Workshop on "Cell/Matrix Mechanobiology: current state and future directions"
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Considerable experimental evidence acquired during the last three decades has now established that extracellular biophysical cues, such as forces and matrix stiffness, have a profound influence on a wide range of cell behavior such as growth, motility, differentiation, apoptosis, gene expression, adhesion and signal transduction. More recently, it is appreciated that cells not only respond to these cues from the matrix, but also remodel the matrix and hence influence the subsequent cues. This dynamic reciprocity gives rise to an emergent property to the cell/matrix system, and they co-evolve with time. This is particularly prevalent in embryogenesis, development and tumor growth. The precise role of mechanics in determining this reciprocity remains elusive. For example, how cells transduce biomechanical cues into biochemical processes and vice versa, which processes are involved in remodeling the matrix, what determines the spatio-temporal rates of the remodeling process, how cell-cell signaling affect the emergent behavior and how long range are such signals, how do the morphologies and spatial patterns of cell clusters or colonies evolve due to the complex cell-cell and cell-matrix partners remain to be resolved. Probing these fundamental questions will need in vitro experimental platforms that allow co-evolution of cells and the matrix, as well as quantification of the key parameters that determine the co-evolution. Simultaneously, theoretical/computational models will be needed to interpret the experimental results, design new experiments, and predict outcomes for engineering applications. A deeper understanding of these issues may have a revolutionary impact on biological and health sciences of the 21st century by offering new paradigms in disease detection and prognosis, in engineering cell functions for developing artificial tissues, as well as developing new materials, sensors and other technologies with applications beyond health and biology. Advances in micro-nano technology, high throughput assays, imaging modalities, and large scale computational power can catalyze this revolution through unique capabilities of probing biological phenomena at a cellular and subcellular scale. It is thus appropriate at this stage to clarify the critical issues and future directions of cell/matrix mechanobiology, and evaluate its potential impact on the society. These issues will be discussed in the workshop, titled "Cell/Matrix Mechanobiology: current state and future directions" by prominent scientists in the filed from around the world.

The primary objective and vision of the workshop are to (1) pose the critical questions and challenges in the field of cell/matrix mechanobiology, (2) identify essential experimental and theoretical/computational platforms and tools needed to explore the questions, (3) identify its potential societal impact, e.g., in health care, and in developing new biohybrid technologies, and (4) propose roadmaps for the field to realize the potentials. There will be short lectures, Q&A sessions and panel discussions.

The major outcome of the workshop will be a position paper. A draft of the paper will be distributed to the invited speakers. The speakers will address some of the questions raised in the paper. The paper will be completed soon after the workshop. The paper will summarize and organize the discussions of the workshop. A draft of the paper will be disseminated to the broader community, funding agencies, national labs and international institutes. The proposed future roadmap in the workshop will have a significant impact on the graduate research and education, and research directions for scientists in the field.