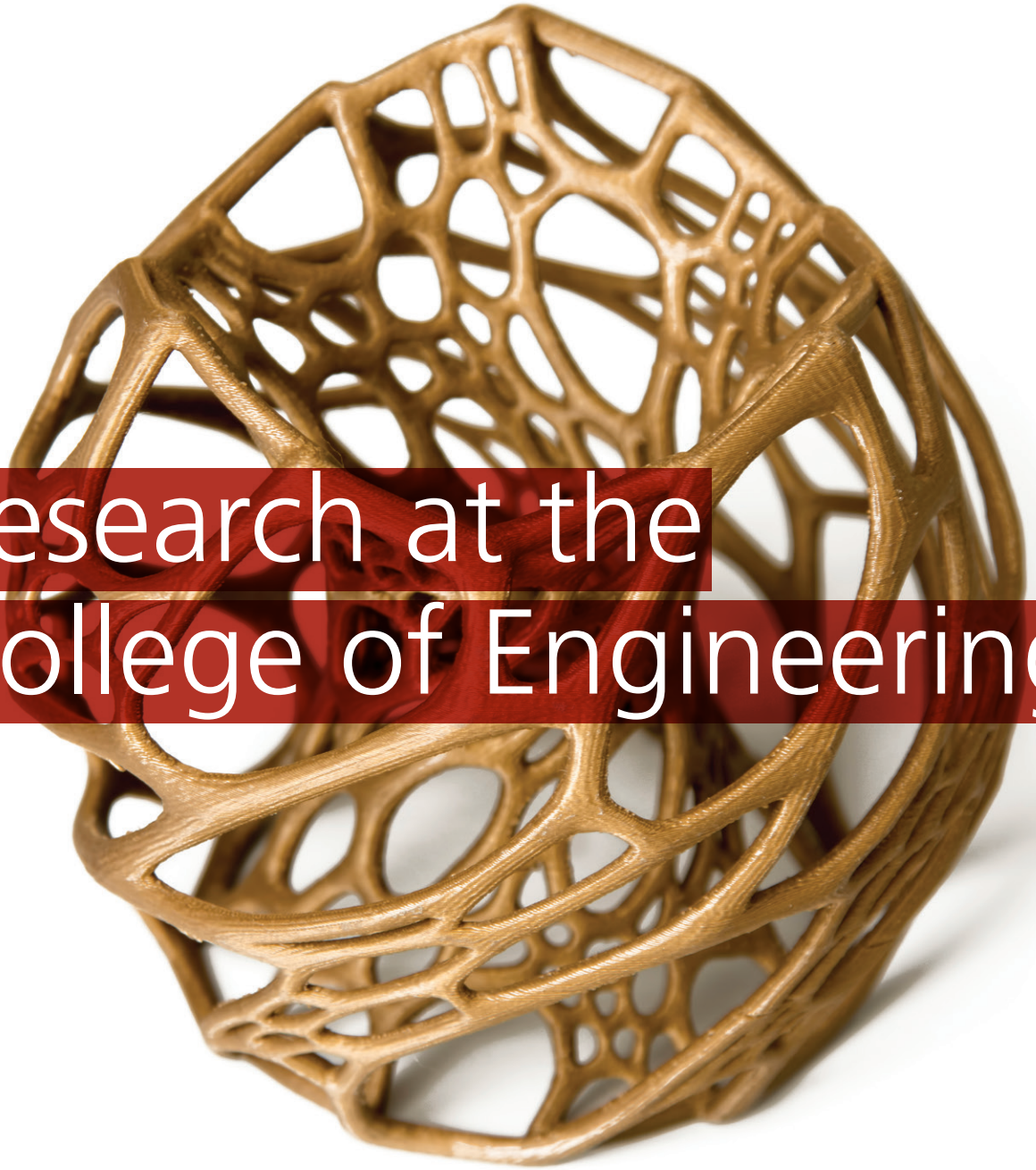
AUS | الجامعة الأميركية في الشارقة
American University of Sharjah



Research at the College of Engineering

Discover how the College of Engineering is shaping the future through its pioneering research agenda.

Research at the College of Engineering in Numbers

38 laboratories

96 full-time faculty

4 world-class research institutes

5 areas of research focus

CEN Research

A snapshot

The College of Engineering at American University of Sharjah is known as one of the Middle East's leading engineering schools. Increasingly, the college is also becoming known as one of the region's leading contributors of engineering research.

The college's burgeoning reputation for research is born out of the university's new research commitment, whereby four new research institutes have been created to advance research outcomes, supported by two advanced research centers and one research laboratory. These research entities provide a state-of-the-art environment through which the research themes of the college can progress, fostering an interdisciplinary approach to research that will have real impact in the wider world.

The success of the college's engineering agenda is in large part due to the dedication and foresight of its internationally acclaimed faculty. The college boasts 96 faculty, 98 percent of whom have achieved a terminal degree in their field, and most of whom have gained their credentials from the world's leading engineering institutions in North America. It is this body of talent and knowledge that will lead the College of Engineering as it becomes a trailblazer for engineering research.

The following pages provide insight into the research being undertaken at the College of Engineering, examining its impact and potential.

Research Degrees

The university's first doctoral degree, a PhD in Engineering Systems Management, was launched in September 2018, with further PhDs expected to be rolled out across the university soon.

Designed to integrate technical engineering skills with managerial and economic capabilities, the PhD in Engineering Systems Management (PhD ESM) equips engineers to move successfully into leadership roles. For engineers looking to advance their academic career, the program is one that enjoys international recognition and can lead to further academic progression.

This new program provides engineers with the specialized knowledge required to oversee large-scale projects, combining technical engineering expertise with management skills. As well as strong scientific and engineering elements, the PhD covers research areas of national and global importance, including:

- supply chain management
- sustainable construction project management
- smart cities management
- engineering management

To find out more about the PhD in ESM, including graduate assistantships available and opportunities for international exchange, please visit

www.aus.edu/cen/phdesm

Research Themes

- Infrastructure for the Built Environment
- Sustainability of the Natural Environment
- Emerging Technologies for Industry 4.0
- Smart Commerce, Government and Education
- Healthcare and Biomedical Technologies

Outcomes of this research support the high-level strategic aims of the governments of Sharjah and the UAE, and address some of the most pressing challenges we face as a society, both now and in the future.

This research is set to have a lasting, positive impact as the region emerges as an economic and environmental leader, and positively shape the way in which we all live and work.

Infrastructure for the Built Environment

The cities and towns of the GCC occupy some of the harshest terrain on earth, with buildings in the region facing severe climatic extremes. As the environmental sustainability of building work becomes a prime consideration for those tasked with designing and constructing buildings, the challenges faced by engineers are compounded.

The research being conducted at AUS in this field seeks out new ways of creating robust, efficient and cost-effective buildings, while maintaining the highest standards of environmental sustainability.

Green Buildings		Construction Management	Strengthening and Rehabilitation	Engineering Materials
Sustainable Building	Intelligent Transportation		Structural Fire Safety	Structural Dynamics and Earthquake Engineering
Nano-Materials for Sustainable Structures		Renewable Energy Systems in Building Operation	Intelligent Maritime Transportation	Smart IoT Sensor for Sensing Structural Weakness
Inspection and Evaluation Sensors	Structural Health Monitoring and Assessment	Non-Destructive Testing and Evaluation	Building Information Modeling	
Sustainable and Resilient Infrastructure	Infrastructure Assessment and Management		Composite Materials	Structure
Heating, Ventilation, and Air Conditioning		Soil Dynamics and Foundation		Construction 3D Printing

Sustainability of the Natural Environment

The government of the UAE, like many other governments around the world, has made environmental sustainability a priority. Finding viable solutions to the key environmental challenges the region faces will have a direct impact on the future well-being of populations across the Middle East.

The College of Engineering is therefore at the helm of research that examines viable renewable energy sources, along with how sustainable water sources can be secured by harnessing the latest technological breakthroughs.

Desalination		Wastewater and Water Treatment	Water Quality Modeling	Water Infrastructure Modeling and Management
Waste Management	Recycling		Hydraulics of Pipelines	Renewable and Conventional Energy Sources
Fuel Cells		Biofuel	Chemical Fuels	Oil and Gas Processing
Smart Grids	Satellite Remote Sensing		GIS Application	
Smart Monitoring of Power System		Modeling and Hybrid Energy Systems		Apparatus Protection
	Flood Management		Water Reuse	

Emerging Technologies for Industry 4.0

Advancements in technology are transforming the way in which we all live and work, with the age of Artificial Intelligence (AI) and the Internet of Things (IoT) upon us.

Through research at the College of Engineering, these breakthroughs are being utilized to the benefit of some of the region's most important industries—manufacturing and aerospace to name just two.

The college's researchers are leading the way in developing cutting-edge technologies that will help realize the UAE's goals of achieving globally competitive and knowledge-driven industries.

Unmanned Vehicles and Robotics	Pattern Recognition	Information and Communication Technologies	Aerospace	Design of Robotic and Autonomous Systems
Sensor Fusion	Mechatronic Systems Design		Hybrid Electric Vehicles	Cloud Computing
Integrated Circuits Design	Measurement and Evaluation of Microelectronic Systems in Cleanroom Environment		Industrial Control	Data Mining Techniques
Embedded Systems Design	Low-Power Sensors for Biomedical and Communications Systems	Wireless and Multimedia	High-Voltage Engineering	Optical
Computer Networks and Security	Biometrics	Radar Signal Processing	Microwaves	Radio Frequency Circuits
IoT	MEMs Devices and Systems	Power Systems	Energy Harvesting; Implantable Wireless Devices	Mobile App Development

Smart Commerce, Government and Education

The UAE, like many of its neighbors, has ambitions to become a global leader in government services and to provide an environment in which organizations—both local and global—can conduct business easily and efficiently.

The efforts of researchers at the College of Engineering are helping to achieve this vision, conducting research that will result in smarter cities, smarter governments and smarter education at all levels.

The outcomes of this research will keep costs and bureaucracy to a minimum, and exploit the technology for maximum effect in all sectors.

Supply Chain Management and Logistics		Project Management		Smart Government
	Quality Management Systems		Inventory Management	Financial Engineering
Smart Cities		Service Performance		Quality Process Control
	Destructive and Non-Destructive Testing		Innovative Scheduling Techniques and Risk Minimization in Construction Projects	
Engineering Cost Accounting		Value Engineering		Engineering Economics Analysis

Healthcare and Biomedical Technologies

With populations across the Middle East increasing and lifestyle diseases on the rise, finding solutions that help to prevent disease, as well as improve outcomes for patients, is a focus for researchers at the College of Engineering.

One of the priorities of the UAE Vision 2021 National Agenda is to create a world-class healthcare system for the country. The research outcomes of the college in this field will contribute to the realization of this goal.

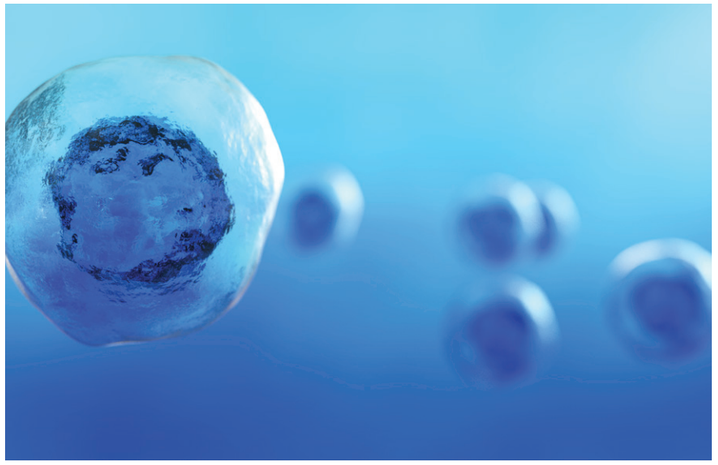
Biomechanics and Materials		Ultrasonically Triggered Drug Delivery for Cancer Treatment		Rehabilitation Machines
	Gait Analysis		Bio-Signal and Image Processing	Operating Room Scheduling
Modeling of Human Joints		MEMS and NEMS		Imaging Systems
	Medical Informatics		Biomedical Electronics and Instrumentation	
Modeling and Simulation of Biological Systems		Nano-Biotechnology		Health Resource Management

Research Entities

Four new interdisciplinary, PhD-granting research institutes have been established at AUS: the Biosciences and Bioengineering Research Institute (BBRI), the Materials Science and Engineering Research Institute (MSERI), the Gulf Environments Research Institute (GERI), and the Smart Cities Research Institute (SCRI).

To support these institutes, two advanced research centers and one research laboratory have alsobeen created: the High-Performance Computing Center (HPCC), the Geospatial Analysis Center (GAC) and the Genomics Research Laboratory (GRL).

These institutes and centers will allow researchers at the College of Engineering to progress outcomes across the college's five research themes, addressing critical global issues in health sciences, materials science, city planning and environmental sustainability.



GERI Gulf Environments Research Institute

www.aus.edu/GERI

The Gulf Environments Research Institute (GERI) serves to better understand the impact of environmental changes, both now and in the future, on the various environments of the GCC. With climate change already impacting these environments, GERI acts as a focal point for collecting and analyzing data that demonstrates the influence of climate change on natural and built environments in the region, with particular focus on the GCC's marine habitats. Through the acquisition of this research, the institute will work with other stakeholders to create and implement policies that will protect the natural environments of the GCC, to the benefit of the wider community.

The institute provides a hub through which expertise is cultivated and developed, providing opportunities for professionals in the marine and environmental sciences to further their education and training, and to promote their research to a local and global audience.

BBRI Biosciences and Bioengineering Research Institute

www.aus.edu/BBRI

Through the creation and dissemination of knowledge, the Biosciences and Bioengineering Institute (BBRI) seeks to reduce the prevalence of disease, and improve the clinical outcomes of patients, in the GCC and around the world. BBRI can also help to reach water-food-energy sustainability, especially in marginal environments as experienced in the UAE.

The institute brings together leading, international expertise to research disease, with a focus on those diseases having a significant impact on the communities of the GCC: premature cardiovascular disease, type 2 diabetes, cancer and diseases of the nervous system. This is in addition to research in biotechnology with focus on food, water and energy security.

With state-of-the-art research equipment, BBRI offers individuals looking to advance their careers in biosciences and bioengineering the opportunity to acquire the knowledge and skills necessary to succeed across many medical and biotechnology-related fields. With a focus on the entrepreneurship and commercialization, the institute also offers strong prospects for the successful transfer of new knowledge to the wider community.

MSERI Materials Science and Engineering Research Institute

www.aus.edu/MSERI

The Material Science and Engineering Research Institute (MSERI) offers a place for professionals within the discipline of materials science and engineering to pursue further academic achievement, as well as acting as a regional leader for conducting and disseminating research in the field.

The focus of the Institute's research is in areas that will address the current and future needs of communities in the GCC and around the globe, creating more durable and sustainable materials and structures, without compromising quality. The institute fosters research that addresses key environmental challenges, finding solutions that minimize reliance on non-renewable energy and which support environmental sustainability. To achieve this goal, MSERI works in an interdisciplinary fashion, bringing together internationally acclaimed researchers and academics from across the university's colleges.

SCRI Smart Cities Research Institute

www.aus.edu/SCRI

The SCRI aims to foster interdisciplinary research activities that support the realization of smart cities towards a seamless, efficient, secure, happy and sustainable living environment.

We bring together a diverse array of faculty with proven expertise in fields such as telecommunication, Internet of Things, sensor technology, transportation, energy, tourism, health informatics, urban planning and environment with the goal to develop ideas and implementation strategies for smart cities in the UAE and GCC countries. In pursuing our goals, the SCRI will collaborate with local government and industry to foster cross-disciplinary research, training and outreach.

With governments throughout the GCC keen to create more smart cities, the Smart Cities Research Institute (SCRI) will conduct and disseminate research that will help realize this goal, and assist cities in the region, and around the globe, become more efficient, secure and sustainable. Through its research and outreach activities, the SCRI seeks to exploit the latest technological developments to improve the quality of services provided to our city's inhabitants, and thereby improve their overall welfare and well-being.

The institute uses a focused interdisciplinary approach, bringing together faculty from across a number of areas of study to create smart city outcomes that have real benefit for both governments and individuals. The Institute also acts as a forum for bringing various internal and external smart city stakeholders together, including policy makers, industry leaders and academics, with a view to achieving practical and meaningful results in the rapidly developing field of smart cities.

HPCC High-Performance Computing Center

www.aus.edu/HPCC

The High-Performance Computing Center (HPCC) brings together internationallyrenowned experts in the field of high-performance computing, with the goal of generating research outcomes that have a positive impact, both regionally and globally.

The center provides high-performance computing services across the university, allowing intensive computational tasks to be carried out efficiently and seamlessly. HPCC also provides faculty, staff and students at the university greater opportunities to harness data collected through their research, solve complex problems and provide better prospects for understanding what this data means. HPCC will enable interdisciplinary research activities at AUS and is expected to play a key role in establishing AUS as a leading research institution. The center also conducts outreach activities, providing a world-class, high-performance computing resource to industry and academia throughout the region.

GAC Geospatial Analysis Center

www.aus.edu/GAC

The Geospatial Analysis Center (GAC) at AUS facilitates world-class research in the fields of geospatial science and engineering. The center utilizes the latest geospatial technology and techniques to produce research outcomes with high impact not just for the UAE and GCC, but globally. Through the acquisition and analysis of geospatial data, the center is able to provide timely and accurate advice to government and industry on issues related to environmental risk assessment, crisis management, climate change monitoring, land use planning and urbanization, demographic analyses, among many other fields. The center adopts an interdisciplinary approach to promote geospatial research at AUS, aiming to address many pressing issues in UAE and the region.

GRL Genomics Research Laboratory

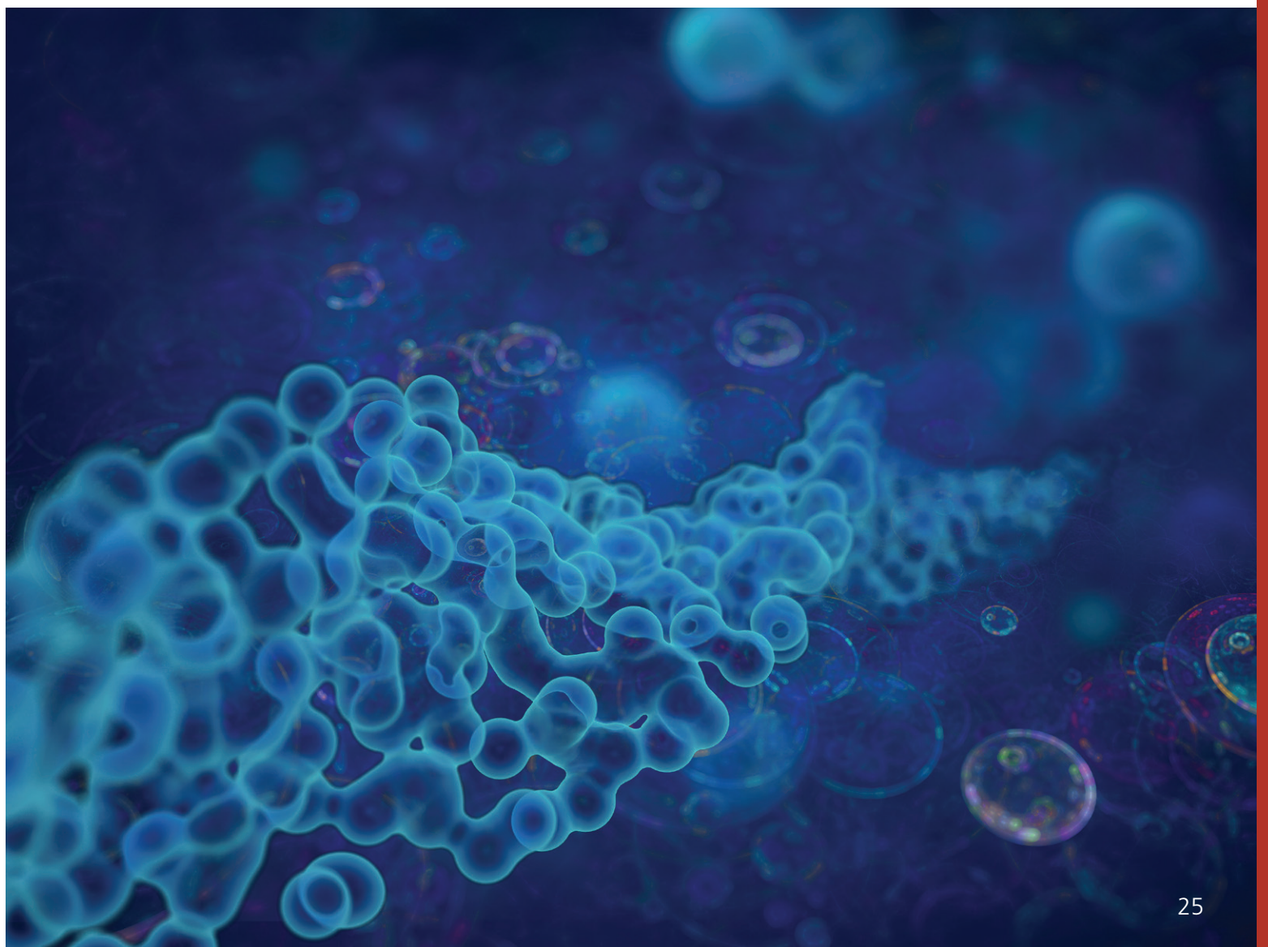
www.aus.edu/research

The Genomics Research Laboratory (GRL) is a hub for educational exchange and research collaboration in the field of genomics. The GRL functions as a regional facility to provide AUS researchers, their collaborators and the broader scientific community with the means to advance genomic discoveries in medicine, agriculture, and environmental and marine sciences.

In conjunction with collaborators, and relying on the fact that AUS is the "most culturally diverse campus in the world," the laboratory has embarked on a 1,000 Genomes project designed to examine an individual's entire genome—all 3,000 million base pairs—with the goal cataloging health-related human genetic variation.

These data will help scientists worldwide to understand why some people are susceptible to various diseases and others not. Using the same approach, GRL scientists will examine plant genomes, fish genomes and more in an effort to improve food, water and energy security in the UAE.

Currently, the GRL team is recruiting genomic specialists, technicians and bioinformaticians to participate in this adventure.



Facilities

The College of Engineering boasts some of the region's most impressive engineering research facilities. In 2019, these facilities will be taken to a whole new level with the opening of a new, three-story Engineering and Science Building. The new building will provide space for students and faculty to collaborate and innovate, utilizing the very latest in science and engineering research equipment. The state-of-the-art building, along with the existing, renovated engineering buildings, will cover close to 30,000 square meters. Combined, the buildings will contain 25 classrooms, 33 new laboratories and a makerspace, providing an area for our engineers-in-training to combine their skills and knowledge to create and hone their ideas.

Research Laboratories

- Unit Operations Laboratory
- Process Control Laboratory
- Petroleum Laboratory
- Materials Science Laboratory
- Heat Transfer Laboratory
- Fluid Mechanics Laboratory
- Environmental and Water Laboratory
- Corrosion Laboratory
- Chemical Reaction Laboratory
- Surveying Laboratory
- Structures and Construction Materials Laboratory
- Geotechnical Laboratory
- Geology and Subsurface Exploration Laboratory
- Environmental Laboratory
- Fluid Mechanics and Hydraulics Laboratory
- Asphalt and Highway Laboratory
- Computing Laboratory
- Internet and Network Computing Laboratory
- Internet and Mobile Computing Laboratory
- Computer Networks Laboratory
- Database Systems Laboratory
- Microwave Image Laboratory
- Non-Destructive Evaluation Laboratory
- Microelectronics Cleanroom

- Measurement and Instrumentation Laboratory
- Industrial Control Laboratory
- Electronics Laboratory
- Electric Machine and Power Electronics Laboratory
- Electric Circuits Laboratory
- Control Systems Laboratory
- Communication and Signal Processing Laboratory
- Biomedical Electronics Laboratory
- Manufacturing Laboratory
- Dynamics and Control Systems Laboratory
- Aerospace Laboratory
- Measurement and Instrumentation Laboratory
- Mechatronics Laboratory
- Refrigeration and Air Conditioning Laboratory
- Internal Combustion Engine Laboratory
- Heat Transfer Laboratory
- Microcontrollers: Programming and Interfacing Laboratory
- Microcontrollers and VSLI Laboratory
- Senior Design Projects Laboratory
- Embedded and Industrial Systems Laboratory
- Digital Systems Laboratory
- Power Systems Laboratory

Commercialization of Research

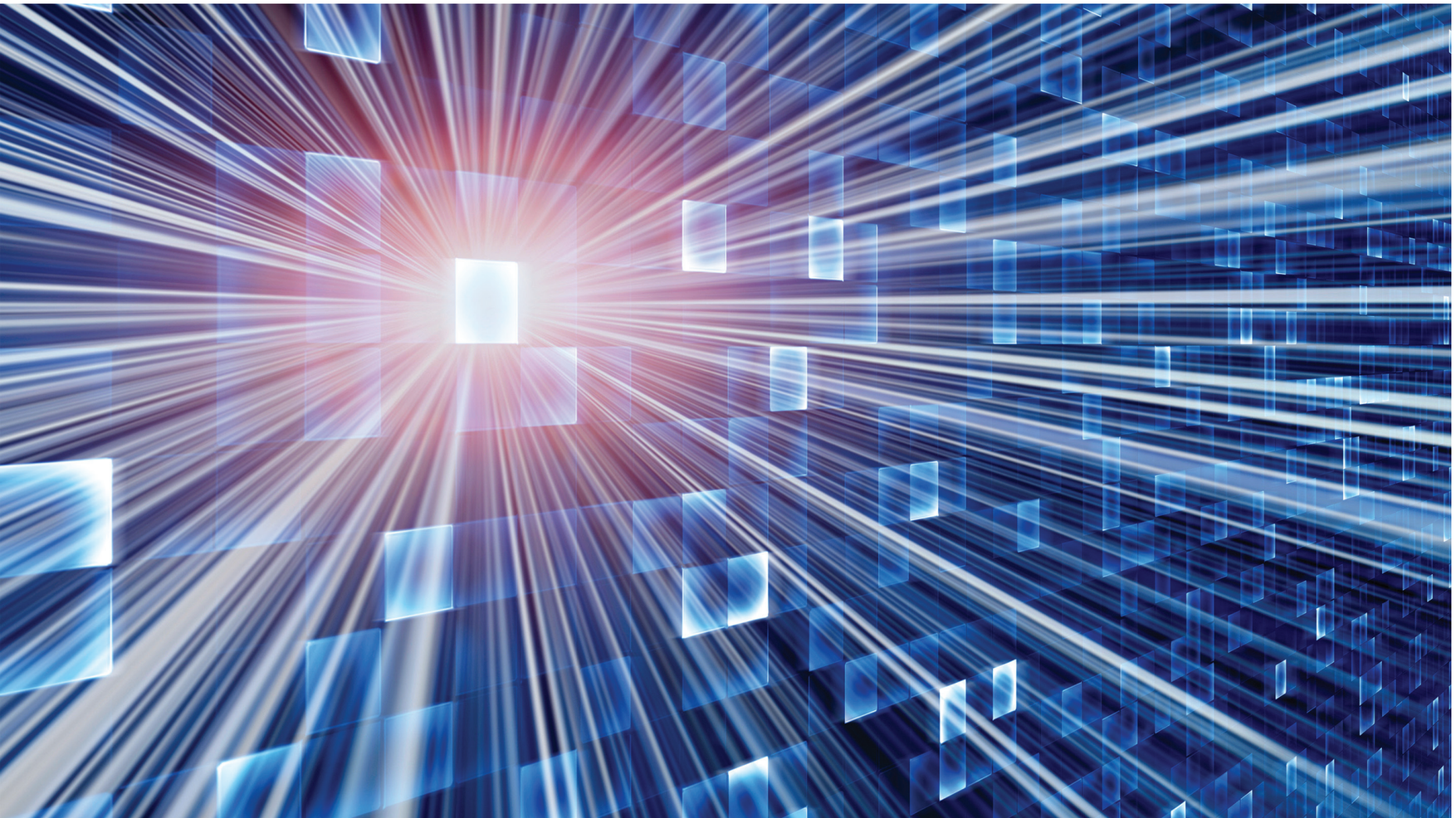
American University of Sharjah realizes the importance of bringing new innovations to the marketplace, and plays a key role in the emergence of Sharjah as a leading destination for innovation and entrepreneurship. Through our partnerships and collaborations, we give our current students and alumni opportunities to take their big ideas to the wider world.

Sharjah Entrepreneurship Center (Sheraa)

Sheraa is Sharjah's innovation hub, bringing together the best and brightest entrepreneurs to foster creativity and innovation. Sheraa has a presence on the AUS campus, providing students with the opportunity to incubate their start-up idea, with access to a team of innovation and entrepreneurship experts. To date, Sheraa has helped more than 250 entrepreneurs to successfully launch over 150 ideas. For more information, including case studies of great Sheraa success stories, visit https://sheraa.ae/.

Sharjah Research, Technology and Innovation Park

The launch of the Sharjah Research, Technology and Innovation Park adjacent to the AUS campus presents enhanced opportunities for commercialization of AUS research initiatives. The park will be home to knowledge-intensive businesses, leveraging the intellectual and academic capabilities of AUS, and attracting leading local and international companies in the following areas:



- Digitization
- Environmental Technology
- Product Design and Architecture
- Water Technology
- Renewable Energy
- Transportation and Logistics

Featured Research Projects

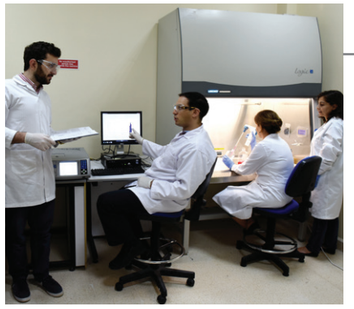
Teams from across the College of Engineering are constantly working to bring to life innovative ideas that will have an impact on the way we all live and work. Below is a sample of just some of the latest and greatest research projects our faculty and students have been working on.

Water Quality Assessment

With natural water sources in the UAE in short supply, it is critical that the fresh water the UAE does have access to is safeguarded and utilized in the most efficient way possible. Researchers from the College of Engineering have therefore been investigating the variability of water quality in the local distribution network that is managed by the Sharjah Electricity and Water Authority. A Geographical Information System (GIS) is being used to understand the different factors that impact water quality, with the interactions between water and the distribution network also under investigation. It is hoped that the research will protect water quality in the Emirates in the future and identify best practices for efficient water use.

Energy-Harvesting Chip

A team of researchers has developed a new energy-harvesting chip that gathers energy from the air and converts it into easily accessible battery power. The chip is reported to be one of the best-in-class when it comes to efficiency, and is one of the smallest of its kind to date, realized on a 65-nanometer technology. The chip is likely to have real benefit for large parts of the population, with potential uses of the chip including powering wireless sensors on bridges, roads and buildings to monitor structural safety, implanted biomedical devices and improving the battery life of mobile phones.



Localized Drug Delivery

In the field of cancer treatment, AUS is leading the way in developing a chemotherapy treatment that has a reduced number of negative side effects on patients. A team of researchers is developing a groundbreaking treatment that sees only the site of the cancer impacted by the drug, thereby reducing many of the adverse side effects traditionally associated with chemotherapy, such as hair loss, immune system compromises and nausea.

Hydrogen Fuel-Powered Drone

The university has successfully built a hydrogen-fueled, cell-powered multi-rotor drone, with the potential to fly for many hours (as opposed to traditional, battery-powered drones that are typically only able to stay in the air for 15 to 20 minutes). The drone is powered by a Proton Exchange Membrane Hydrogen Fuel Cell (PEMFC) and is able to maintain both steady hover and forward flight. The research is appealing, as it suggests higher endurance and low-cost drones are a feasible reality.

Harsh Environment Materials

With the UAE having some of the most severe climate conditions on earth, an international team, which includes members of the College of Engineering, is developing materials that will be sustainable under the harshest environmental conditions. The team is experimenting on concrete strengthened with carbon fiber re-enforced polymer (CFRP), subjecting it to the harshest conditions, including exposure to salt water, heat and humidity. The results to date are promising for increasing the longevity of coastal infrastructure systems.

In-Pipe Inspection Project

A team from the College of Engineering has developed a robot that can detect leaks in oil and gas pipelines. Using an algorithm that enables high accuracy localization, the device overcomes navigation problems often associated with in-pipe inspection robots. Wireless communications have also been added to the robot, allowing an operator to use the device remotely and receive real-time data, making it easier to find and repair leaks. The project received AED 1 million in 2017, when it won the UAE AI and Robotics for Good Prize, National Category.

The AUS Story

American University of Sharjah (AUS) was founded in 1997 by His Highness Sheikh Dr. Sultan Bin Muhammad Al Qasimi, Member of the Supreme Council of the United Arab Emirates and Ruler of Sharjah. Sheikh Sultan articulated his vision of a distinctive institution against the backdrop of Islamic history and in the context of the aspirations and needs of contemporary society in the UAE and the Gulf region.

Firmly grounded in principles of meritocracy and with a strong reputation for academic excellence, AUS has come to represent the very best in teaching and research, accredited internationally and recognized by employers the world over for creating graduates equipped with the knowledge, skills and drive to lead in the 21st century.

AUS values learners not driven only by academic success, but by those that embrace our dynamic campus life and embody our ideals of openness, tolerance and respect. This combination of academic excellence and community spirit ensures AUS is filled with world-class faculty and students, poised to become the innovators, thinkers, contributors and leaders of tomorrow.

Find out more:

To learn more about research at the College of Engineering, including how you could become involved, please get in touch.

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www.aus.edu/cen

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