



## CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS

Award ID:  
R1225

Project Title:  
Recruitment of Established Investigators

Award Mechanism:  
Recruitment of Established Investigators

Principal Investigator:  
Danuser, Gaudenz

Entity:  
The University of Texas Southwestern Medical Center

### Lay Summary:

Dr. Gaudenz Danuser is currently Professor of Cell Biology at Harvard Medical School, where he directs an interdisciplinary laboratory composed of molecular cell biologists, biophysicists, mathematicians, and computer scientists. Jointly, they are focused on unraveling the regulation of the chemical and mechanical processes that underlie cell migration and cell division, both fundamental cell functions in almost every aspect of life. Their deregulation is coupled to innumerable diseases, including cancer. While genetics, biochemistry and molecular biology have provided deep insight into the molecular components of cell division and migration machineries, we have still very little understanding how all these components work together in space and time. We have even less understanding of how this molecular machinery is affected by environmental factors, including interactions between neighboring cells. Answering these questions is essential for identifying the modes of aberrant cell function and for designing more effective therapeutic measures against diseases.

Danuser's laboratory is best known for the development of quantitative live cell microscopy approaches that permit the direct visualization and measurement of the molecular events implicated in these processes. Using mathematical modeling approaches they then reconstruct the functional hierarchy between hundreds of molecular events in time and space, an approach that has high potential for shifting the focus of cell biological investigation from individual molecular components to the study of systems of pathways. His lab has applied this framework to unravel the complex set of interacting molecular pathways required to integrate chemical and mechanical cues from the environment and direct cell migration.

Moving to UTSW, the Danuser lab will apply their imaging and data analysis paradigm to identify the molecular conditions that allow cancer cells to acquire persistent motility, leave the primary tumor, and spread to other tissues where they form secondary tumors. The lab will also study how chemical and mechanical cues in the tumor microenvironment affect these processes and whether drugs that are in clinical use for killing the primary and secondary tumors trigger transformations in a subpopulation of tumors cells that lead to the acquisition of motility and drug resistance. Ultimately, the goal of this work is to establish a platform technology for quantitative cell biological experiments that will support the identification of biomarkers for more accurate prognosis of metastasis and the drug discovery process in cancer scenarios where motility is a suitable target for preventing metastatic tumor dissemination and relapse.

Dr. Danuser received his diploma (1993, equivalent to M.S.) and Ph.D. (1997) from ETH Zurich in Switzerland in engineering and computer science. Through his postdoctoral training with Shinya Inoue and Rudolph Oldenbourg at the Marine Biological Laboratory in Woods Hole, MA, he entered the field of bioimaging and began to work on cell motility, initially in neurons and plants. He started his own lab in 1999 at ETH Zurich in the Department of Mechanical Engineering, where he worked on the molecular mechanics of cell migration and adhesion. In 2003 he was recruited back to the U.S, where he joined the Department of Cell Biology at the Scripps Research Institute in La Jolla. There, he quickly moved through the ranks of Assistant (2003 – 2006), Associate (2006 – 2008), and Full Professor (2009) before being recruited to Harvard Medical School. Danuser's research has been recognized by several honors and awards, most recently by the Barany Award for Young Investigators from the Biophysical Society (2009), a Transformative R01 Grant from the NIH President's Office (2009), and the Holt Lectureship at MIT (2010). He is a regular keynote speaker at national and international meetings and a standing member of the NIH study section "Enabling Bioanalytical Instrumentation and Technologies". He is also a devoted teacher both at Harvard Medical School and as a course director at the Marine Biological Laboratory in Woods Hole, where his teaching focuses on computational cell biology, molecular biomechanics and the theory of measurement applied to cell biology.