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University of Miami, Physics Department Colloquium

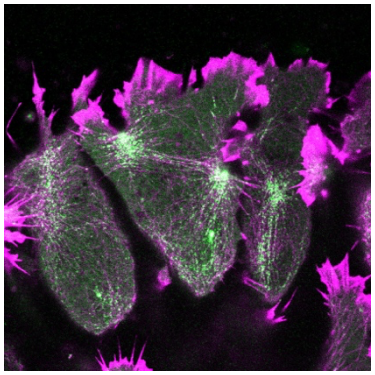
Date: Wednesday, September 6, 2023
Time: 4:00 pm – 5:00 pm
Location: Wilder Auditorium – Room 112, Knight Physics Building

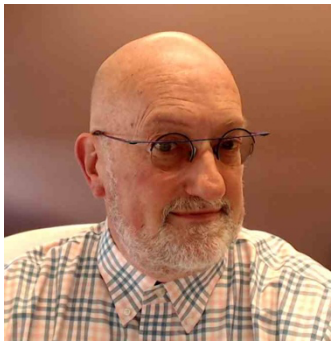
The Biophysical Basis of Embryonic Self-Assembly

Dr. Lance Davidson
University of Pittsburgh

Abstract

It is hard not to be awed when watching movies of embryonic morphogenesis. Developing animal embryos undergo a choreographed set of maneuvers that fold, tuck, pinch, and reshape an undistinguished ball of cells into a functional organism. At the end of this process, the vertebrate larva is equipped with features such as head, eyes, heart, and muscles that we recognize in our own bodies. The last 30 years have seen a revolution in understanding the genetics of embryos, and we are in a similar revolution in understanding the biophysical and biomechanical processes that shape the embryo. Principles from mechanical engineering and soft matter theory are being integrated to understand the self-assembly of novel "active materials". In this talk I will review the history of mechanical inquiry into development, and introduce some of the processes of self-assembly in the Xenopus frog embryo. Throughout this talk I will discuss how my group and others are working to develop conceptual frameworks together with experimental biomechanical tools to measure material properties and manipulate forces within these fragile microscopic tissues. Lastly, I will discuss major open questions in morphogenesis where physics and biology converge.





Biography: Dr. Lance Davidson has taken a non-traditional path to his current position as a professor of Bioengineering at the University of Pittsburgh. He completed a BS in Physics from the University of Illinois at Urbana-Champaign. With an interest in fields intersecting with Physics he earned a MS in Space Science from York University in Toronto Ontario. From there he worked several years as a scientific programmer in the defense industry. He found his way back to graduate school to earn a PhD in Biophysics at the University of California at Berkeley. His graduate work was one of the first to integrate computational models with experimental biomechanical approaches to morphogenesis. He moved to the University of Virginia at Charlottesville for a Postdoc to develop embryological and cell biological methods (e.g. "wet-lab" skills) in amphibian embryos. In 2006 he moved to Pittsburgh to join the Bioengineering Department in the Swanson School of Engineering. He has been supported by grants from the NSF, including a CAREER award, the NIH, including a recent MERIT award, the American Heart Association, the American Cancer Society, and most recently the Office of Naval Research.