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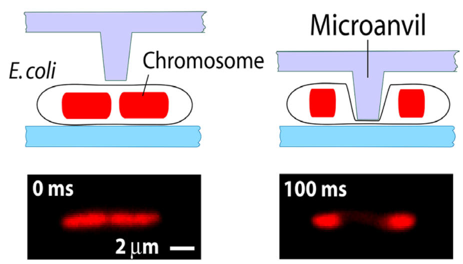
Driven in part by applications of microfluidics, understanding how cells respond to physical forces, compress, and how cancer cells metastasize into the bloodstream are expanded.



While most cells experience mechanical stress, relatively little is still known about the regulatory networks that respond to it. Established techniques, such as a rheology setups, micropipettes and magnetic tweezers, have found use among biophysicists and soft matter physicists, but it often lacks the ability to track how cells actively adapt to stresses over longer than approximately a few seconds.

Mannik et al. published an article highlighting advancements in lab-on-a-chip-based tools that can mechanically stimulate single cells and small cell assemblies, called organoids, over days and months. The paper discusses the promise of strategies to apply compressive, stretching and shear forces for single cells and organoids.

"Lab-on-a-chip devices, combined with advanced microscopy techniques, have started to provide us with a detailed look on how molecular pathways activate in response to mechanical perturbations," said author Jaan Mannik.

The emerging lab-on-a-chip platforms have made it possible to measure the force a single cell can generate as it grows, as well as how cancer cells contort their shape to jockey through normal tissue to metastasize into the bloodstream.

Microfluidics can capture how cells in the bloodstream respond to shear forces. By sorting out cells by deformability at rates up to 2,000 cells per second, the latter approach has particular potential for screening cancer cells.

Biomedically relevant is organ-on-a-chip technology that applies oscillatory stress to heart and lung cells and enables screening different drugs on these cells in their native dynamic environment.

Mannik hopes to see future work improve on platforms' biocompatibility and makes the technology more accessible for broader communities of investigators.

Source:: "Lab-on-a-chip based mechanical actuators and sensors for single-cell and organoid culture studies," by Jaan Männik, Tetsuhiko Teshima, Bernhard Wolfrum, and Da Yang, *Journal of Applied Physics* (2021). The article can be accessed at https://doi.org/10.1063/5.0051875.