Physics and Bioengineering Joint Colloquium

Prof. Velia Fowler

Department of Biological Sciences
University of Delaware

"Red Blood Cell Membrane Architecture, Shape and Biomechanics: From the Micro- to Nanoscale"

The biconcave disk shape and deformability of the mammalian red blood cell (RBC) is vital for its circulatory function and relies upon a specialized cytoskeletal structure called the membrane skeleton. The membrane skeleton consists of a 2D viscoelastic network of membrane-associated actin filaments (F-actin) connected by long, flexible spectrin molecules. Previous models have proposed that elastic network properties and network linkages to transmembrane proteins are sufficient to explain RBC shapes. However, our work now demonstrates that RBC biconcave shape depends on the contractile activity of non-muscle myosin IIA (NMIIA). RBC NMIIA molecules assemble into bipolar filaments with F-actin binding motor domains at their ends that exert forces on the membrane skeleton to form the dimple. We are using super-resolution fluorescence microscopy to determine the nanoscale organization and dynamics of F-actin and NMIIA in RBCs, and are collaborating with computational biologists to examine the relative importance of actin polymerization dynamics versus actomyosin contractile forces in controlling micron-scale membrane curvature and biconcave shape of RBCs.

Velia M. Fowler joined the University of Delaware as Professor and Chair of Department of Biological Sciences in January 2019. She received a B.A. from Oberlin College in 1974, a Ph.D. from Harvard University in 1980, and was a Jane Coffin Childs Postdoctoral Fellow at the NIH and Johns Hopkins University School of Medicine. She joined the Scripps Research Institute in 1987 and was promoted to Professor in 2000. Her research program investigates how actin dynamics and myosin contractility provide stability and exert forces to shape membrane curvature and influence cell and tissue biomechanics and physiology in red blood cells, the eye lens, striated muscle and many other cell types. She has published 130 research papers, chapters and reviews, mentoring over 25 graduate students and postdoctoral fellows. Her research has been funded by investigator-initiated research grants from the NIH for over 30 years.

Thursday, March 10, in LL 316 at 4:25 PM

For Zoom participation, please see information below:

Meeting ID: 972 1274 7894

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