Investigation.
Collaboration.
Impact.

Research Initiatives
2018–19
Research at Carnegie Mellon

A research institute like no other, Carnegie Mellon is home to the world’s leading experts in a range of fields. In this tradition, Carnegie Mellon Qatar nurtures and develops opportunities for faculty members and students to build regionally relevant research programs in their areas of expertise.
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For faculty members, research is a way to explore questions and deepen understanding within their areas of expertise. Our faculty researchers are dedicated to scientific inquiry, exploration and discovery, and their body of work demonstrates creativity, hard work and a commitment to finding real answers. Living and working within Qatar, they focus both on questions that are unique to Qatar, and issues that are applicable in our modern world.

At an undergraduate campus, there is another reason why research matters: systematic inquiry and investigation enhances learning. Our undergraduate students can experience the scientific process directly, with hands-on work in a variety of areas. This work nurtures the skills of creativity and critical thinking, and for some students, sparks a career path in research. For others, research develops the skills of teamwork and problem solving, which are invaluable in the workplace.

At Carnegie Mellon, we describe our research as “delivering work that matters.” We are a research university like no other, with a clear mission to investigate questions that will have real impact. At the CMU-Q campus, we have an additional charge: to deliver work that matters to Qatar.

Research Initiatives 2018–19 offers a glimpse into the work our faculty and students have achieved over the academic year. I invite you to learn more about the thought and inquiry taking place at Carnegie Mellon University in Qatar.

Michael Trick
Dean
Harry B. and James H. Higgins Professor of Operations Research
Research at CMU-Q

At its heart, research at Carnegie Mellon looks for practical answers to complex, real world problems. In this spirit, we at the Qatar campus encourage our faculty members and students to explore their fields and engage in projects that will have an impact.
Faculty Research Highlights

Research at Carnegie Mellon focuses on work that matters across the spectrum of human experience. In this tradition, faculty researchers at the Qatar campus focus on making a real world impact in a variety of fields of study.

Turkish Natural Language Processing

Kemal Oflazer, along with co-editor Murat Saraclar of Bogazici University in Istanbul spent more than four years bringing together 25 years of work in the area of Turkish Natural Language Processing. The book was published in 2018 in both hard-copy and online versions, and more than 2,000 copies of various chapters have been downloaded.

Digital, 3D model to help in prenatal care

CMU-Q’s Hasan Demirkoparan and Heiko Topol have created a new mathematical model to predict how human tissue responds to the physical stresses of pregnancy. The digital 3D model could lead to a new tool for doctors to measure the risk of miscarriage or pre-term delivery.

New avenue of investigation for cancer therapy

CMU-Q researchers have discovered a new area of inquiry that could lead to more effective breast cancer treatment. Ihab Younis and Ettaib El Marabti, a 2017 graduate, have investigated how the cellular mechanism splicing is different in cancer cells. Targeting these cells could be one way to kill cancer cells while leaving healthy tissue intact.

HBKU collaborations

Nesrine Affara delivered a seminar for the Life Science Seminar Series at Hamad Bin Khalifa University, sharing insights into the mechanisms that link humoral immunity, inflammation and cancer. Ihab Younis presented his work on deregulation of minor intron splicing as a critical contributor to breast cancer at the College of Health and Life Sciences Research Day.

Alan Male’s A Companion to Illustration

Susan Hagan was invited to contribute a chapter to Alan Male’s, A Companion to Illustration: Art and Theory, a benchmark reference volume that explores the definition of illustration and its impact on culture. Hagan’s chapter discusses illustrators as collaborative problem solvers.

Dudley Reynolds led a roundtable discussion on the topic of language learning and multilingualism. The discussion was part of the WISE Happening series, a monthly forum hosted by the World Innovation Summit for Education (WISE).

One function of language is that it connects people to history, heritage and identity. We are a world of nations, and language also serves to create national cohesion.

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Faculty Research Highlights

Faculty members at the Carnegie Mellon Qatar campus are actively engaged in projects that have local, regional and international significance.

New molecular biology lab

Gordon Rule established a new lab with a team of students investigating the molecular basis of how glutathione transferase inhibits a kinase. This work could lead to a new class of anti-cancer agents.

Health care initiative

Mustafa Akan’s work designing a more equitable distribution of donor livers is part of CMU’s new Tepper Health Care Initiative, which supports faculty members’ research advances in health care. Over the 2018-19 academic year, Akan was invited to present his research to the American Transplant Congress, the American Society of Transplant Surgeons, the INFORMS Healthcare Conference, and the Australian Society of Operations Research.

International faculty collaborations

- Christos Kapoutsis was selected for the International Federation for Information Processing’s Working Group 1.2, “Descriptional Complexity.”
- Kemal Oflazer was invited to serve as associate editor of Computer Speech and Language (Elsevier).
- Giselle Reis was elected to the steering committee for “Logical Frameworks and Meta Languages: Theory and Practice Workshops.” She also served as program chair for the 2018 Logical Frameworks and Meta Languages: Theory and Practice (LFMTP).

Research into e-textbooks

At information literacy conferences in Europe and North America, Teresa MacGregor and Alicia Salaz presented their research into textbook format preference. The study looks at how libraries can maximize the learning value of e-textbooks by training students to use digital platform features more effectively.

Climate change and sustainability

Chadi Aoun presented a workshop on climate change and sustainability at the Qatar Investment Authority, as well as a lecture on green information systems at the THIMUN Qatar Leadership Conference. In 2019, he was invited to serve on the SustainableQatar advisory board.

Liberal Arts conference at Texas A&M

Several CMU-Q faculty members, including keynote speaker Dudley Reynolds, presented at the seventh annual Liberal Arts International Conference hosted by Texas A&M University at Qatar. The conference aimed to shed light on the liberal arts in a dynamic global era.

Research Initiatives 2018–19

- Incoming subaward with Qatar University
  The Garbled Computer: Towards computing without seeing
  Co-LPI: Ryan Riley
  Co-LPI: Qutaibah Malluhi
  Qatar University

- Incoming subaward with Hamad Bin Khalifa University
  Circumventing of microbial bioinvasion controls by ballast water
  PI: Annette Vincent
  LPI: Basem Shomar
  Qatar Environment and Energy Research Institute (QEERI), HBKU

- New seed grant in arts and sciences
  Pilot corpus of undergraduate information systems writing in Qatar
  Pia Gomez Laich

- New seed grant in biological sciences
  Molecular mechanism of Jun Kinase (JNK) inhibition by GSTP1: Phase I - reagent development
  Gordon Rule
Research Seminar Series

The Research Office launched a new seminar series for the CMU-Q community, inviting students, faculty and staff to learn more about the ongoing projects at the university.

SLATE-Q: Making writing expectations explicit through interdisciplinary collaborations

University students are expected to write analytically and argumentatively, but many lack the awareness or language control, and assignments often do not make expectations explicit. A collaboration between applied linguists and information systems faculty members, this study has developed pedagogical interventions to support learners as they write effective, analytical texts.

The SLATE-Q team is led by Silvia Pessoa and includes CMU-Q principal investigators Selma Limam Mansar, Pia Gomez Laich, Divakaran Liginlal, Thomas Mitchell, and Susan Hagan. The team also includes Ahmar Mahboob, University of Sydney, and Ryan Miller, Kent State University.

Modeling collagenous soft tissue

Mathematical models that describe how soft biological tissue responds to mechanical stress are an essential part of basic biomechanics. This project creates continuum level mathematical formulations that describe the relation between swelling, deformation, stress, and key metabolic factors.

Heiko Topol is a postdoctoral research associate with a background in mechanical engineering. The co-lead principal investigators for this project are CMU-Q’s Hasan Demirkoparan and Thomas Pence from Michigan State University.

Formalization of automated trading systems in a concurrent linear framework

By formally representing the core of a financial exchange as a set of logical formulas, it is possible to both run the exchange and prove properties about it. This project uses a concurrent and linear framework to model a financial order matching system where buy and sell orders are matched according to the price-time priority.

Dragiša Žunić was a postdoctoral research associate who worked with co-lead principal investigators CMU-Q’s Giselle Reis and CMU’s Iliano Cervesato on this project.

A comparison of the impact of the Basel Standards upon Islamic and conventional bank risks in the gulf state region

Subsequent to the 2008 global crisis, Basel III has proposed some major changes to banking regulations. This project is a comparative study of the Islamic and conventional banking sector risks using market data generated from a sample of publicly listed Islamic and conventional banks in the Gulf Cooperation Council (GCC) region.

John O’Brien and Fuad Farooqi are part of the business administration faculty at CMU-Q, teaching courses in finance and accounting. In addition to Islamic finance, their research interests lie in the areas of fintech and the blockchain.

Bacteriophages in wastewater: isolation and use

Water security and sustainability in Qatar is a critical issue, since the only source of drinking water is the desalinated seawater from the Arabian Gulf. Water quality and safety is a key component of water security. This project aims to isolate and use bacteriophages as biomonitoring tools in wastewater treatment plants to validate the efficacy of the treatment process.

Annette Vincent is the program director of biological sciences and the lead principal investigator for this project. The principal investigators include CMU-Q’s Valentin Ilyin and Basem Shomar from HBKU’s Qatar Environment and Energy Research Institute.

Role of the PDZ- and LIM-containing protein Zasp in integrin-mediated cell adhesion

In multicellular organisms, cells attach to each other and the matrix around them using specific adhesion proteins called integrins to form functional tissues and organs. Cells can regulate their adhesion to move, migrate and invade. This study focuses on how cells regulate integrin function, which could help better understanding how normal cells function and how disease onset takes place.

Mohamed Bouaouina is an assistant teaching professor of biological sciences at CMU-Q and lead principal investigator on the project.
Student and Alumni Research Highlights

For their research projects, students are encouraged to reach beyond traditional program boundaries to tap into creativity, innovative problem solving and teamwork.

School of Computer Science award for research
Omar Khattab received the Alumni Award for Undergraduate Excellence in Computer Science by CMU’s School of Computer Science. The award was given for Khattab’s senior thesis, which he completed under the mentorship of Mohammad Hammoud.

iGEM competition
A team of students from four programs developed a rapid, inexpensive test using CRISPR technology to screen for carriers of sickle cell anemia. They presented their project at the International Genetically Engineered Machine (iGEM) competition in Cambridge, Massachusetts.

ISSCR Abstract Merit Award
CMU-Q alumna Bushra Memon, who is now pursuing her PhD at the College of Health and Life Sciences at Hamad Bin Khalifa University, was recognized by the International Society for Stem Cell Research for her outstanding research on diabetes during the 2019 ISSCR Conference in Los Angeles.

I spent all of my time researching at CMU-Q, which is now reflected in the work I do. I am able to do this job because of the laboratory skills I developed at CMU-Q.

Saad Rasool
Research Specialist, Sidra Medicine
Class of 2018

Voice technology at the World Economic Forum
CMU-Q alumnus Mahmoud Al Ismail, now a research associate at the School of Computer Science, was part of a CMU delegation to the World Economic Forum’s Annual Meeting of New Champions, in Tianjin, China. Al Ismail is part of a team at the Language Technologies Institute.

Research Initiatives 2018-19

Alumni diabetes research at CUDOS 2018
CMU-Q alumni showcased their work at the conference series on understanding molecular mechanisms in cardiovascular biology, diabetes, obesity and stroke, organized by Sidra Medicine. Alya Al-Kurbi, Asma Al-Naama, Omair Al Nuaimi, Reem Hasnah and Mohammed Janahi each presented work in the area of Type 1 diabetes.

Frontiers of Oncology
Sophomore student Abdullah Shaar co-authored a Frontiers of Oncology article that investigates the role of a proto-oncoprotein in human malignancies. Shaar worked on the project during an internship at the National Center for Cancer Care and Research at Hamad Medical Corporation.

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Student Projects

Through research projects, students develop the skills of intellectual rigor and creative problem solving that are integral to their careers and future studies.

QSIURP 2018 awards

Through the Qatar Student-Initiated Undergraduate Research Program, students develop research skills by working on projects that are driven by their interests. The projects are research, scholarly, or artistic activities that lead to the production of new knowledge, increased problem-solving capabilities, original, critical, or historical theory and interpretation, or the production of art.

- Sayeda Amir, Role of Kindlin-2 in breast cancer cell adhesion and migration
  Faculty advisor: Mohamed Bouaouina

- Mohammed Yusuf Ansari and Maimoon Siddiqui, Developing a group study mobile application by researching human computer interaction
  Faculty advisor: Giselle Reis

- Aya Nour, Effect of p38α-dependent AUF1 phosphorylation on transcription factor ATF3 stabilization
  Faculty advisor: Ihab Younis

- Julian Sam and Sameer Ahmad, Code translation for implementing a functional assertion engine in SML
  Faculty advisor: Giselle Reis

International conferences

- IEEE Local Computer Networks Conference, Shaden Shaar, Chicago, USA
- CIKM 2018 International Conference on Information and Knowledge Management, Omar Khattab, Turin, Italy
- iGEM 2018 Giant Jamboree competition, Kaan Aksoy, Dina Altarawneh, Joana Khatib, Maimoon Siddiqui, Boston, USA
- 17th IEEE International Conference on Machine Learning and Applications, Shaden Shaar, Orlando, USA

Senior Honors theses

- Al-Dana Al-Mohannadi, Toward enhancing technology use in Qatar’s public schools
  Faculty advisor: Susan Hagan

- Khalid Al-Naemi, Integrin-mediated signaling in breast cancer cells
  Faculty advisor: Mohamed Bouaouina

- Najlaa Al-Thani, Metagenomic analysis of DNA and RNA profiles in ballast water
  Faculty advisor: Annette Vincent

- Sayeda Amir, Role of Kindlin-2 in breast cancer cell adhesion and migration
  Faculty advisor: Mohamed Bouaouina

- Aisha Fakhroo, PTEN gene encodes a ncRNA that acts as a potent tumor suppressor in breast cancer
  Faculty advisor: Ihab Younis

- Kawthar Jafarian, Molecular tools for microbial viability assessment in environmental samples: Case study of ballast water
  Faculty advisor: Annette Vincent

- Youssef Kanbour, Targeted demethylation of CpG islands
  Faculty advisor: Ihab Younis

- Omar Khattab, A distributed, graph-based framework for information retrieval
  Faculty advisor: Mohammad Hammoud

- Aya Nour, The effect of p38α kinase on binding of AUF1 protein to ATF3 transcripts in breast cancer
  Faculty advisor: Ihab Younis
Meeting of the Minds
The annual Meeting of the Minds symposium featured research projects from all five programs of study, including 26 from undergraduate students. Expert judges represented organizations from across Qatar.

CMU-Q awards

Best project: First place
- Omar Khattab, IRg: A distributed graph-based framework for information retrieval
  Advisor: Mohammad Hammoud
Khattab created a novel framework that makes it easier and more efficient for information retrieval experts to develop and deploy scalable search engines. Large-scale information retrieval is central to many applications like web and e-commerce searches.

Best project: Second place
- Beom Jjin Jayden Park and Hawra Al-Saygh, Effect of aspartame on kinetics of calf intestinal alkaline phosphatase
  Advisor: Annette Vincent

Best project: Third place
- Youssef Kanbour, Re-expression of BCRA1 using targeted DNA demethylation in breast cancer cells
  Advisor: Ihab Younis

Best poster design
- Al-Dana Al-Mohannadi, Educating girls in Qatar: Toward enhancing technology use in public schools
  Advisor: Susan Hagan

Planning and Statistics Authority awards
For many years, the Planning and Statistics Authority has supported undergraduate research at CMU-Q with special awards for projects relevant to Qatar.
The awards from the Planning and Statistics Authority were announced by
Dr. Barak Yehya, a longtime friend and supporter of CMU-Q.

- Aisha Fakhroo, Boshra Al-Sulaiti and Reem Elasad, PTEN gene encodes a ncRNA that acts as a potent tumor suppressor in breast cancer
  Advisor: Ihab Younis

- Kawthar Al-Sadat, Molecular tools for microbial viability assessment in environmental samples: Case study of ballast water
  Advisors: Basem Shomar, Qatar Environment and Energy Research Institute, and Annette Vincent

- Al-Dana Al-Mohannadi, Educating girls in Qatar: Toward enhancing technology use in public schools
  Advisor: Susan Hagan

- Faiq Deifiandry, What does the eye say?
  Advisor: Jennifer Bruder

- Anis Charfi, Esraa Mohamad and Syed Mehdi, Deception detection in Arabic text

QNRF undergraduate awards
Qatar National Research Fund and CMU-Q have a long history of partnership and collaboration, and the fruits of this partnership are on display at Meeting of the Minds. Many of the student projects are off-shoots of larger, faculty-led projects that have been generously funded by QNRF.

- Albandari Al-Khater, Modulating PARP1 splicing in breast cancer as potential therapeutic approach
  Advisor: Ihab Younis

- Omar Khattab, IRg: A distributed graph-based framework for information retrieval
  Advisor: Mohammad Hammoud

- Anis Charfi, Syed Mehdi and Esraa Mohamad, ARAP – Author profiling and its application for market segmentation
Appendices

Ongoing Externally Funded Projects
Faculty Publications
Faculty Presentations
Meeting of the Minds Posters
Faculty Members
About Us
Ongoing Externally Funded Projects

National Priorities Research Program, Qatar National Research Fund

   Lead PI: Mohamed Bouaouina

b. Teams of aquatic/aerial robots for marine environmental monitoring (TARMEM)
   Lead PI: Gianni Di Caro
   Subaward partners:
   PI: Enrico Simetti, University of Genova
   PI: Filippo Arrichiello, University of Cassino and Southern Lazio

c. Personalised drug selection for cancer treatment in Qatar
   PI: Valentin Ilyin
   Subcontract with Hamad Medical Corporation (HMC):
   Lead PI: Peter Coveney, University College London
   Co-Lead PI: Mohamad Ussama Al Homsi, HMC

Carnegie Mellon University in Qatar

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Research Initiatives 2018–19

h. Towards mobile opportunistic cloud computing: Enabling generic computation offloading to extreme heterogeneous entities
   Lead PI: Khaled Harras
   QHCN: Towards reliable and efficient mHealth system with multimodal processing and communications for effective remote patient diagnosis
   Pt: Khaled Harras
   Subcontract with Qatar University (QU):
   Lead PI: Amr Mohamed, QU

i. SLATE-Q: Scaffolding literacy in academic and tertiary environments: The case of communication in information systems
   Lead PI: Silvia Pessoa
   Pt: Pia Gomez Laich
   Pt: Selma Limam Mansar
   Pt: Thomas Mitchell
   Pt: Susan Hagan
   Pt: Divakaran Liginil
   Subaward partners:
   Pt: Ryan Miller, Kent State University
   Pt: Ahmar Mahboob, University of Sydney

j. Bringing computer science to secondary schools – Curriculum design and implementation
   Lead PI: Saquib Razak

k. MADAR: Multi-Arabic dialect applications and resources
   Co-Lead PI: Kemal Oflazer
   Pt: Houda Bouamor
   Subaward partners:
   Lead PI: Nizar Habash, New York University Abu Dhabi
   Pt: Owen Rambow: Columbia University

l. Testing English reading comprehension through deep text analysis and question generation
   Lead PI: Kemal Oflazer
   Pt: Teruko Mitamura, Carnegie Mellon University

m. Automated verification of properties of concurrent, distributed and parallel specifications with applications to computer security
   Co-Lead PI: Giselle Reis
   Pt: Iliao Cervesato, Carnegie Mellon University
   Subaward partner:
   Pt: Carsten Schürmann, University of Copenhagen

n. Using bacteriophages as biomonitoring tools for water quality measurements
   Lead PI: Annette Vincent
   Pt: Valentin Ilyin
   Subaward partner:
   Pt: Basem Shomar, Qatar Environment and Energy Research Institute (QEERI), HBKU

Qatar Foundation World Innovation Summit for Education (WISE)

o. Language policy in globalized contexts
   Lead PI: Dudley Reynolds


Mustafa Akan. "REACH: A new strategy for prioritizing hepatocellular carcinoma patients on the liver transplant waitlist." INFORMS Healthcare Conference, MIT Sloan School, Boston, USA.

Mustafa Akan. "Size based exception points for fair liver allocation." INFORMS Healthcare Conference, MIT Sloan School, Boston, USA.


Mustafa Akan. "Size based exception points for fair liver allocation." INFORMS Annual Meeting, Seattle, USA and Phoenix, USA.

Chadi Aoun. "How can you save the world with Green Information Systems?" THIMUN Qatar Leadership Conference, Doha, Qatar.

Chadi Aoun. "Climate change and sustainability: Implications for effective governance." Qatar Investment Authority (QIA), Doha, Qatar.


Zelealem Yilma. "Maximally centralized bipartite graphs." 10th International Colloquium on Graph Theory and Combinatorics, Lyon, France.

Ihab Younis. "Deregulation of minor intron splicing as a critical contributor to breast cancer." Hamad Bin Khalifa University, College of Health and Life Sciences Research Day, Doha, Qatar.
Meeting of the Minds
Posters

Biological Sciences

- Effects of pH and temperature on the activity of alkaline phosphatase from sheep’s brain, Sara AlDarwish, Maha AlTamimi
- Effect of high temperatures on alkaline phosphatase isolated from Escherichia coli, Khulood Al-Haroon, Noora Al-Shukri
- Kinetic study on effects of the inhibitor L-Phenylalanine on calf intestinal alkaline phosphatases, Haya Alkaabi, Naiile AlSowaidi
- Comparing thermostability and enzyme kinetics of bacterial alkaline phosphatase and calf-intestinal alkaline phosphatase at high temperatures, Reem Al-Karbi, Sondoss Hassan
- Modulating PARP1 splicing in breast cancer as potential therapeutic approach, Albandari Al-Khater
- Integrin-mediated signaling in breast cancer cells, Khalid Al-Naemi
- Molecular tools for microbial viability assessment in environmental samples: Case study of ballast water, Kawthar Al-Sadat
- Metagenomic analysis of DNA and RNA profiles in ballast water, Najla Al-Thani
- Role of kindlin-2 in breast cancer cell adhesion and migration, Sayeda Sakina Amir
- Role of P21 in the regulation of apoptosis in breast cancer tumor formation, Sayeda Sakina Amir
- PTEN gene encodes a ncRNA that acts as a potent tumor suppressor in breast cancer, Aisha Fakhroo, Boshra Al-Sulaiti, Reem Elasad

Business Administration

- Near-optimal dynamic pricing strategies for selling limited inventory to rational customers, Shireen Ahmed, Fahad Bahlad, Abraham Farooqui
- Supporting students development of self-authorship and reflective judgement, Zeina Darwiche
- Two-sided matching with random utility and outside options, Anthony Lo, Fariza Shiyap, Xinyu Ma
- Design of service points in queuing networks, Madhvi Menon, Menatalla Mahmoud

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- Code translation for implementing a functional assertion engine in SML, Sameer Ahmad, Julian Sam
- IRg: A distributed graph-based framework for information retrieval, Omar Khattab

Information Systems

- Educating girls in Qatar: Toward enhancing technology use in public schools, Al-Dana Al-Mohannadi
- What does the eye say?, Faiq Defiandry
- Effect of language direction on spatial cognition, Masooma Zehra, Danish Memon

Postgraduate posters

- An oracle hierarchy for small one-way finite automata, Malek Anabtawi, Sabit Hassan, Christos Kapoutsis, Mohammad Zakzok
- MADAR Twitter user dialect identification, Houda Bouamor, Nizar Habash, Sabit Hassan, Kemal Oflazer
- ARAP – Author profiling and its application for market segmentation, Anis Charfi, Syed Mehdi, Esraa Mohamad
- Deception detection in Arabic text, Anis Charfi, Esraa Mohamad, Syed Mehdi
- Supporting students writing case analysis in information systems and organizational behavior, Silvia Pessoa, Pia Gomez Laich, Thomas Mitchell, Michael Maune
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