts of viral DNA or RNA from a sample, like the polymerase chain reaction (PCR) test used for COVID-19 diagnosis, rely on an amplification method that requires complicated conditions and preparations and specific constant temperatures. They also take at least 30 minutes to complete and are often prone to errors.

Dr. Song's approach instead uses an electrokinetic pre-concentration technique, where a small electric current is run through a microfluidic channel to drive all target molecules in the sample towards a membrane, trapping them in one place. DNA and RNA can then be extracted without additional samples or molecule amplification. This method could cut testing time and costs, and aid the scientific and medical community in detecting a wider range of diseases.

The team is currently working to improve their technique. Once fully developed, the invention could be used at home for COVID-19 pre-screening, which would allow for more testing and could reduce the disease's spread until a vaccine is available. It can also be utilized to detect other pathogens.

Source: Naser Al Wasmi, New York University Abu Dhabi Public Affairs, https://nyuad.nyu.edu/en/news/latest-news/science-and-technology/2020/september/concentrating-on-covid-19.html

MBZUAI AND WEIZMANN INSTITUTE OF SCIENCE TO COLLABORATE ON AI RESEARCH

The Mohamed bin Zayed University of Artificial Intelligence (MBZUAI) in the UAE and Israel's Weizmann Institute of Science signed a memorandum of understanding (MoU), agreeing to work together across a range of fields to advance the development and use of artificial intelligence (AI) as a tool for progress.

The MoU, which is the first of its kind to be signed between two higher education institutes from the UAE and Israel, covers a range of opportunities for collaboration, including student and postdoctoral fellows exchange programs, conferences and seminars, various forms of exchange between researchers, sharing of computing resources, and the establishment of a joint virtual institute for AI.

The MoU was signed by His Excellency Dr. Sultan Ahmed Al Jaber, UAE Minister of Industry and Advanced Technology and Chairman of the MBZUAI Board of Trustees, and Prof. Alon Chen, President of the Weizmann Institute of Science.

Dr. Al Jaber said: "As a pioneering university, MBZUAI seeks out partnerships with leaders in their respective fields to further our collective scientific understanding and push the boundaries of technological innovation…Through this MoU we can leverage the expertise of both our institutes towards using artificial intelligence to address some of the world's most pressing challenges, from COVID-19 to climate change and beyond."

Prof. Chen was also excited at the prospect of the two institutes working together: "It is said that science knows no borders. I have every hope that this collaboration between scientists in the same region will be a shining example of this expression, and will extend the boundaries of human knowledge."

Source: https://mbzuai.ac.ae/news-events/The-Mohamed-bin-Zayed-University-of-Artificial-Intelligence-and-Weizmann-Institute-of-Science-to-collaborate-on-AI-research

His Excellency Dr. Sultan Ahmed Al Jaber
UAE Minister of Industry and Advanced Technology and Chairman of the MBZUAI Board of Trustees

Prof. Alon Chen
President of the Weizmann Institute of Science

10 students from AUS were honored at the Global Undergraduate Awards 2020 for their work in a variety of areas

AUS STUDENT RESEARCH WINS TOP HONORS AT GLOBAL UNDERGRADUATE AWARDS 2020

A recent American University of Sharjah (AUS) graduate won top honors at the Global Undergraduate Awards 2020, the leading international academic awards program for undergraduate students, while another nine AUS students received regional awards for their entries.

Aishwarya Sriram, an AUS architecture graduate, won the architecture and design award for her project "Bee-Ball Deathtrap," which she produced under the mentorship of Assistant Prof. Gregory Spaw in her fourth-year architecture studio at AUS's College of Architecture, Art and Design (CAAD). Inspired by the moment a giant hornet attacks a Japanese honeybee, Bee-Ball Deathtrap explores the predator-prey relationship prevalent in the natural world.

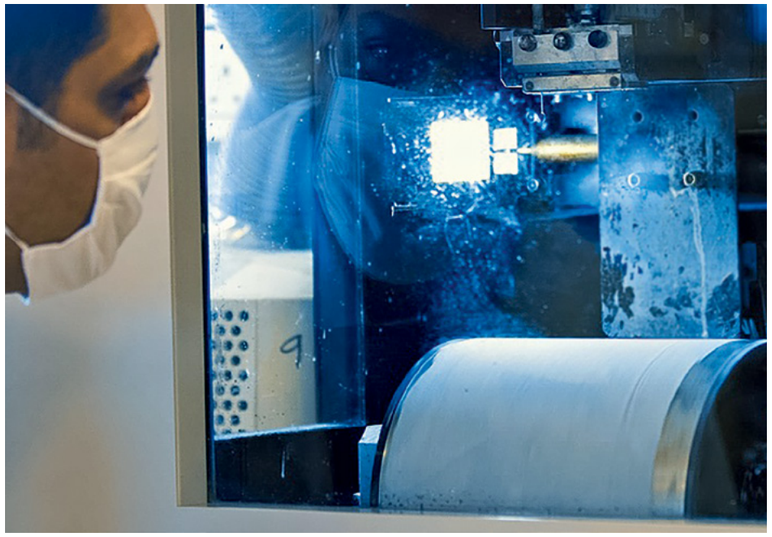
"I chose this project because I felt it is one of my most honest design explorations during my undergraduate studies. I explored the interaction of the two species in two- and three-dimensional drawings and models. Each of the elements involved in this story was codified and given a particular profile in 3D models, which helped simulate the entire attack as if it were frozen in time," Sriram explained.

Nine other AUS students also received regional awards for projects covering a wide variety of topics.

A computer science team consisting of alumni Ali Reza Sajun, Lana Alhaj Hussein, and Dara Sakhnini, and student Brylle Ryan Gomez, won a regional award for utilizing deep learning and the Internet of Things (IoT) to develop a system that labels camera traps capturing images of animals in the wild. Other regional winners from AUS included English major Aya Sallam and mass communication alumna Suzana Osama from the College of Arts and Sciences, and architecture alumni Samrakshana Suresh and Dhruva Lakshminarayanan from the CAAD.

Several students from AUS's CAAD were also recognized with highly commended awards, including Shifa Aaquil, Gheed Ashoor, Nohair Elmessalami (with Sondos Al Sibai), Malak Hawamdeh, Mariama M.M. Kah, Arian Saghafifar and Habibah Salman.

Source: https://www.aus.edu/media/news/aus-student-research-wins-top-honors-at-global-undergraduate-awards-2020



RESEARCHERS FROM KHALIFA UNIVERSITY AND UNIVERSITY OF SALERNO DEVELOP ECO-FRIENDLY ANTIVIRAL FACE MASK

A collaborative team of researchers from the UAE's Khalifa University (KU) and the University of Salerno in Italy has developed the first working prototypes of NavaMASK, a fully biodegradable and biocompatible antiviral face mask.

Made from a novel biomaterial developed by the researchers, for which they have applied for a patent, NavaMASK will offer excellent breathability and strong antimicrobial properties. It can be washed and reused several times before it must be replaced. In addition, disposing of these biodegradable masks will not harm the environment.

The NavaMASK consists of perpendicularly arranged nanofibers with a diameter ranging between 100nm and 600nm, which allow air to pass through but block particles, bacteria, and viruses. Its advanced filtration system and strong antimicrobial properties will ensure >99% removal efficiency of bacteria, thus NavaMASK is expected to outperform many of the face masks currently on the market.

Dr. Shadi W. Hasan, Associate Professor and Theme Lead at the Center for Membranes and Advanced Water Technology (CMAT), led the KU team, which included Dr. Faisal Al Marzooqi, Assistant Professor, Dr. Fawzi Banat, Professor and Chair of the Chemical Engineering Department, and Dr. Musthafa Mavukkandy, Post-Doctoral Researcher in Chemical Engineering.

The KU researchers are currently planning to start Phase II to develop a new second-generation design for the NavaMASK, which will maintain high removal efficiency, high comfortability, and easier breathing, but with fewer layers.

Source: Clarence Michael, Khalifa University English Editor Specialist, https://www.ku.ac.ae/khalifa-university-researchers-develop-biodegradable-and-biocompatible-environ-friendly-anti-viral-adaptive-face-mask-2

KHALIFA UNIVERSITY BECOMES OFFICIAL COVID-19 TESTING CENTER

The Khalifa University Center for Biotechnology (BTC) has been licensed by the Abu Dhabi Department of Health (DoH) as an official COVID-19 testing center, making it the first UAE university with an on-campus facility able to test students and employees for the virus.

The testing service offered at the BTC is linked to Malaffi, a centralized database of real-time public health information, as well as to the Alhosn app, Abu Dhabi's official COVID-19 results and contact tracing app.

In the run up to the licensure, the BTC upgraded its laboratories to include a routine diagnostic arm to further increase the nation's testing capacity, if required. The BTC has already passed the proficiency test by the Abu Dhabi Quality and Conformity Council and will routinely report to the DoH operations center.

"The center has a state-of-the-art molecular genetic laboratory, which spans every basic competency from DNA and RNA extraction to next-generation sequencing," explained Dr. Habiba Alsafar, Director of the BTC. "Since the COVID-19 outbreak, the BTC laboratory has had to pivot very quickly and add two arms to its research capability, namely diagnostics and manufacturing services. These capabilities give decision-makers a string of competencies that they can call on to manage the current and future disease outbreaks."

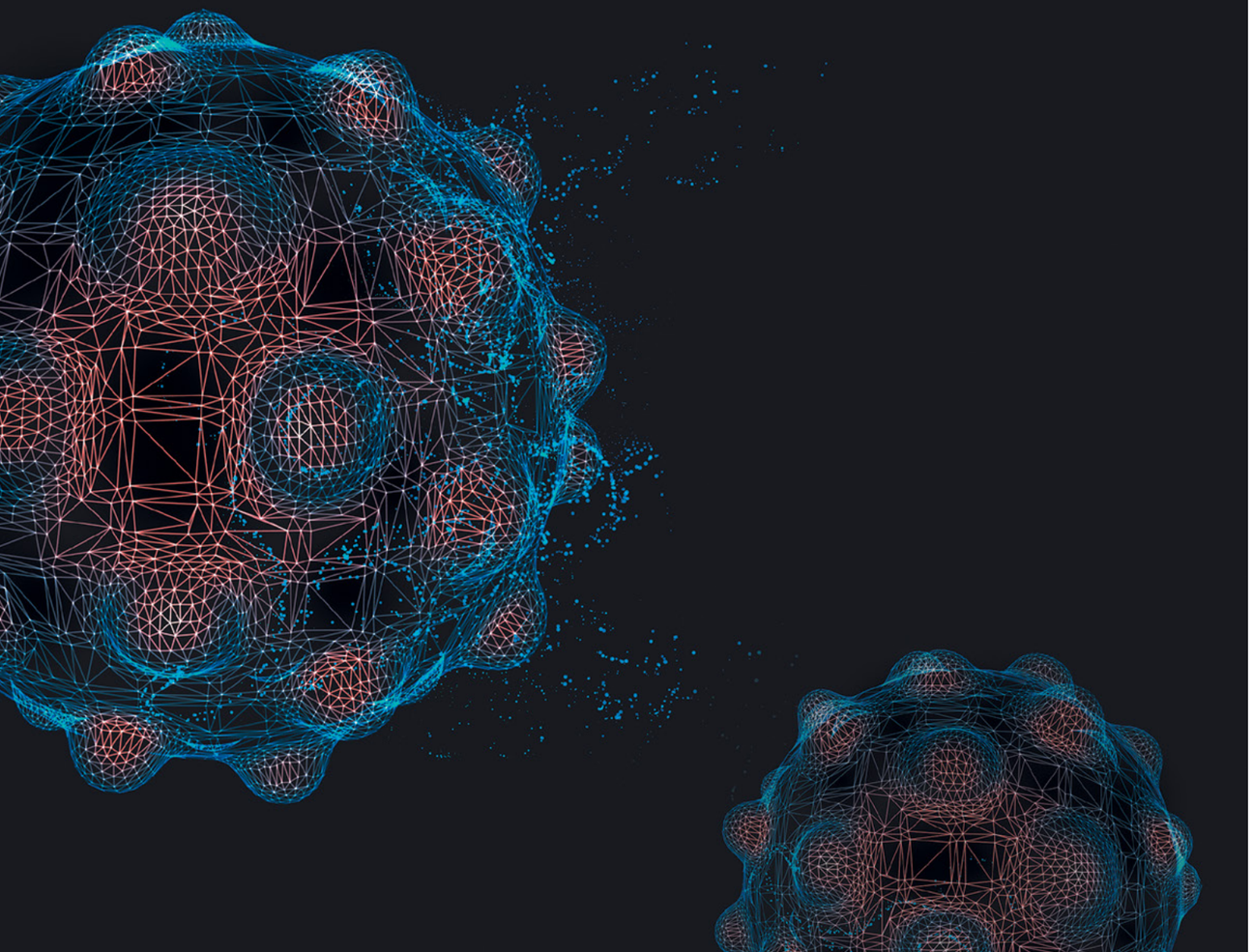
Dr. Alsafar also leads a multidisciplinary team from Khalifa University working with other institutions across the globe to investigate how the COVID-19 virus, usually found in animals such as bats, has jumped to humans.

Previously, the BTC joined with its partners to successfully manufacture reagents for extracting COVID-19 RNA over the course of just two weeks as part of its contribution to help the nation tackle the challenges posed by the global pandemic.

Source: Clarence Michael, Khalifa University English Editor Specialist, https://www.ku.ac.ae/khalifa-universitys-center-for-biotechnology-receives-doh-license-for-uaes-first-on-campus-covid-19-testing-facilities

SHEDDING LIGHT ON MUTATION IN HYPOXIC CANCER CELLS

A research project investigating cancer cells that can grow and adapt with a limited oxygen supply is hoped to provide some insights into markers for better immunotherapy treatment.



Oxygen deprivation in a cancer cell occurs when a solid tumor grows quickly, which can cause the core of the cancer to become too distant from the blood vessels supplying it with oxygen. While a lack of oxygen, or hypoxia, can be detrimental to normal human cells, it can strengthen cancer cells' resistance to treatments. However, scientists believe that the same hypoxia that impedes chemotherapy and radiation treatment in cancers can be used to identify mutated cells and develop targeted therapies to combat this devastating disease.

That is why Dr. Goutham Hassan Venkatesh, Assistant Professor and Research Scientist at the Thumbay Research Institute for Precision Medicine of Gulf Medical University in Ajman, is leading a research project exploring oxygen deprivation in breast cancer tumor cells. The research team hopes the project will increase scientific understanding of hypoxic tumors, as well as identify unique biomarkers that can be used to develop targeted cancer immunotherapy treatments.

Collaborators on the project include: Ms. Pamela Bravo, Mr. Philippe Dessen, Dr. Jerome Thiery, Prof. Filippo Rosselli, and Prof. Salem Chouiab from the Gustave Roussy Cancer Centre andthe Faculty of Medicine at University Paris-Saclay in Villejuif, France; Dr. Walid Shaaban Moustafa Elsayed from the College of Dentistry at Gulf Medical University in Ajman, UAE; Dr. Bartosz Wojtas from Nencki Institute of Experimental Biology post-doc; Mr. Hussam Hussein Nawafleh, Dr. Francis Amirtharaj, Dr. Raefa Abou Khoza, and Prof. Salem Chouaib from the Thumbay Research Institute for Precision Medicine at Gulf Medical University in Ajman, UAE; and Mr. Sandeep Mallya and Dr. Kapaettu Satyamoorthy from the Department of Cell and Molecular Biology in the Manipal School of Life Sciences at the Manipal Academy of Higher Education in Manipal, India.

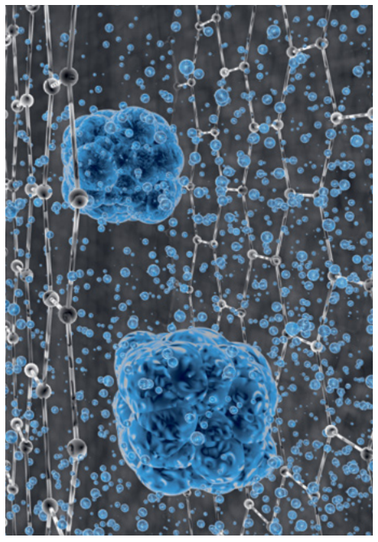
A paper on their research was recently published in the peer-reviewed journal *OncoImmunology*. The project, which began in 2018, was funded by the Sheikh Hamdan Bin Rashid Al Maktoum Award for Medical Sciences.

Explaining the motivation behind this study, Dr. Venkatesh said: "We were interested to identify whether hypoxic tumors acquire mutations. If so, how does this happen? Do the mutations lead to an increase in the tumor mutational burden, which counts the total number of mutations in cancer cells? And do hypoxic cells express any antigens – which are the molecules or molecular structures expressed on the surface of a cell – that are suitable targets for immunotherapy? If we can identify such antigens, we can improve the efficacy of immunotherapy treatments."

Immunotherapy is an emerging form of cancer treatment where specially designed medicines are used to encourage a patient's immune system to fight off the cancer. This approach may prove to be more effective than standard treatments, such as chemotherapy and radiation, for hypoxic tumor cells. Chemotherapy is a systemic treatment that circulates

"WE WERE INTERESTED TO IDENTIFY WHETHER HYPOXIC TUMORS ACQUIRE MUTATIONS. IF SO, HOW DOES THIS HAPPEN? DO THE MUTATIONS LEAD TO AN INCREASE IN THE TUMOR MUTATIONAL BURDEN, WHICH COUNTS THE TOTAL NUMBER OF MUTATIONS IN CANCER CELLS?"

Dr. Goutham Hassan Venkatesh
Assistant Professor and Research Scientist
Thumbay Research Institute for Precision Medicine, Gulf Medical University



chemotherapy and radiation last only as long as the treatment does.

While immunotherapy is considered a promising emerging treatment for cancer, it is estimated that only 20% to 30% of cancer patients respond to the drugs that boost the immune system's ability to target cancer cells.

"Several tumor-related factors contribute to the resistance to immunotherapy, including the presence of hypoxia in the tumor core. A hypoxic condition in the cancer core makes it difficult and inaccessible for immune cells to identify and kill the tumor cells," Dr. Venkatesh noted.

One of the reasons for the poor immunotherapy response is the lack of defined biomarkers for cancer cell mutations, which are used to develop targeted immunotherapy.

"Currently, the total number of mutations in the cancer cells, which is called the tumor mutational burden, or TMB, is used as a biomarker for predicting the immunotherapy treatment response, meaning it helps us know how well the treatment will work or not. We were interested to identify whether hypoxic tumors acquire such mutations, and if so, how does this happen? Do these mutations lead to an increase in TMB?"

To explore hypoxic tumors for mutations, the team analyzed breast cancer cells, looking specifically at their DNA damage and identifying the mutated antigens that are expressed on the surface of a tumor, called neoantigens. They found that hypoxic tumor cells express biomarkers that can be used in predicting immunotherapy's effectiveness.

Highlighting the importance of his team's findings, Dr. Venkatesh said, "From our research, we identified that hypoxia, despite being a factor for treatment resistance, contributes to the expression of biomarkers in the form of total mutations and neoantigens. It is our hope that our research findings will improve prospective preclinical and clinical studies into hypoxia, mutations, and neoantigen levels to achieve better immunotherapy outcomes."

The next step for this area of research is to develop therapeutic strategies that target hypoxic cells in combination with immunotherapy to overcome the immunotherapy resistance of hypoxic tumor cells.

"This research offers multiple avenues for treatment, as these neoantigens derived from mutated proteins are ideal targets for cancer immunotherapy. As these antigens are produced in a hostile hypoxic environment, improving the immune system's ability to recognize and attack the cancer cells is a challenge that needs to be addressed in future," Dr. Venkatesh concluded.

WHILE IMMUNOTHERAPY IS CONSIDERED A PROMISING EMERGING TREATMENT FOR CANCER, IT IS ESTIMATED THAT ONLY 20% TO 30% OF CANCER PATIENTS RESPOND TO THE DRUGS THAT BOOST THE IMMUNE SYSTEM'S ABILITY TO TARGET CANCER CELLS

Immunotherapy differs from these standard cancer treatments in that it uses specific medications to improve the body's own ability to target and destroy the malignant cells.

According to the US-based Cancer Treatment Institute, immunotherapy has been proven effective against types of cancer that have historically been resistant to chemotherapy and radiation. Immunotherapy can also provide long-lasting benefits, improving the patient's ability to fight off recurrent cancer. In contrast, the benefits of chemotherapy and radiation last only as long as the treatment does.

Title of published paper
Hypoxia increases mutational load of breast cancer cells through frameshift mutations

Published in
OncoImmunology

Clarivate Analytics journal impact factor: **5.869**

Project funded by
Sheikh Hamdan Bin Rashid Al Maktoum Award for Medical Sciences

Left to right: Dr. Walid Shaaban Moustafa Elsayed, Mr. Hussam Hussein Nawafleh, Dr. Goutham Hassan Venkatesh, and Dr. Raefa Abou Khoza

NEXT-GENERATION TUNABLE RF FILTER TO SUPPORT INDUSTRY 4.0

The growth of wireless communication technologies that are integral to the Fourth Industrial Revolution, or Industry 4.0, has necessitated the development of cost- and power-efficient devices that can tune and filter the radiofrequency (RF) spectrum used in advanced wireless systems.

A collaborative research project has, for the first time, demonstrated the feasibility of a next-generation RF tuning device to allow cost-effective and power-efficient adaptable communication systems. The project is led by Dr. Heba Abunahla, Research Scientist at Khalifa University (KU), and is part of KU's System-on-a-Chip Center, which is dedicated to the design and realization of advanced electronic circuits and systems and sensory devices.

The wireless technologies that modern society uses for many daily activities, like mobile phones and fitness trackers, and that are critical for the growth of the Internet of Things (IoT), transmit data by manipulating radio waves. They do this through tiny specialized sensors, known as RF filters, that send and receive data. As wireless communication has grown, the radio bandwidths used to transmit this data have become more and more crowded. This has necessitated the development of robust RF filters that can automatically and intelligently tune the bandwidth to remove unwanted radio signals – a type of filter known as tunable RF filters.

"Being a crucial component in radio frequency transceivers, filters play a major role in wireless communication, which is among the main pillars of the IoT technology stack. The main purpose of our project was to demonstrate experimentally, after verifying the design with simulations, the feasibility to integrate a new, emerging memory device within the metal of the RF filter to achieve frequency tuning," Dr. Abunahla explained.

The collaborative group includes System-on-a-Chip Center Director Dr. Baker Mohammad, Dr. Rida Gadhafi of the University of Dubai, and Dr. Mihai Sanduleanu, Dr. Anas Alazzam, and Mamady Kebe from KU. A paper on their research was recently published in the peer-reviewed, open-access journal *Scientific Reports – Nature*.

Their project integrates tunable RF filters with the emerging technology of memristor, an electrical component that "remembers" the amount of charge that has previously flowed through it and adjusts its resistance accordingly. Memristor devices are able to retain the data stored within them

"THE MAIN PURPOSE OF OUR PROJECT WAS TO DEMONSTRATE...THE FEASIBILITY TO INTEGRATE A NEW, EMERGING MEMORY DEVICE WITHIN THE METAL OF THE RF FILTER TO ACHIEVE FREQUENCY TUNING"

Dr. Heba Abunahla
Research Scientist
Khalifa University

without the need for a power source. When memristors are used to store data they are referred to as resistive random access memory (RRAM) devices.

Dr. Abunahla's team proposed constructing an RRAM device using graphene oxide – a chemically modified version of the "wonder material" graphene – and integrating it into the metal of the RF filter. Graphene oxide shares some of graphene's noted strength, but is far cheaper and easier to use. Although initially not as conductive as graphene, methods have been developed to enhance graphene oxide's transparency and conductance.

"Graphene-based switching devices are gaining great interest due to their excellent properties in terms of low cost, flexibility, adaptability, and being environmentally friendly. Deploying graphene as electrodes in RRAM devices can increase its conductivity and thus improve the device's performance," said Dr. Abunahla.

GRAPHENE OXIDE SHARES SOME OF GRAPHENE'S NOTED STRENGTH, BUT IS FAR CHEAPER AND EASIER TO USE

The team first tested their hypothesis by designing a detailed computer simulation. To provide a proof of concept, they then developed a prototype tunable RF filter using graphene oxide. While previous research projects have used RRAM as a standalone component to tune resistance, the team integrated the graphene oxide-based RRAM into the metal of the RF filter.

To demonstrate the diversity of the resulting tunable RF filter, the team tested their proposed device design using three different metals – copper, gold, and silver – for its electrodes. All three metals demonstrated the potential to be deployed in the tunable RF filter depending on the intended use of the communication element. The proof-of-concept device used gold to demonstrate the proposed RRAM-based filter tuning. Testing of the prototype device at room temperature for two hours, in both the on and off position, demonstrated that the device was stable and could hold its last written state for up to one year.

Left to right: Dr. Baker Mohammad, Mamady Kebe, Dr. Anas Alazzam, and Dr. Heba Abunahla

"OUR DEVICE ENABLES LOW-COST AND LOW-POWER TUNABLE FILTERS FOR ALWAYS-CONNECTED DEVICES, WHICH IS AN IMPORTANT CONTRIBUTION TO THE UAE'S FOURTH INDUSTRIAL REVOLUTION"

Dr. Heba Abunahla
Research Scientist
Khalifa University

"This project proved the possibility of tuning RF devices using a cost-efficient and power-effective approach. The results exhibited by this project showed promising insights that serve as milestones in the research of memory-based adaptable communication systems," Dr. Abunahla said.

The research team asserted that their project has significant potential for commercialization in the local and global telecom markets. The RF tunable filter market was estimated to be worth $89 million in 2020, and is expected to reach $148 million by 2025, according to research published by MarketsandMarkets.

"Our device enables low-cost and low-power tunable filters for always-connected devices, which is an important contribution to the UAE's Fourth Industrial Revolution, where we foresee large-scale adoption of IoT and artificial intelligence-enabled technologies and systems," Dr. Abunahla explained.

The Fourth Industrial Revolution – or Industry 4.0 – is the ongoing automation of manufacturing and industry through smart technologies like IoT and machine-to-machine communications. Under the Strategy for the Fourth Industrial Revolution, launched in 2017, the UAE is looking to become an Industry 4.0 hub to increase its contribution to the national economy by advancing innovation and future technologies.

The next step for the project is to enhance the filter design to adapt to the fifth-generation technology standard for broadband cellular networks, known as 5G. 5G networks, which were introduced in 2019, have greater bandwidth than previous cell networks. This increased bandwidth enables higher download speeds, which in turn supports more rapid communication, business, and the integration of smart technologies.

Title of published paper
Integrated graphene oxide resistive element in tunable RF filters

Published in
Scientific Reports – Nature

Academic Accelerator journal impact rating: **4.120**

Project funded by
Khalifa University

DEVELOPING A UNIFIED MODEL FOR MEMS ELECTROSTATIC SENSORS

The increasing integration of specialized devices that use changes in electrostatic charges to detect contaminants has necessitated the development of a unified model to efficiently produce more of these devices.

Dr. Mehdi Ghommem, Associate Professor of Mechanical Engineering at the American University of Sharjah (AUS), has assembled a team to develop a model for the most common type of electrically actuated micro-electromechanical systems, or MEMS, devices for sensing applications.

He and his collaborators, Dr. Fehmi Najar from Tunisia Polytechnic School and Mr. Mohamed Arabi, Dr. Eihab Abdel-Rahman, and Dr. Mustafa Yavuz from the University of Waterloo, recently published a paper on their work in the peer-reviewed journal *Nonlinear Dynamics*.

"WE HOPE THAT THE DEVELOPMENT OF A UNIFIED MODEL CONTRIBUTES TO THE FURTHER REFINEMENT OF MEMS SENSORS TO UTILIZE THEM TO DELIVER HIGHER-QUALITY, SAFER LIVING AND WORKING ENVIRONMENTS"

Dr. Mehdi Ghommem
Associate Professor of Mechanical Engineering
American University of Sharjah

Electrostatic sensors convert the presence of a target contaminant in a given media into a resolvable electrical signal. They work by detecting the motion of a vibrating microstructure that has been coated with polymer layers that are highly sensitive to the target contaminant alone.

The rapidly advancing field of micro-electromechanical systems (MEMS) has enabled the integration of this electrostatic sensing technology into micro-scale devices. These devices are able to be produced at large volumes by leveraging the complex and sensitive semiconductor production process to mass-produce tiny, highly specialized "chips" with significant sensing and analysis power.

The resulting "electrically actuated" MEMS sensors consume very little power, respond rapidly, and are compatible with integrated circuit processes. These benefits, along with the cost-effectiveness of the technology, have supported the increasing use of electrostatic sensors in inertial measurement systems, industrial processes, and medical diagnostics. A real-world example of an

THE RESULT OF THEIR WORK WAS THE DEVELOPMENT OF MODELING AND SIMULATION TOOLS FOR MEMS ELECTROSTATIC SENSORS USING CANTILEVERED MICROBEAMS

electrically actuated MEMS device is an inkjet printer head.

However, as beneficial as electrically actuated MEMS sensors are, they are difficult and time-consuming to design as they are very complex. To reduce the amount of time and effort involved in developing these special sensors, Dr. Ghommem and his team sought to develop a unified model for the type of electrostatic sensors that employ cantilever microbeams, which are the most common structures in MEMS.

"Effective models can significantly reduce the time and expense involved in developing MEMS sensors and improve their performance in terms of sensitivity and operating range. Consider a unified model as sort of a shortcut – it provides a useful tool for the development of a range of MEMS electrostatic sensors. A unified model could also improve researchers' understanding of the nonlinear dynamic behavior of electrostatic sensors," Dr. Ghommem explained.

Nonlinear dynamic behavior refers to changes in the output of a material, component, or structure that are not proportional to changes in its input. Many systems and phenomena are nonlinear, like weather, and appear chaotic and unpredictable, although their behavior is not actually random. Due to the complexity of nonlinear systems, they can be difficult to fully model mathematically.

The main challenge the researchers faced was developing a mathematical model that could capture the complex dynamics of electrostatic sensors made of microbeams when operating in both gas and liquid media.

The result of their work was the development of modeling and simulation tools for MEMS electrostatic sensors using cantilevered microbeams. Their unified model was validated by comparing the dynamic responses of a set of chemical electrostatic sensors when exposed to different concentrations of contaminants to their experimental counterparts.

"The need for effective modeling and simulation tools for MEMS has been well recognized by the scientific community over the last few decades. We hope that the development of a unified model contributes to the further refinement of MEMS sensors to utilize them to deliver higher-quality, safer living and working environments," Dr. Ghommem said.

The next step for the project is further collaboration with researchers from the University of Waterloo to build an electrostatic MEMS chemical sensor in liquid media and test its operation following the detection mechanisms identified through the model. The research team is currently working on the development of a sensing set-up based on the motion-electrical current transduction technique.

"We hope that this project opens the door for further investment on the emerging MEMS technology in the UAE," Dr. Ghommem concluded.

Title of published paper
A unified model for electrostatic sensors in fluid media

Published in
Nonlinear Dynamics

Academic Accelerator journal impact rating: **5.030**

Project funded by
American University of Sharjah Faculty Research Grant

EXPLORING IMPROVED MACHINE LEARNING MODELS TO PREDICT CONFIRMED COVID-19 CASES

As the world continues to grapple with the COVID-19 pandemic, researchers and decision-makers are increasingly relying on machine learning models to predict infection rates, which in turn guide public health policies and actions. However, the available models are not completely accurate.

Since initial identification of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) in Wuhan, China in December 2019, the virus has continued to spread across the world. As of early November 2020, over 50.7 million people in 216 countries were infected with COVID-19, and 1.26 million had died from the disease.

To assist efforts to combat the global pandemic, Dr. Amir Ahmad, Associate Professor of Information Systems and Security in the College of Information Technology at United Arab Emirates University (UAEU), has led a team of international researchers in a project to analyze and organize confirmed COVID-19 case-prediction models published in peer-reviewed journals, and proposed suggestions to improve their performance.

His collaborators on the project included Dr. Sunita Garhwal from India's Thapar University, Dr. Santosh Kumar Ray from the Khawarizmi International College in Al Ain, Dr. Gagan Kumar from the Indian Institute of Technology Guwahati, and Dr. Sharaf Jameel Malebary and Dr. Omar Mohammed Barukab from King Abdulaziz University in Saudi Arabia. The team recently published a paper on their work in the journal *Archives of Computational Methods in Engineering*.

"This rapid spread of COVID-19 has greatly burdened healthcare systems. For those working to control and eradicate this disease, being able to predict COVID-19 cases can help them prepare their medical facilities and decide what control measures to put in place," explained Dr. Ahmad. "Machine learning models, which are specialized computer algorithms developed to identify trends, patterns, and inferences from complex and large datasets, are being used to help predict confirmed COVID-19 cases. But right now, the available models face many limitations that must be confronted. That is why we decided to study the published models, to understand how they work, what their challenges are, and what can be done to make them more effective."

As a first step in their project, the team reviewed machine learning models developed to predict confirmed COVID-19 cases that have been featured in peer-reviewed publications. They then developed a taxonomy to organize the models by type, allowing the team to more easily compare the various datasets and machine learning models they employ. A taxonomy in the context of machine learning presents a formal structure of classes or types of objects within a domain, organizing knowledge through a specific vocabulary to make it easier to find related information. The research team's taxonomy grouped the previously published models into four categories: traditional machine learning regression, deep learning regression, network analysis, and social media and search query data-based methods.

After organizing the COVID-19 case-prediction models into these four categories, the researchers identified the models' limitations. One limitation was the widespread use of time series frameworks to predict confirmed COVID-19 cases, a process which relies on past observations to forecast future infections. However, in the context of COVID-19, this approach is limited by the fact that many countries

only began testing for the disease in January 2020, and by the end of May, there were fewer than 150 data points for COVID-19. This means there is insufficient data relating to past cases to accurately predict future infections using time series framework analysis.

Additionally, the research team found that the available COVID-19 datasets were too small for deep learning regression methods, which require large training datasets to generate accurate predictions.

They also observed that the infrequency of pandemics and the specific characteristics of COVID-19 mean that COVID-19 case-incidence prediction models cannot be trained using data from previous modern pandemics like the Severe Acute Respiratory Syndrome (SARS) outbreak of 2003 and the Middle East Respiratory Syndrome (MERS) outbreak of 2012.

The accuracy of COVID-19 case-prediction models is also impacted by poor testing and reporting data. This can be due to unavailability of tests, reluctance on the part of individuals to be tested due to social stigma, and the prevalence of mild and asymptomatic COVID-19 cases.

"Some of the unique characteristics of COVID-19 include the fact that around 80% of COVID-19-affected individuals have mild or no symptoms. These low or no-symptom COVID-19 infected typically do not get tested for the illness, but they are still an important piece in the COVID-19 puzzle because they can infect others. This means that confirmed COVID-19 case numbers used to train prediction models is missing a large chunk of COVID-19 cases," Dr. Ahmad shared.

He and his collaborators noted that how COVID-19 plays out in a population is often highly specific to each country due to factors like population density, environment, culture, government measures, and virulence of prevalent strains. This specificity means that COVID-19 case-prediction models developed using the data from one country cannot easily be applied to other countries.

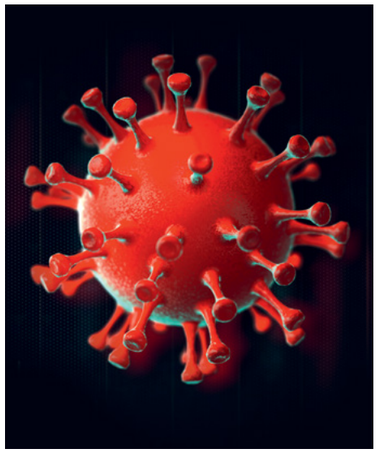
To address these limitations in the available COVID-19 confirmed-case prediction models, the research team proposed some improvements and new research areas. One suggestion was to utilize the models developed by epidemiologists to study the transmission of a disease through a population or predict its impact on people.

"Established epidemiological models, such as susceptible-infected-recovered (SIR) models, have been successfully used for modeling infectious diseases. Machine learning experts should work with epidemiologists to develop hybrid models of machine learning algorithms and epidemiological models that can more effectively predict COVID-19 cases," Dr. Ahmad said.

Some other suggestions related to filling in data gaps for COVID-19 confirmed cases by using other available data. For example, data on the purchasing of medicine to treat COVID-19 can be used to help ascertain infected case numbers in countries where testing rates are low.

The researchers also called for more work to be done to determine how to modify COVID-19 data from one country so that it can be applied to another, such as developing transfer learning models that can take the training used to solve one problem and use it to solve a related problem.

As a next step, Dr. Ahmad and his team are working to implement the suggestions they offered in their published work to develop novel machine learning methods to predict confirmed COVID-19 cases. They intend to combine different models trained on different types of data to offer a better solution for forecasting infections.



"MACHINE LEARNING EXPERTS SHOULD WORK WITH EPIDEMIOLOGISTS TO DEVELOP HYBRID MODELS OF MACHINE LEARNING ALGORITHMS AND EPIDEMIOLOGICAL MODELS THAT CAN MORE EFFECTIVELY PREDICT COVID-19 CASES"

Dr. Amir Ahmad
Associate Professor of Information Systems and Security
College of Information Technology, United Arab Emirates University

Title of published pape
Predicting the number of confirmed cases of COVID-19 by using machine learning: methods and challenges

Published in
Archives of Computational Methods in Engineering

Academic Accelerator journal impact rating: **7.610**

Project funded by
No specific funding received, however, the College of Information Technology and UAEU provided all necessary support to complete the research project

DR. ALAWI ALSHEIKH-ALI

IMPROVING THE WORLD THROUGH RESEARCH AND LEARNING

The acquisition and generation of knowledge are two equally noble pursuits that are worthy of the efforts of any individual looking to contribute to the world.

This belief has guided Dr. Alawi Alsheikh-Ali through his medical education to become a cardiologist, then a clinical researcher, and most recently, an academic leader. Today, Dr. Alsheikh-Ali is the Provost, Dean of the College of Medicine, and Professor of Cardiovascular Medicine at the Mohammed Bin Rashid University of Health and Medical Sciences (MBRU).

"My journey began with a desire to become a doctor. I was fortunate to have mentors during my time at medical school and in my clinical training who inspired my interest in clinical research and nurtured my curiosity. The environment I trained in made no distinction between learning and research," Dr. Alsheikh-Ali recalled.

He began his 13-year educational journey with a Bachelor of Science in Biology from the Massachusetts Institute of Technology (MIT) in 1995, where he was the first Emirati graduate. He then enrolled at Boston University for a Master of Science (MSc) in Applied Anatomy and Physiology. He became the first Emirati recipient of a Doctorate of Medicine from Tufts University, where he was also awarded the Martin J. Loeb Memorial Prize in Medicine. Dr. Alsheikh-Ali then went on to complete two fellowships at Tufts to train for his specialization, cardiovascular medicine and clinical cardiac electrophysiology, making him one of only a handful of physicians in the Gulf region to become triple-boarded by the American Board of Medical Specialties in Internal Medicine, Cardiovascular Diseases, and Clinical Cardiac Electrophysiology.

During his training and fellowships, Dr. Alsheikh-Ali began to understand the larger value of clinical research, which would change the direction of his journey.

"As I was concluding my structured clinical training, and having worked on several studies by then, I realized that dedicating time for a formal and structured graduate degree in research was essential if I were to continue pursuing clinical research. Through a faculty development award at Tufts, in 2009 I was able to pursue an MSc in clinical research while working part time as a cardiac electrophysiologist. That took my skills and understanding of clinical research methodology to a different level. Not only did it make me a better

Alawi Alsheikh-Ali
Mohammed bin Rashid University of Medicine and Health Sciences
H-index: 32
ORCID ID

researcher, but I feel it also made me a better clinician and overall a more critical consumer of the medical literature," he recalled.

During this period, Dr. Alsheikh-Ali authored his most-cited paper, "Patent foramen ovale (PFO) in cryptogenic stroke: incidental or pathogenic?" Published in the peer-reviewed journal *Stroke* in 2009, it has since received a remarkable 333 citations.

The paper detailed a collaborative project led by Dr. Alsheikh-Ali to quantify the link between strokes of unknown origin, or cryptogenic strokes, and PFO, a type of hole in the heart that occurs when a natural opening between the left and right atria fails to close after birth. Around one-third of all strokes are considered cryptogenic. While previous research had demonstrated the association between PFO and cryptogenic strokes, there had been no conclusive work to determine the probability that the otherwise relatively common structural defect was the cause of the stroke or if it was just an incidental finding.

Through their analysis of 23 case-control studies, Dr. Alsheikh-Ali and his team were able to determine that across all age groups, PFO is incidental in 33% of cryptogenic stroke patients. That number falls to 20% in young patients and increases to 48% in older ones. They concluded that the remaining two-thirds of patients with PFO may benefit from closure surgery to reduce their chances of cryptogenic stroke.

After completing his master's in clinical research in 2009, Dr. Alsheikh-Ali returned to the UAE to develop the Cardiac Arrhythmia Service at Sheikh Khalifa Medical City (SKMC), where he later became Chair of the Institute of Cardiac Sciences. Over the following decade, Dr. Alsheikh-Ali dedicated mucho of his time to establishing clinical registries of patients with heart disease in the UAE and wider Gulf region. These interactive databases are valuable tools for research, allowing investigators to examine data relating to specific population sets for important trends and patterns that can inform treatment and prevention approaches.

"My colleagues and I in the Gulf region have managed to establish and run several large clinical registries of patients with various forms of heart disease. This offered us an understanding of how such patients are managed in our region and where gaps of care are present and how we can address them," Dr. Alsheikh-Ali explained.

"These databases also provided a systematic view of who our patients in the region are. They tend to be younger, more likely to be smokers and obese, and with diabetes mellitus. I hope future work will focus on understanding what it is about our population that makes them have heart disease at a relatively younger age. That knowledge should be relevant to everyone interested in preventing heart disease," he added.

While all of Dr. Alsheikh-Ali's many research achievements are significant, he considers his role in helping to establish a new medical school at MBRU to be his most worthwhile accomplishment. In 2016, Dr. Alsheikh-Ali returned to the academic world where his career began, becoming the Founding Dean and Professor of Cardiovascular Medicine at MBRU.

While all of Dr. Alsheikh-Ali's many research achievements are significant, he considers his role in helping to establish a new medical school at MBRU to be his most worthwhile accomplishment. In 2016, Dr. Alsheikh-Ali returned to the academic world where his career began, becoming the Founding Dean and Professor of Cardiovascular Medicine at MBRU. Three years later, he was also appointed Provost.

"Just like I was inspired by many great mentors, I hope I can help others find inspiration and mentorship through the work we do, and they can in turn go on and do the same for others. It is this perpetual and exponential value chain that will make the world a better place," Dr. Alsheikh-Ali shared.

"JUST LIKE I WAS INSPIRED BY MANY GREAT MENTORS, I HOPE I CAN HELP OTHERS FIND INSPIRATION AND MENTORSHIP THROUGH THE WORK WE DO, AND THEY CAN IN TURN GO ON AND DO THE SAME FOR OTHERS"

Dr. Alawi Alsheikh-Ali

Provost, Dean of the College of Medicine, and Professor of Cardiovascular Medicine
Mohammed Bin Rashid University of Health and Medical Sciences

DR. MONTASIR QASYMEH

PURSUING KNOWLEDGE TO THE ATOMIC SCALE

In engineering, sometimes a tiny effect can have a significant impact. Researchers should leave no stone unturned in the pursuit of knowledge, no matter how small.

That is the lesson Dr. Montasir Qasymeh, Associate Professor of Electrical and Computer Engineering at Abu Dhabi University, learned early on in his career. Over his decade of teaching experience, Dr. Qasymeh has published more than 40 articles in reputed journals and international conferences and has attracted research funding worth approximately AED 1.8 million, including two Abu Dhabi Department of Education and Knowledge awards for research excellence.

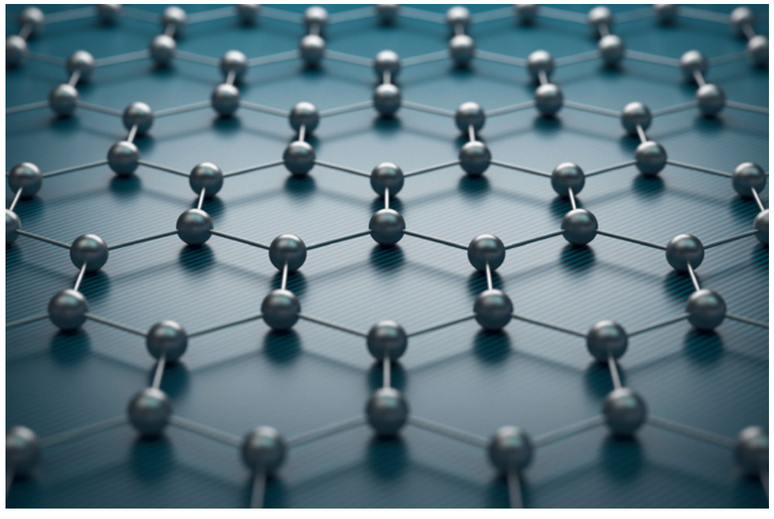
Montasir Qasymeh
Abu Dhabi University
H-index: 7
ORCID ID

"When I was first working on nonlinear optics when I was in my mid-twenties, I was modeling the Kerr effect, which is a minuscule change in the speed of light traveling through the material when an electrical field is applied. The effect was so minuscule that I doubted it would have any impact on system performance. However, I discovered afterwards that under the right conditions, such a small effect would lead to significant impact. This taught me that engineering is a real change-maker," Dr. Qasymeh recalled.

It should come as no surprise that Dr. Qasymeh has ended up making his biggest impact as a scientist in an area of research that leverages the physical properties of matter and light at the atomic and subatomic particle level – quantum physics. He is part of a collaborative research team that was the first in the world to propose using the conductivity of 2D materials, specifically graphene, to build novel electro-optic quantum devices.

The field of quantum physics is relatively young, with quantum theory only introduced in 1984 by David Deutsch and the possibility of developing computers governed by quantum physics proposed by Richard Feynman in 1986. However, breakthroughs in quantum devices – electronic, mechanical, or optical devices that are governed by the rules of quantum physics – have been picking up pace in recent years. In 2019, IBM introduced the first quantum computer that takes just a few seconds to solve the type of complex problems that would take conventional computers hundreds of years.

Dr. Qasymeh's research looks to leverage the unique properties of graphene to support the development of efficient quantum systems. Graphene is a carbon allotrope material made up of a single layer of carbon atoms arranged in a two-dimensional honeycomb lattice. Its structure makes it very strong, stiff, thin, nearly transparent, and efficient in conducting electricity and heat. The material also has unique electrical properties; electrons move through it like particles of light – so quickly that they behave according to both theories of relativity and quantum mechanics. This makes graphene a promising material for use in quantum devices.



Graphene is a carbon allotrope material made up of a single layer of carbon atoms arranged in a two-dimensional honeycomb lattice. The structure of graphene makes it very strong, stiff, thin, nearly transparent, and efficient in conducting electricity and heat. Graphene also has unique electrical properties.

"I HOPE THAT OUR WORK ADDS TO THE KNOWLEDGE THAT LINKS QUANTUM PHYSICS WITH ELECTRICAL ENGINEERING. I BELIEVE SUCH INTEGRATION CAN LEAD TO THE DEVELOPMENT OF PRACTICAL DEVICES THAT CAN BE USED TO SOLVE SOME OF THE SOPHISTICATED PROBLEMS FACING HUMANITY"

Dr. Montasir Qasymeh

Associate Professor of Electrical and Computer Engineering
Abu Dhabi University

"Our research has shown that unprecedented functionality and dense compatibility can be achieved in graphene-based electro-optic quantum devices compared to classical devices. Developing electro-optic quantum devices will pave the way for merging superconducting quantum systems with photonics systems. The resulting hybrid systems can leverage the advantages of both technologies to enable extraordinary applications in quantum information, metrology and sensing, and other fields," Dr. Qasymeh explained.

He and his collaborators have applied for four patents relating to their research with the United States Patent Office and are eager to expand their exploration of quantum systems.

"I hope that our work adds to the knowledge that links quantum physics with electrical engineering. I believe such integration can lead to the development of practical devices with exceptional capability that can be used to solve some of the sophisticated problems facing humanity," Dr. Qasymeh said.

He advised any young people considering or pursuing research to stay curious and persistent in their pursuit of knowledge.

"Science and knowledge have no limits. Remember that every challenge is also an opportunity. If you have the will to achieve something, you will find a way," he concluded.

HOW CAN WE FIND OIL-EATING BACTERIA TO CLEAN UP THE SEA?

Researchers Katherine French and Norman Terry have designed a new way to identify types of bacteria that can eat oil pollution. They have adapted their research paper, published in *Frontiers in Microbiology*, for kids.

Oil is used in many things around us: as fuel for transport, to produce plastic, and even to make our streets. To get oil we have to extract it from the ground or the ocean floor, and accidents can happen. Oil spills are disastrous for the environment, killing animals and plants and polluting water supplies. But did you know some bacteria actually eat oil – removing it from the environment in a quick and safe way?

Oil-eating bacteria can be found in the ground and then grown in the laboratory. Once enough of them have been grown, they can be put back into the ground or ocean in very high numbers. They then eat the oil with no further damage to the environment. This method of cleaning up oil is a type of bioremediation.

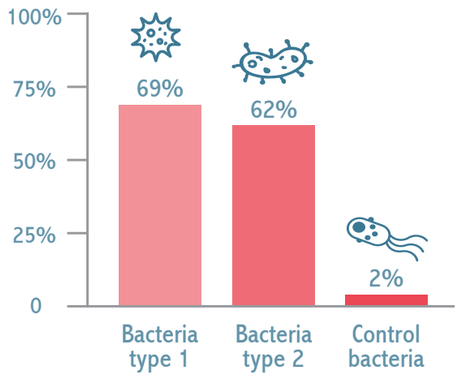
Unfortunately, the tests that are used to differentiate between bacteria that eat oil and those that don't are very expensive. This is because the tests require special machines. Also, they can't be done everywhere because not every laboratory has the right machines. Instead, companies often use other methods that aren't very good for the environment. Their use is only justified because the oil itself is even worse. Our solution? We wanted to invent a new, cheaper test to identify oil-eating bacteria. That way, more companies will use them!

To identify which bacteria are able to eat oil, we used a substance called Nile Red. Nile Red is usually clear, but when it comes into contact with crude oil, it turns red. The stronger the intensity of the red color, the more oil is present. This is known as the fluorescence intensity. To make sure our test worked correctly, we used a control group of bacteria. We knew beforehand that these bacteria cannot break down oil. So, if our test worked, test tubes with these bacteria should have a high color intensity. This was the case. Therefore, we knew that the bacteria in the tubes with less color intensity were able to eat oil.

OUR NEW TEST WORKED REALLY WELL! IN AS LITTLE AS FOUR DAYS, WE WERE ABLE TO IDENTIFY BACTERIA THAT ATE MORE THAN HALF OF THE OIL WE GAVE THEM

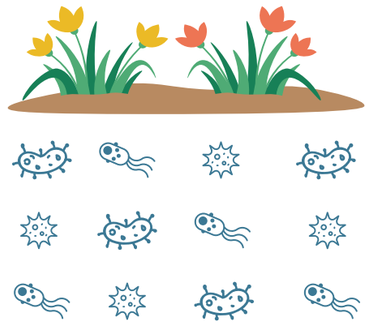
Cleaning up toxic crude oil from our environment is very important to save animals, our own water resources, and the land we need to grow food. Most methods to remove spilled oil are expensive and harmful for the environment in themselves. Therefore, bioremediation is a really useful alternative. Our new test can cheaply identify which bacteria in a piece of contaminated ground are able to eat oil. Scientists only need Nile Red, which is far less expensive than specialized machines. Such a test can be done in nearly any laboratory. Plus, growing bacteria in laboratories is easy! So once the bacteria with this special ability have been identified, their number can be greatly enhanced in the laboratory. After that they can be put back into the contaminated ground in much higher numbers than they were before. This way, they can eat all the oil and clean up the environment – naturally!

AMOUNT OF OIL EATEN



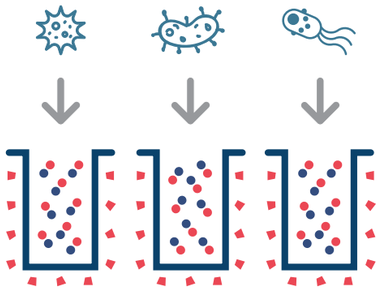
STEP 1

We took bacteria from the ground of areas contaminated with oil and sorted them into different types.



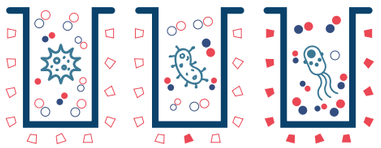
STEP 2

We added each type of bacteria to a prepared mix of crude oil and the dye, Nile Red.



STEP 3

We measured the intensity of the color of each mixture.



TERMS TO KNOW

BIOREMEDIATION

The use of naturally occurring microorganisms (such as bacteria) to clean up polluted areas.

CRUDE OIL

A natural resource found deep in the ground under layers of rocks. It is used by humans to produce fuel, but it is also used for toys, make-up and all kinds of other things. Parts of it are harmful to most lifeforms on Earth, like plants, animals and humans.

FLUORESCENCE

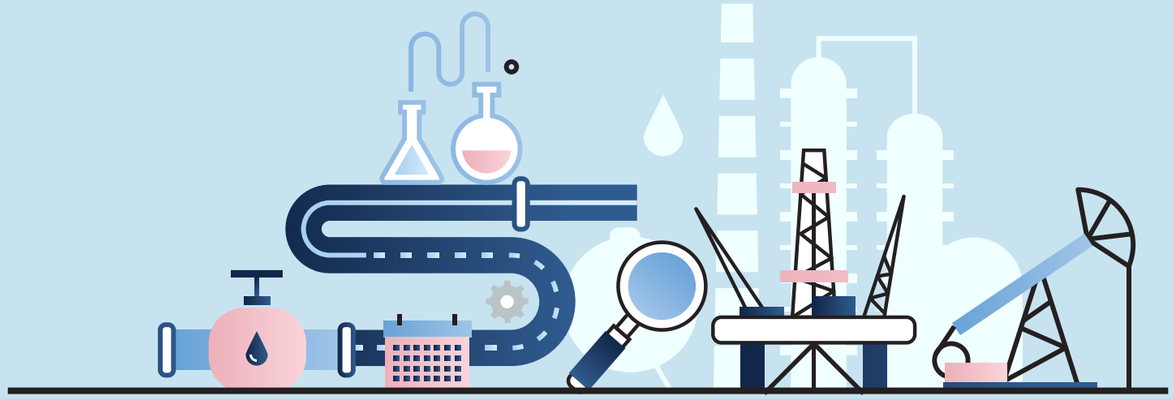
Some substances emit light in a specific color when they are illuminated with light in another specific color. For example, a mix of crude oil and Nile Red looks red when it is illuminated with a green light. Nile Red only looks this way when it is mixed with substances similar to crude oil. Without crude oil, it is colorless.

NILE RED

A colorless substance that turns red when it comes into contact with crude oil.

OIL SPILLS

Sometimes when oil is being extracted from the ground or ocean floor, or being transported, accidents happen and lots of oil leaks into the environment. This can kill or injure any living things nearby, and the oil can spread across hundreds of miles in the ocean. It also pollutes water and land, dirtying water supplies and making crops inedible. Some companies also dump oil and its byproducts into the environment intentionally to save the cost of proper disposal.



Source: French et al. (2020) How can we find oil-eating bacteria to clean up the sea? *Science Journal for Kids.* https://sciencejournalforkids.org/wp-content/uploads/2020/08/Bioremediation_article.pdf

EVENTS CALENDAR

CAN WE PREDICT VIRUS EMERGENCE?

WHEN
18 January 2021, 6:30-8pm

WHERE
Virtual

ORGANIZER
New York University Abu Dhabi

In this talk, Elodie Ghedin, Chief of the Systems Genomics Section at the National Institute of Allergy and Infectious Diseases, will provide an overview of worldwide ongoing surveillance for emerging viruses and the ways novel technology can accelerate these efforts. She will address how immune status, respiratory tract location, and cell type can shape virus diversity, and how infected individuals contribute to the viruses that are transmitted.

THE END OF THE WESTERN MODEL

WHEN
20 January 2021, 6:30-8pm

WHERE
Virtual

ORGANIZER
New York University Abu Dhabi

Recent socio-political changes have terminated the role that the United States and its Western allies assumed after 1945 as political teachers and role models to the rest of the world. Pankaj Mishra, literary and political essayist, author of Age of Anger, and winner of the 2014 Windham-Campbell Prize for non-fiction, will explore the likely consequences of this epochal transformation in this talk.

INNOVATION ARABIA 14

WHEN
22-24 February 2021

WHERE
Virtual

ORGANIZER
Hamdan Bin Mohammed Smart University in partnership with INDEX Conferences and Exhibitions

The 14th edition of Innovation Arabia will address contemporary issues and explore the enormous potential of Arab countries to accelerate the pace of socio-economic growth and development. It will provide a platform for passionate communities aspiring to a new level of success for innovation, allowing them to assess the impact of innovation on organizations and draw a plan for the expectations of future generations.

3RD MIDDLE-EASTERN MATERIALS SCIENCE CONFERENCE

WHEN
15-17 March 2021

WHERE
New York University Abu Dhabi

ORGANIZER
New York University Abu Dhabi

Materials science is one of the most rapidly growing multidisciplinary fields of basic and applied research, with new advanced materials being the key to technological and societal development. The conference will feature presentations from leading international academic, industrial, and regulatory experts in the domain of materials science. This event is by invitation only. Interested scholars must contact nyuad.memsc@nyu.edu.

6TH INTERNATIONAL CONFERENCE ON COMPLEX DYNAMICAL SYSTEMS IN LIFE SCIENCE: MODELING AND ANALYSIS (6TH ICCDS'2021)

WHEN
15-17 March 2021

WHERE
CIT Building, UAEU

ORGANIZER
ICCDS

In its 6th edition, the International Conference on Complex Dynamical Systems in Life Science (ICCDS) will gather experts from top universities around the globe to present their latest results in mathematical modeling of different fields in life sciences, such as ecology, oncology, infectious diseases, genetic disease, chronic diseases, and neurological disorders.

4TH INTERNATIONAL CONFERENCE ON COMMUNICATIONS, SIGNAL PROCESSING AND THEIR APPLICATIONS (ICCSPA) 2020

WHEN
16-18 March 2021, 9am-6pm

WHERE
Main Building and Engineering Science Building, American University of Sharjah

ORGANIZER
ICCSPA

This conference brings together academics, engineers, scientists, researchers, and students from around the world to share their recent findings related to all aspects of communications and signal processing. Attendance is by invitation only. To request an invitation, please email iccspa@aus.edu.

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