HIGH TECH FOR SMALL FARMS

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PITTSBURGH
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How CMU is preparing for the battleground of the future

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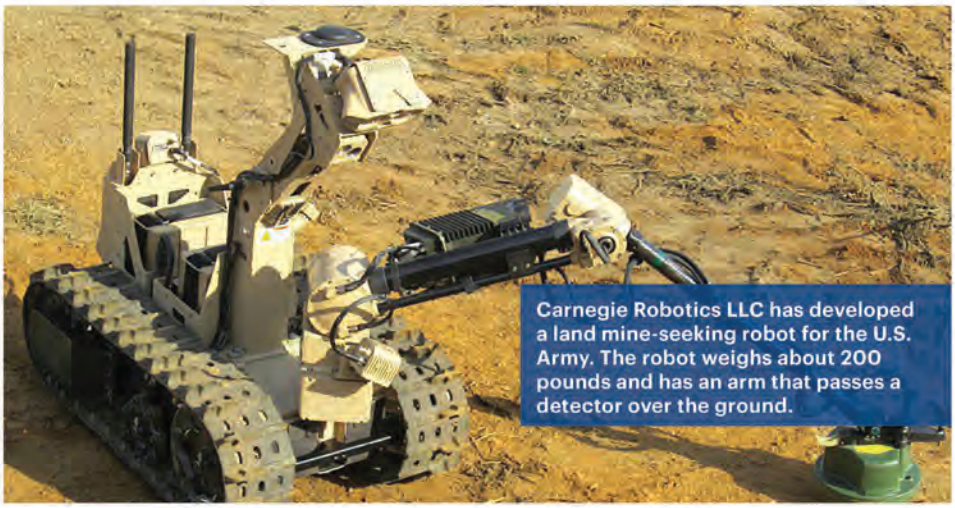
PITTSBURGH BUSINESS TIMES



Carnegie Robotics LLC has developed a land mine-seeking robot for the U.S. Army. The robot weighs about 200 pounds and has an arm that passes a detector over the ground.

While the nature of war may never change, the U.S. Army's Future Command General Mike Murray said the character of war fundamentally will, and that change is already being seen through the implementation of technology like artificial intelligence.

Today the U.S. Army officially activated its new Artificial Intelligence Task Force in partnership with Carnegie Mellon University during a ceremony at CMU's National Robotics Engineering Center in Lawrenceville.

"Why did the Army do this?" said Murray. "It was one single purpose. To make our soldiers and our units of the future more effective, and... to ensure they have the concepts and capabilities and organizational designs they need to fight and win on a future battlefield. Or better yet, they will never have to fight."

Murray said the best validation for the work to come out of this task force would be to never have to use the tools they build.

The AI task force's initial priorities include applying AI tech to equipment maintenance and logistics, situational awareness, and humanitarian assistance and disaster relief.

CMU President Farnam Jahanian said CMU has been collaborating with the U.S. Department of Defense for over 70 years and proven that breakthroughs in science and technology are greatly accelerated by engagement with real problems. Jahanian said CMU recognizes the importance of a partnership with the U.S. Army as work where human lives are at stake.

"This effort is about creating and leveraging autonomous tools that take [soldiers] out of harm's way," said Jahanian. "It's about algorithms that can save billions of dollars in maintenance costs and make sure critical equipment and logistical resources are ready when our soldiers need them."

Other uses could include better training and medical care, autonomous ground vehicles, unmanned aircraft, sensors that rapidly process information and images, and innovations to assist the soldiers who buy, store and move DOD supplies.

For example, Secretary of the Army Mark Esper said that during the Iraq War, soldiers died during routine logistics runs. With AI advancements and implementation, Esper said the Army can put fewer soldiers in autonomous vehicle convoys and save many lives.

While CMU will serve as the host site for the AI Task Force headquarters, the partnership will eventually include other leading universities and private sector engagement. Jahanian said the U.S. Army will provide funding to these partners for research, but did not disclose the amount CMU would get.

Jahanian said CMU has an obligation to use its talents and knowledge to strengthen national defense and national security, but the opening of the task force partnership will also open a dialogue at the university around the ethics behind each technology developed.

Murray and Esper added that while the U.S. Army is working to modernize, it can never really know exactly what to expect from a battleground of the future. As the imaginations of many audience members present jumped to fully-autonomous weapons systems and fighting completed by robots, they said many more ethical discussions are to be had before those types of plans make the to-do list of the task force.

The task force will be overseen by the Army Futures Command, established in July 2018. It marks the first major reorganization of the U.S. Army since Forces Command and Training and Doctrine Command were established in 1973.

How America's dying rust belt town can transform into "SMART CITIES" OF THE FUTURE

This article has been reprinted by Fast Company. *Visit the full article online.*

FAST COMPANY

MONDAY, JANUARY 14, 2019

Architecture Student Has DESIGNS FOR FASHION

FEBRUARY 27, 2019

Zain Islam-Hashmi has created his niche as an architect of fashion who creates clothing and wardrobe ensembles with materials like resin, cement and plexiglass.

Islam-Hashmi is serving as head designer for Carnegie Mellon University's annual Lunar Gala fashion show and graduates this spring with a bachelor's degree in architecture and minors in intelligent environments and digital fabrication. He has taken advantage of opportunities at CMU and around the world and shaped them into a unique education.

Photo Credit: Aisha Han/Visual Editor

The Lunar Gala showcases CMU fashion designers annually each year. In the show, teams of students craft original and unique apparel lines that combine technology and unexpected materials to create wearable fashion.

> *"We have an understanding of people in architecture. Fashion is a way to deepen that interaction."*
>
> *— Zain Islam-Hashmi, student and Lunar Gala head designer*

"I really liked the fact that CMU was so interdisciplinary ... and there were possibilities to do things that weren't offered yet. When I compared it to other universities, I felt like there were more options at CMU," he said.

For the third year, Islam-Hashmi will present a fashion line at the Lunar Gala that relies heavily on materials more commonly found in architecture and the construction industry. His teammates on the line, known as Alluminare, are Mariana Alberola Rezza and Stephanie Smid, both second-year master's students in the School of Architecture. Islam-Hashmi said architecture and fashion are not mutually exclusive.

"We have an understanding of people in architecture. Fashion is a way to deepen that interaction," said Islam-Hashmi, a past chapter president of the American Institute of Architecture Students. "There's a lot of techniques and material in architecture that could have a lot of relation and applicability in fashion. Merging the two helps bridge the two worlds, where each learns from the other."

Last spring, some of his fashion designs used dirt, concrete, sand and paper, and he was recognized as a winner at Pittsburgh's Ecolution Fashion Show. The show challenged designers to incorporate recycled and reused materials.

GLOBAL PERSPECTIVE

Islam-Hashmi's summers have been spent around the world.

After hearing Emmanuelle Moureaux speak at CMU in 2015, Islam-Hashmi applied and was accepted for an internship at Moureaux's architecture and

Zain Islam-Hashmi adjusts a top during a rehearsal for Lunar Gala.

> *"The creativity and intellectual adventurousness we witness in students like Zain truly capture the spirit of CMU: interdisciplinarity, innovation and passion."*
>
> *— Richelle Bernazzoli, assistant director of undergraduate research and national fellowships*

design firm in Tokyo. He also spent time at Arcop Associates in Karachi, Pakistan, and worked at Domaine de Boisbuchet summer workshops in Lessac, France.

In Ghana, he volunteered to help design and build a clinic in Yeboahkrom. This experience of working with Cast Earth construction techniques served as a basis for his senior thesis.

He's now looking at Pittsburgh to understand how the city's physical urban environment has changed over time.

Islam-Hashmi said CMU's Undergraduate Research Office has been a key part of his success.

"They've challenged my writing and how I articulate what I'm thinking. They've given me a bigger, broader understanding of what research is and what it can be. There are so many diverse and interesting things happening at Carnegie Mellon," he said.

Richelle Bernazzoli, assistant director of undergraduate research and national fellowships in the Undergraduate Research Office, helped guide Islam-Hashmi's work.

"Undergraduates like Zain are making exciting connections between disparate fields to solve pressing real-world problems and to add to the artistic context," Bernazzoli said. "The creativity and intellectual adventurousness we witness in students like Zain truly capture the spirit of CMU: interdisciplinarity, innovation and passion."

Islam-Hashmi has used Small Undergraduate Research Grants and Summer Research Fellowships to help support his Lunar Gala fashion line and a new map of Pittsburgh. The map, which he will build with fellow architecture student Gargi Lagvankar, is expected to be housed in a stairwell of the College of Fine Arts Building.

Architecture Professor Jeremy Ficca has been impressed by Islam-Hashmi, with whom he has worked as a studio instructor, thesis advisor and director of the Design Fabrication Laboratory.

"I'm quite impressed with Zain's resourcefulness. He has leveraged a wide range of opportunities on campus and across the globe to further his interests, knowledge and skills," Ficca said.

Carnegie Mellon's School of Architecture aims to prepare students to be interdisciplinary design thinkers in diverse global contexts. Ficca said the school provides opportunities for students to apply what they are learning in their research into practice.

"Architecture can serve as a lens to understand our increasingly complex world. The range of topics our students address through their design work is a testament to the breadth of issues and conditions related to architecture," Ficca said.

STUDENTS MAKING AN IMPACT
in a "Big Way, So Far Away"

JANUARY 28, 2019

Four students took a meaningful and fulfilling winter-break trip they'll never forget.

Christina Ou, Cathy Fang, Melina Driscoll and Ashley Burbano, members of Carnegie Mellon University's Engineers Without Borders (EWB), traveled to Nyadire, Zimbabwe, where they spent two weeks at the town's United Methodist Centre helping the small community of about 2,000 people. Their trip was twofold: They followed up on their chapter's four-year solar street light project and began a new effort to improve the cooking system for a local school.

"This trip has been the highlight of my CMU career," said Fang, a junior mechanical engineering major who also studies human-computer interaction. "It's great that CMU supports these projects to help students broaden their views and perspectives and understand people from different backgrounds. You don't get that from textbooks."

Fang and her classmates monitored, evaluated and gathered feedback on the 24 solar street lights installed in September 2017 along the main road of Nyadire. Based on years of research and community feedback, the solar system was determined to be an efficient way to light the resource-strapped neighborhood, where the electrical grid is very unreliable.

Christina Ou, Cathy Fang, Ashley Burbano and Melina Driscoll took a winter-break trip to Nyadire, Zimbabwe, as part of the CMU chapter of Engineers Without Borders, where they followed up on a solar street light project and began an effort to improve a local school's cooking system.

Ou, a senior electrical and computer engineering major, said CMU's EWB chapter led fundraising efforts to pay for 95 percent of the installation cost of more than $40,000. The community will be responsible for covering the maintenance costs moving forward.

"We're really proud that our chapter spent four years on this project, and we were able to see it through to completion," Ou said. "It's a sustainable, long-lasting and effective lighting source."

The project is changing lives for those in the community.

"We were told when the electricity is out, students will sit under the lights to do their homework," Fang said.

COOKING WITH GAS

Burning firewood in an oil-lined concrete pot is the current heat source for cooking at the Nyadire Primary School, which has an enrollment of about 150 boarding students and more than 450 day school students. Firewood is expensive and scarce in Nyadire, which is trying to preserve its forests. The students discovered it takes a large amount of firewood to cook for the students each day, and securing the wood is labor-intensive.

Propane gas and ethanol gel were identified as alternatives to firewood, but the students have found that a biogas system is the frontrunner at this point. Driscoll, a sophomore information systems major, said the biogas system would use an underground digester, or mixer, that biodegrades human, animal and food wastes. The biodegradable waste will release methane gas, which would be fed through a pipe into the school's stoves.

"Part of our data collection was calculating how much waste was available to make sure there would be enough waste to produce enough gas to cook every day," Driscoll said.

"It's great that CMU supports these projects to help students broaden their views and perspectives and understand people from different backgrounds. You don't get that from textbooks."

— Cathy Fang, student

Driscoll said there are cows and chickens at a local farm that could supply much of the waste, but the team is still weighing options.

Implementing a new cooking system is not just an engineering problem — it's a social problem, too, the students said.

"Manually feeding waste into a digester is really messy. It's not a fun job. We have to make sure the people are willing to do that. Will they be able to sustain the system? We have to take all these factors into consideration," Ou said.

Ou (far left), Burbano (center), Driscoll (third from right) and Fang (second from right) worked with the school's kitchen staff, teachers and school headmaster, Tendai Mushapaidze (far right).

Back in Pittsburgh, the four students are drafting a proposal for the biogas system for submission to the national EWB chapter. If it's approved, specifications for implementation must be crafted, submitted and accepted before embarking on another trip to Nyadire.

A "SUPER VALUABLE" EXPERIENCE

While a new team of students will carry the torch forward, this team is grateful to have had the opportunity to impact the lives of others.

"Contributing to a community that benefits from our work is very rewarding," Driscoll said. "To see how our work can improve the lives of people in such a big way, so far away, made me very motivated to keep going with every step of the project. The head of the primary school, the children and the cooks really appreciated our work."

Ou, a four-year member of EWB, said her experience has been rewarding.

"I really like Engineers Without Borders because it's a practical way to apply my learning as an engineer and an opportunity to solve a real-world problem, impact real people and benefit an actual community," she said.

Evan Schindewolf, a senior physics major who was part of the solar lights team but did not make this most recent trip, said he "learned so much" from his work in EWB.

"I joined EWB because I wanted to work with people from other cultures, learn the engineering process and make an impact. It's been super valuable to be a member of EWB," he said.

New Avenue of Investigation for CANCER THERAPY DISCOVERED at Carnegie Mellon Qatar

DECEMBER 17, 2018

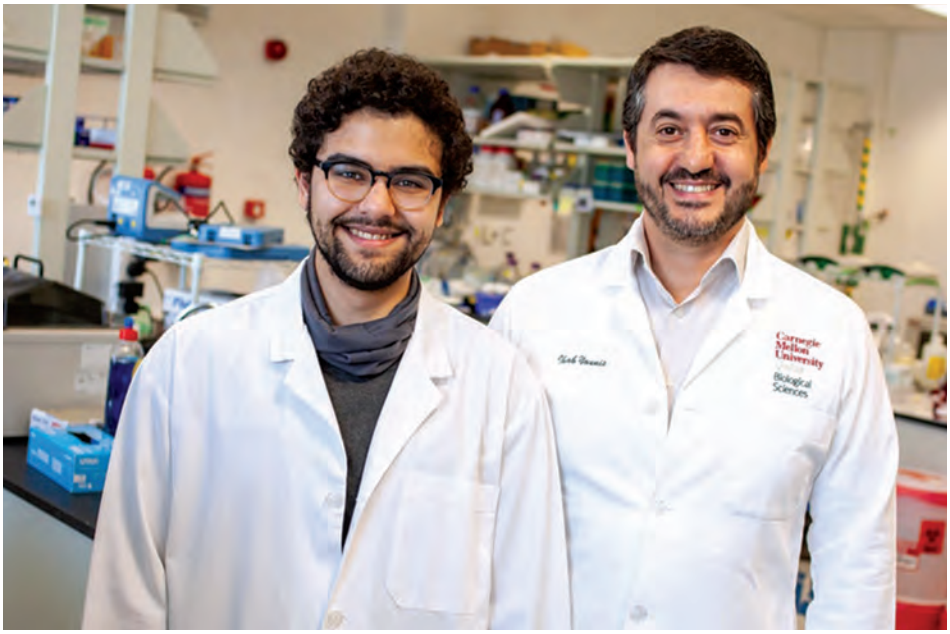
PROJECT INSPIRES CMU-Q ALUMNUS TO PURSUE CAREER IN CANCER RESEARCH

A team of researchers at Carnegie Mellon University in Qatar (CMU-Q) has discovered a new area of research that could lead to more effective cancer treatment with fewer side effects.

Ihab Younis, assistant professor of biological sciences, and Ettaib El Marabti, a 2017 graduate of CMU-Q's Biological Sciences Program, have revealed that the cellular mechanism called minor intron splicing is different in cancer cells than in normal cells.

Younis' research has focused on the role of introns for more than 10 years. The genes of many organisms have stretches of non-coding DNA that interrupt the sequences that code for protein. These non-coding sequences, which are called introns, must be removed, and the remaining sequences must be spliced back together to produce messenger RNA that is ready to be translated into protein.

"This research has been very much data-driven," he said, noting that his initial work in the area focused on the role of introns in neurodegenerative disease. "It was noticed early on that minor introns, which make up only 0.4 percent of introns, are often inefficiently spliced. This is puzzling since the proteins encoded by genes containing minor introns perform important roles in the cell. Our results suggested that the splicing mechanism acted like a molecular switch that could help cells adapt to stress and other changes."



Ettaib El Marabti, a 2017 graduate of CMU-Q's Biological Sciences Program, and Ihab Younis, assistant professor of biological sciences, have been pursuing research that could lead to more effective cancer treatments.

Younis and El Marabti then compared the minor intron sequences of healthy cells and cancer cells. They found that

> *"Targeting the cells in this way would work in combination for more effective treatment with fewer unfavorable side effects."*
>
> *— Ihab Younis, assistant professor*

cancer cells appear to have a faulty splicing mechanism. This finding, outlined in a paper titled "The cancer spliceome: Reprogramming of alternative splicing in cancer," was published in *Frontiers in Molecular Biosciences.*

"We do not suggest the use of this type of therapy would replace traditional therapies," Younis said. "Rather, targeting the cells in this way would work in combination for more effective treatment with fewer unfavorable side effects."

"Carnegie Mellon as an institution is built on the belief that research should have an impact on people's lives."
— CMU-Q Dean Michael Trick

"Carnegie Mellon as an institution is built on the belief that research should have an impact on people's lives," said CMU-Q Dean Michael Trick. "Ihab and Ettaib's research could have important implications in the treatment of cancer."

Younis is now looking into select minor introns in cancer cells that appear to target tumor suppressors. "This area of the cancer research is very new, but the body of research is growing as more labs look at the role of alternative splicing of messenger RNA in cancer cells. It's an exciting avenue to explore," said Younis.

IGNITING A PASSION FOR RESEARCH

When he joined the CMU-Q faculty in 2015, Younis sought out students who could help him establish his research lab. El Marabti, then a third-year student, was given the task of analyzing the sequence of the genetic codes of the minor introns of normal and cancerous cells.

Ettaib El Marabti started in Ihab Younis' lab at CMU-Q as a third-year student, where he gained a love of research that he plans to incorporate into his career as a physician.

"I learned that I love research because of this project with Dr. Younis," El Marabti said.

The project grew, and in 2017, El Marabti presented his findings at the Keystone Symposium on mRNA Processing and Human Disease in New Mexico as well as CMU-Q's research symposium, Meeting of the Minds. El Marabti took the top prize at Meeting of the Minds 2017.

After graduating in 2017, El Marabti began medical school at Weill Cornell Medicine - Qatar. The paper was completed while El Marabti was a first-year medical student.

"Every time I ask him to help, he has always been more than generous with his time," Younis said. "He finishes his day at Weill Cornell and comes here to work on the computational parts of the project."

El Marabti said he intends to incorporate research into his career as a physician.

"I spent the summer doing research at Memorial Sloan Kettering (Cancer Center) working in a similar area," he said. "I'm not sure what field I would like to pursue when I finish medical school, perhaps oncology, but I know that research will be a part of my career."

CMU-Q offers undergraduate degree programs in biological sciences, business administration, computational biology, computer science and information systems. Students are encouraged to participate in research to hone their skills in creative problem-solving and scientific inquiry.

GIFT TO ADVANCE MECHANICAL ENGINEERING
at Carnegie Mellon

FEBRUARY 26, 2019

$10 MILLION COMMITMENT WILL ENDOW DEPARTMENT HEADSHIP, SUPPORT CONSTRUCTION OF NEW BUILDING

An entrepreneurial idea to expand training for 21st-century careers, hatched on a working ranch in Montana and in Carnegie Mellon University's advanced manufacturing laboratories, has sparked a $10 million gift to support mechanical engineering at the institution.

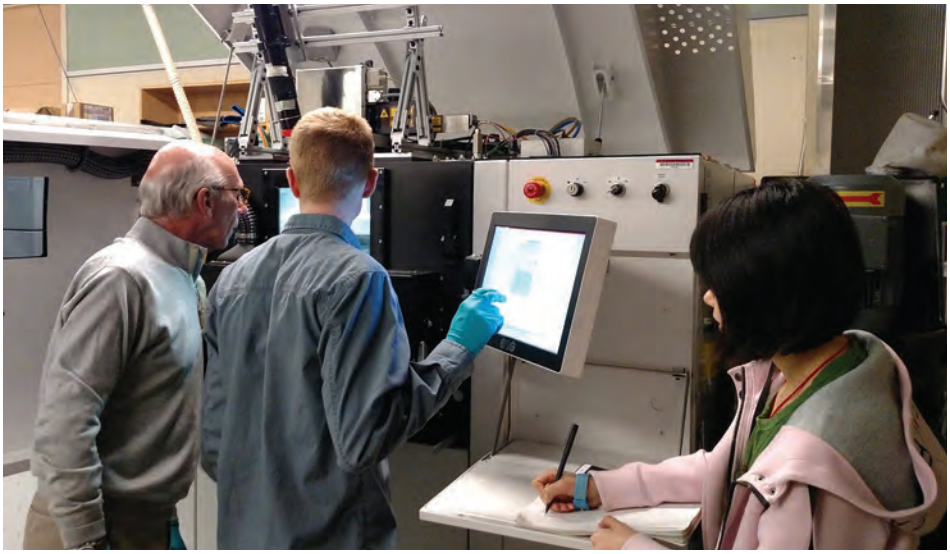
Trustee and alumnus David Coulter and his wife, Susan Coulter, have made the transformational commitment that will endow the headship for the Department of Mechanical Engineering as well as support the construction of a new Scaife Hall, which will house the department. The endowment to support the department head will provide critical funds for emerging priorities in mechanical engineering and is the first endowed headship announced in the College of Engineering. The department is ranked in the top 10 in the nation by *U.S. News & World Report*, which also places the College of Engineering at No. 6.

"David and Susan have been outstanding university citizens for decades," CMU President Farnam Jahanian said. "Their latest act of generosity that will benefit the Carnegie Mellon community promises to advance one of our leading programs — one that is driving manufacturing innovations for our modern world."

From left, Farnam Jahanian, Susan Coulter, David Coulter and James Rohr at the Coulter Welcome Center.

> *"Their latest act of generosity that will benefit the Carnegie Mellon community promises to advance one of our leading programs — one that is driving manufacturing innovations for our modern world."*
>
> *— President Farnam Jahanian*

The inspiration for the gift began on the Coulters' ranch outside of Bozeman, Montana, where David Coulter saw the need for workers with high-tech skills to operate and maintain modern machinery related to the local mining and agriculture economy. Following



David Coulter watches students working in the Additive Manufacturing Laboratory. The center has state-of-the-art additive manufacturing equipment and maker spaces to foster an integrated environment of education, research and industry collaborations.

a conversation with Carnegie Mellon Provost Jim Garrett, then dean of the College of Engineering, Coulter began working with the Next Manufacturing Center. The center is part of the college's advanced manufacturing initiative, which includes additive manufacturing, commonly known as 3-D printing.

The center's leadership, including Sandra DeVincent Wolf, Jack Beuth and Anthony Rollett, helped Coulter evolve his initial vision of vocational training into an expansive idea that combines traditional skill development with new technology such as additive manufacturing. A facility where locals will be able to train for manufacturing careers at the leading edge of the new economy is now under construction in Montana.

This positive collaboration between the Tepper School of Business alumnus and mechanical engineering faculty became the foundation for the Coulters' generous gift.

"At Carnegie Mellon, we often speak about how our strengths in deep disciplinary knowledge truly take flight when we collaborate across disciplines," Coulter said. "I feel like we're doing that in real time with this project, and I see our involvement as an alumni prototype for these cross-disciplinary projects. We're proud to support both the Tepper School of Business as well as the College of Engineering, and I am excited to see what the Department of Mechanical Engineering will achieve."

The Coulters' commitment to a new Scaife Hall follows a lead grant from the Allegheny Foundation in October. When complete, the new building will more than double the size of the existing building and will include expanded, technology-rich labs; modern, flexible classrooms; and spaces that facilitate formal and informal collaborations. Following the demolition of the current building, the $75 million facility will be constructed on an expanded footprint at the same location on Frew Street near Flagstaff Hill on the CMU campus.

"Mechanical Engineering is a leader in emerging fields such as soft robotics and advanced batteries. We need world-class facilities in the department to support the exceptional work of our faculty and students," said Allen Robinson, department head and professor. "We are so grateful for David and Susan's extraordinary generosity, which will impact the department for decades to come."

Robinson will become the first Coulter Head of the Department of Mechanical Engineering and will continue to hold the Raymond J. Lane Distinguished Professorship in Mechanical Engineering.

The Coulters' past CMU support includes a $5 million contribution to the recently completed first building on the David A. Tepper Quadrangle. The David and Susan Coulter Welcome Center, housed in the Tepper Building, serves as the new front door to campus, a one-stop destination for all visitors, including prospective students and their families.

A 1971 alumnus of the Graduate School of Industrial Administration, now the Tepper School of Business, David Coulter is a special limited partner with Warburg Pincus LLC in New York City. Previously, he was vice chairman of JPMorgan Chase & Co. and chairman and CEO of Bank of America Corp. In 2018, he was honored with the Tepper School Alumni Lifetime Achievement Award.