Biomedical engineering researchers' findings and methodology are game-changers

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A study by three researchers in VCU's Department of Biomedical Engineering enhances understanding of a cell's response to mechanical cues from its surrounding environment, a key regulator of cell function. "Mechanotransduction Dynamics at the Cell-Matrix Interface" by assistant professor Seth Weinberg, Ph.D., student Devin Mair and associate professor Christopher Lemmon, Ph.D., employs a computational-experimental methodology with implications for further insights into mechanical interactions between cells. The study, which is part of a project funded by a $1.8 million grant from the National Institutes of Health, appears in the May 2017 issue of *Biophysical Journal*.

Called "a great advance in modeling cell behavior in mechanically complex microenvironments," in the journal's "New and Notable" feature, the research applies quantitative modeling to characteristics of the extracellular matrix (ECM)—the collection of molecules outside the cell that provides biochemical and structural support to a cell group. It demonstrates that cell-cell forces are transmitted more effectively when the ECM interfaces with an elastic substrate. The journal cited the authors' methodology, which applies physics-based models of cell behavior to environments that evolve over time, as an innovation that goes beyond this study's findings.

Weinberg and Lemmon were doctoral students together at Johns Hopkins University and have have collaborated on this project for several years. The idea, initially sketched out on a napkin over dinner,

capitalizes on their respective expertise and skillsets. "Chris had a really innovative idea to answer difficult questions within the field of mechanobiology, but he didn't have the computational background to develop the model," Weinberg said. "I knew how to develop large multiscale models, but I had never worked on problems in mechanobiology."

Weinberg's and Lemmon's labs now have several active collaborations based on hybrid computational-experimental models. Lemmon called their approach "a new paradigm for thinking about the mechanical interactions between cells and their surroundings" and noted that few labs are working in this mode.

Mair said working with Weinberg and Lemmon on this study has given him a leg up as he prepares to begin his doctorate this fall—coincidentally also at Johns Hopkins. "I am starting my Ph.D. with knowledge that most people only gain through the Ph.D. process," he said. "I completely attribute this to the mentoring Dr. Lemmon and Dr. Weinberg have provided."

More information: Seth H. Weinberg et al. Mechanotransduction Dynamics at the Cell-Matrix Interface, *Biophysical Journal* (2017). DOI: 10.1016/j.bpj.2017.02.027

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