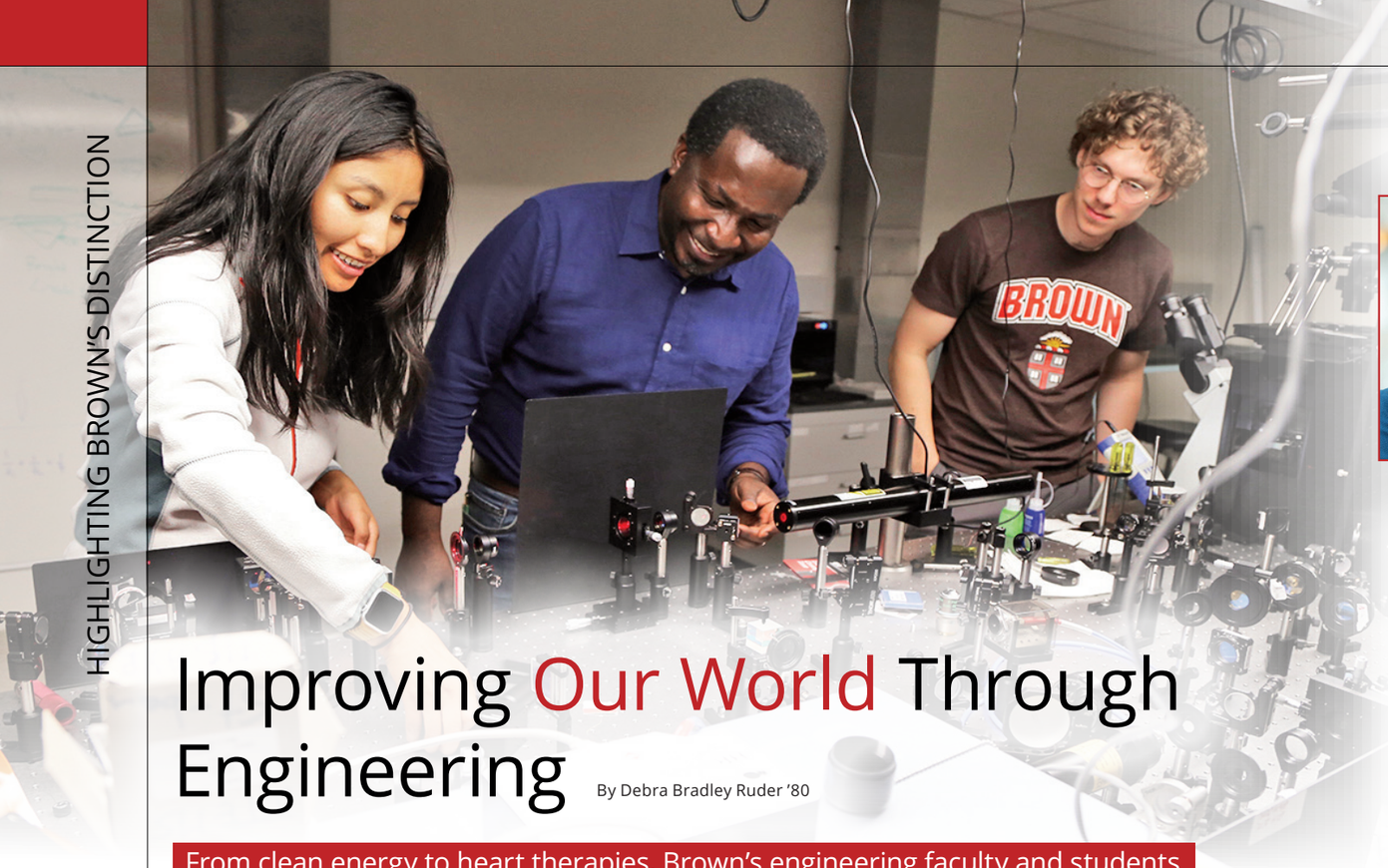

Improving Our World Through Engineering

By Debra Bradley Ruder '80

From clean energy to heart therapies, Brown's engineering faculty and students are collaborating on research to solve societal problems and improve lives.

Professor of Engineering Nitin Padture has spent years developing next-generation solar cells that hold promise for efficiently converting the sun's energy into electricity — and for helping mitigate climate change.

A set of these cells, which also may have an edge over the current technology for space applications, soon will orbit Earth aboard a small research satellite designed and built by Brown undergraduate engineers. Their experiment, part of a NASA science initiative, will test the cells' endurance in the harsh space environment. The students are fabricating the multilayered cells, made from crystalline materials called perovskites, with Padture's guidance, and they expect their satellite — with its mounted solar cells and observational camera — will launch in mid 2024.

Padture and his lab are leading groundbreaking research to improve the stability and reliability of these cutting-edge photovoltaics and move them closer to commercial use. Perovskite cells, he explains, are versatile, remarkably light absorbent and far cheaper to manufacture than conventional silicon-based solar cells.

"These are fascinating materials, and research is the key to reaching their full potential," Padture says. "There's a lot of excitement and activity at Brown around sustainable energy."

Faculty and students at Brown's School of Engineering, the nation's third oldest engineering program, are conducting innovative research like this to address pressing societal challenges in energy, the environment, health care and other arenas — and they're doing so within a liberal arts tradition that values a well-rounded education.

Collaboration in Action

TEJAL DESAI

"The type of engineering that happens at Brown is truly special," says the University's new Dean of Engineering Tejal Desai, an accomplished biomedical engineer who earned a bachelor's degree from Brown in 1994. "It's collaborative. And it's directed at, how do we change the world for the better?" The school's approach to inquiry and discovery across fields of study "fosters our ability to solve problems, because problems are not constrained to one discipline; they're multifaceted," Desai says.

Desai, a former faculty leader at the University of California, San Francisco who succeeds Professor Larry Larson as dean, looks forward to deepening collaborations within engineering and across campus, including with Brown's medical and public health schools. The holder of 27 issued or pending U.S. patents, she also wants to help Brown entrepreneurs bring discoveries into the marketplace through partnerships with industry.

Desai plans to build an active bionanotechnology lab at Brown and continue to develop microscale and nanoscale (much smaller than a human hair) tools for transporting therapies in the body and helping the body heal itself. She has been working on, among other projects, tiny implantable devices to treat Type 1 diabetes and designing nanoparticles that can deliver medicine through the nose.

Ingenuity With Impact

Walk through Brown's engineering complex, including the state-of-the-art Engineering Research Center that opened in 2017 near Barus and Holley, and you'll find impact in action. Environmental engineering professors Linda Abriola and Kurt Pennell are studying how toxic chemicals migrate through water and surface soil to inform how to protect drinking water. Associate Professor David Borton, who holds a 2012 Ph.D. in engineering from Brown, and collaborators have identified electrical signals in the brain that may lead to improved treatment for obsessive compulsive disorder. And Kareen Coulombe, associate professor of engineering, is using stem cells to produce healthy, implantable cardiac tissue for heart attack sufferers.

In the growing area of home-based health care, Professor and Senior Associate Dean of Engineering Kimani Toussaint is working with physics doctoral student Rutendo Jakachira to counter a longstanding racial disparity in pulse oximeters, which have been shown to provide less accurate measurements of blood-oxygen levels for people with darker skin than those with lighter skin. Toussaint and Jakachira are developing a new device, using enhanced optics and algorithms, they hope will give more accurate readings — which are so important for treatment decisions around COVID-19 and other diseases.

The project, says Desai, is an example of the engineering school's commitment to finding solutions that benefit society as a whole. "We have seen amazing advances in engineering research and education at Brown over the last 10 years," she says. "I am excited to shepherd the school through its next phase and to support and foster innovation."

ABOVE: A CHIP WITH FOUR PEROVSKITE SOLAR CELLS MADE IN NITIN PADTURE'S LAB. THE CELLS WILL BE MOUNTED ON THE OUTSIDE OF A STUDENT-BUILT SATELLITE AND OBSERVED BY A BOOM-MOUNTED CAMERA WHILE IN SPACE.

PHOTO UPPER LEFT: KIMANI TOUSSAINT (CENTER) WORKS IN HIS LAB WITH ADRIANA SALAZAR COARITI, RESEARCH COORDINATOR AND PROBE LAB MANAGER, AND PH.D. STUDENT MITCHELL HARLING.

CREDIT: AMY SIMMONS (TOUSSAINT, SOLAR CELLS); BARBARA RIES / UCSF (DESAI)

HIGHLIGHTING BROWN'S DISTINCTION