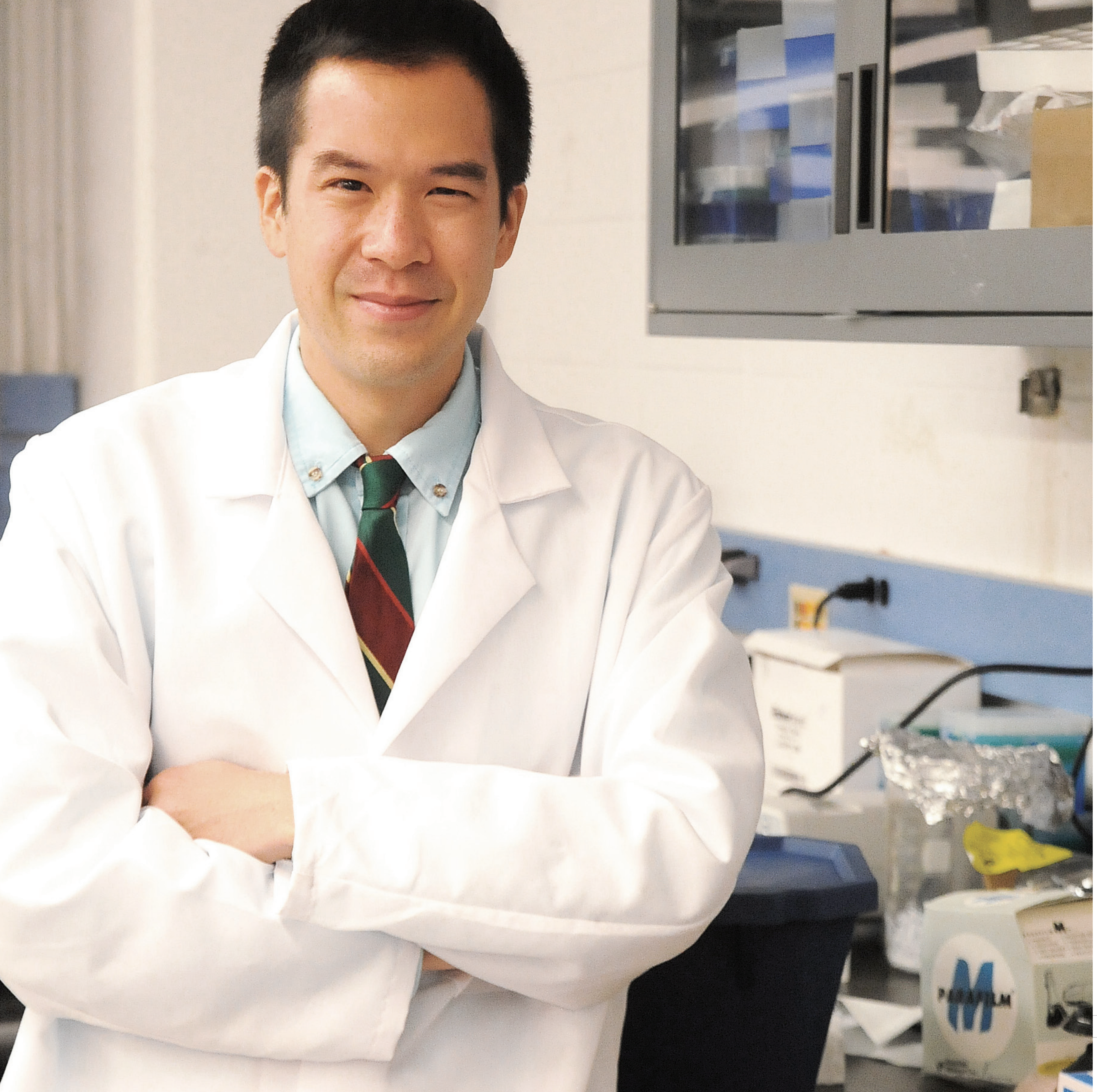

Understanding How Heart Cells Work

HAYDEN HUANG

Assistant Professor of Biomedical Engineering

HEALTH

Arrhythmogenic right ventricular cardiomyopathy (ARVC), which affects one in 5,000 people worldwide, is a leading cause of sudden death. With this disorder, fibro-fatty tissue replaces healthy heart muscle, and the heart's beating becomes uncoordinated. As a result, the heart can't pump well.

With ARVC as their inspiration, Hayden Huang and his team are figuring out how heart cells respond to physical stresses. ARVC can be caused by genetic mutations that affect proteins which link cells together. Huang is testing whether changes in these proteins interfere with how cells stick together and send signals, making the heart less able to withstand the stresses associated with constant pumping and ultimately damaging its tissue.

To do so, he looks at factors such as cell stiffness (how hard it is to deform the cell), cell adhesion (how well cells stick to surfaces or to each other), cell structure (what the cell is made of and how the components are arranged), and cell response (how cells react to physical stresses like being stretched).

Once Huang and his team unravel the mystery of how heart cells work and how ARVC progresses, they can help develop a diagnostic test to determine who suffers from the condition, which can be asymptomatic for a long time, and formulate a treatment to repair or prevent changes in the heart muscle. They also want to solve the mystery of why ARVC primarily affects the right heart when the left heart apparently does most of the heavy work. This research will help scientists better understand the differences between the two sides of the heart and heart function in general.

Huang teaches the Tissue and Molecular Engineering Laboratory and Fluid Biomechanics. He came to Columbia from a position as associate biophysicist and instructor of medicine at Brigham and Women's Hospital, Harvard Medical School.

Huang directs the Biomechanics and Mechanotransduction Laboratory, which studies cellular mechanics and mechanotransduction in cells and cell clusters. While the current scope of the projects are focused on the cardiovascular system, the techniques and insight are relevant to any number of cell and tissue systems.

"The current interest of our laboratory is in determining how cell-cell interactions, especially at the junctions where cells make contact, influence cellular mechanical behavior," Huang said. "Several techniques are used for studying cell-cell interactions, including fluorescence microscopy (wide-field and two-photon), time-lapse microscopy, cell stretching, magnetic micromanipulation, and physical micromanipulation (pipette aspiration, for example)."

B.S., Johns Hopkins University, 1995; S.M., Massachusetts Institute of Technology, 1997; Ph.D., MIT, 2002