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Creighton physicist's work unveils new ability of immune cells

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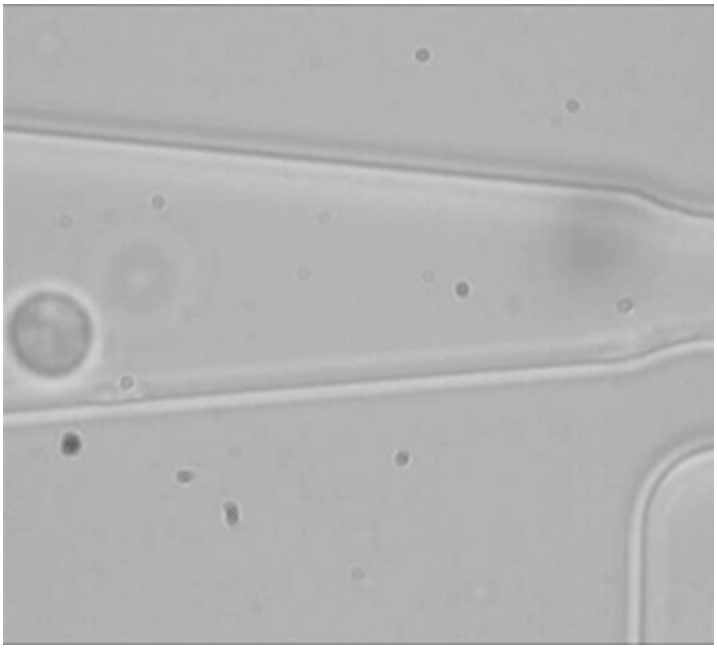

Credit: Creighton University

A major discovery about a set of immune cells, published today in the journal *Science Advances*, started with a Creighton University physics professor going a little farther on an experiment than was initially planned.

First author on the paper, the Rev. Andrew Ekpenyong, MS'08, PhD, an assistant professor in the Department of Physics, was a doctoral student at the University of Cambridge in 2011, working with a team of medical

doctors and scientists studying the stiffness of cells when he noticed something strange about a certain type of immune cell—the neutrophil. The more Ekpenyong pulled the cell with an optical stretcher—a special kind of dual-beam laser invented by Jochen Guck, PhD, a co-senior author on the paper—the smoother and more rounded the cell became.

Neutrophils, a special kind of white blood cell, are the human body's version of the Wild West desperado, shooting first and asking questions later, when foreign objects enter the body. Through cell signaling, neutrophils are first on the scene in such instances, going from a round, smooth and quiet cell to a rough-edged, activated one in an instant. It can take a neutrophil up to an hour to regain its quietude, but as Ekpenyong noticed, manipulation with the optical stretcher can speed the process of depolarization down to about one minute.

"It was just one of those cases where you start out to do one thing and take just one or two steps further for a bit of fun or further insight, and you have something else," said Ekpenyong, who earned a master's degree in physics from Creighton and joined the faculty in 2014 after post-doctoral work at Technical University of Dresden in Germany with Guck. "One of the lead researchers I was working with saw the video I had taken, jumped from his chair, left the room and beckoned his medical colleague to take a look."

That researcher is Edwin Chilvers, PhD, a professor of respiratory medicine in Cambridge's Department of Medicine. For Chilvers, another co-senior author on the paper, the discovery has implications across a broad spectrum of maladies, most notably acute respiratory distress syndrome (ARDS) and acute lung injury (ALI).

In those cases, activated neutrophils have become stuck in the lungs' tiny capillaries, leading to a host of life-threatening problems. Scientists have been searching for a chemical means of calming the cells, but to no

avail. Ekpenyong's physics-based approach has led to his development of a microfluidic device that mimics the body's microvascular system by squeezing and stretching the neutrophils into their tranquil state, after they are activated.

The challenge now, Ekpenyong said, will be to find a way to translate this discovery into a clinical application, something at which Cambridge and Dresden researchers are already hard at work.

Provided by Creighton University