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**MOVING LIVING CELLS AND FLUIDS ON MICROCHIPS FOR DIAGNOSTICS.**

**Mehmet Toner**

Center for Engineering in Medicine, Harvard Medical School, Boston, MA

Biomedical applications of microfabricated devices is no longer limited to non-living systems as genes-on-a-chip or lab-on-a-chip, recent advances in the understanding of cellular behavior in micro-environments have started to pave the way toward living micro-devices. These emerging devices are expected to become key technologies in the 21st century of medicine with a broad range of applications varying from diagnostic, tissue engineered products, cell-based drug screening tools, and basic molecular biology tools. They will also include multiple cell types and/or genetically engineered cells to investigate complex interactions between cells from different tissues. These sophisticated devices will contain micro-engineered tissue units coupled to each other by complex microfluidic handling network. Microfluidic mixing systems will also precisely regulate the composition and concentration of drugs to be tested. This presentation will briefly review the early historical literature on the use of microtechnologies in cellular systems and then focus on various applications in cancer biology, HIV/AIDS and global health, inflammation, and systems biology. The presentation will primarily focus on interesting transport phenomena at the microscale and how such information can be used for the development of microfluidic systems for diagnostics and other applications.