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BASIS High School student Helena Hurbon (right) joins her senior research project mentor, UA associate professor Wolfgang Fink (second from right), at the 2015 da Vinci Circle Annual Dinner. Also on hand are Tembong Fonji (left) and Ty'Dria Wright-White, members of the UA student chapter of the National Society of Black Engineers, for which Fink serves as campus adviser.

H.S. Students Get a Jump Start on Research

Tucson seniors pursue their interests in solar power and bionics in the UA's electrical and computer engineering labs before starting their undergraduate studies.

By Sydney Donaldson,UA College of Engineering | July 22, 2015

High school seniors Parthib Samadder and Helena Hurbon stopped attending class months before their May graduation at BASIS Tucson North High School. But not only did they graduate — they're bound for Ivy League universities.

Samadder and Hurbon swapped their traditional senior-year classroom instruction for a hands-on experiential learning project in the University of Arizona's Department of Electrical and Computer Engineering, or ECE. Samadder used origami to design a solar-powered robot, working with professor **Kathleen Melde**. Hurbon studied bionics and bacteria with associate professor **Wolfgang Fink**, who has a joint appointment in the Department of Biomedical Engineering.

Samadder and Hurbon were two of 57 Tucson-area BASIS seniors doing internships with universities and companies around the nation as part of the BASIS Senior Research Projects Initiative. BASIS, founded in 1998 to make U.S. students more globally competitive, includes publicly funded charter schools in Arizona, Texas and the District of Columbia.

"Experiential learning is key to understanding what engineering is all about," Melde said. "We must introduce high school students to the impact that engineers are making — and that they can make — in the world."

Melde predicted that this type of learning-by-doing research soon will be the norm in preparing high school students for engineering careers.

"This next generation isn't as afraid of failure," she said. "If a student doesn't know how to do something, they'll figure out a solution by Googling it, watching a tutorial on YouTube or reaching out to an expert. Student-led research projects play off of that natural desire to discover and solve problems, and that is what engineering is all about."

These kinds of projects also expose students to the rigors of academic research, said James Kittredge, a college counselor at BASIS Tucson North.

"There's always an advantage in researchers educating the younger generation," he said. "Even if the benefit isn't immediate, companies and institutions like ECE are taking a long view in cultivating an educated workforce."

Hurbon's mentor, Fink, incorporates this long view in his research programs.

"As part of my research, I engage students of all levels, starting from high schools, all the way to undergraduates, to graduate students," said Fink, recently appointed the **2015 da Vinci Fellow (https://youtu.be/YE1BjfUE0lE) [1]** by the UA College of Engineering for outstanding research and teaching.

Samadder explored how origami conceals mathematical principles that have applications for engineering and real life.

"In engineering, origami allows an object to be sheetlike at its destination but small for the journey," said Samadder, who worked with Melde to design a solar-powered robotic device using principles of origami for a compacted form.

With his newly gained skills in soldering, circuit design and antenna testing and exchanges with graduate students in Melde's lab, Samadder said he is prepared for any challenges he might face in his engineering program at Yale University.

"Dr. Melde's lab has amazing graduate students who are happy to help students like me access resources to pursue a wide variety of projects," he said. "ECE is a great place for high school students to explore their research interests and decide what fields they want to go into."

Hurbon, whose career goal is to improve bionics for war veterans, researched the connection between bacterial growth and human prosthetics.

Her project involved using differential equations to model bacterial growth, studying physical factors — such as temperature and moisture content — that contribute to bacterial growth, and exploring bacterial prevention practices.

Hurbon worked in the Visual and Autonomous Exploration Systems Research Laboratory, where Fink is developing robotic rovers for exploring planets and hand-held tools for examining patients' eyes.

The experience was an eye-opener for her.

"With research, you see how things are actually useful," Hurbon said. "You're not just learning equations to learn them. You're learning them to do something good in the world.

"Having research experience before college certainly puts you in an elite few, and I am so grateful for that. I am also incredibly grateful to have worked with Dr. Fink. Engineering is a collaborative effort, and I saw that each time I worked with him."

Hurbon was accepted into Eckerd College's 3-2 sequence program, in which she will earn two bachelor's degrees within five years: a physics degree from Eckerd College and an engineering degree from Columbia University.

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