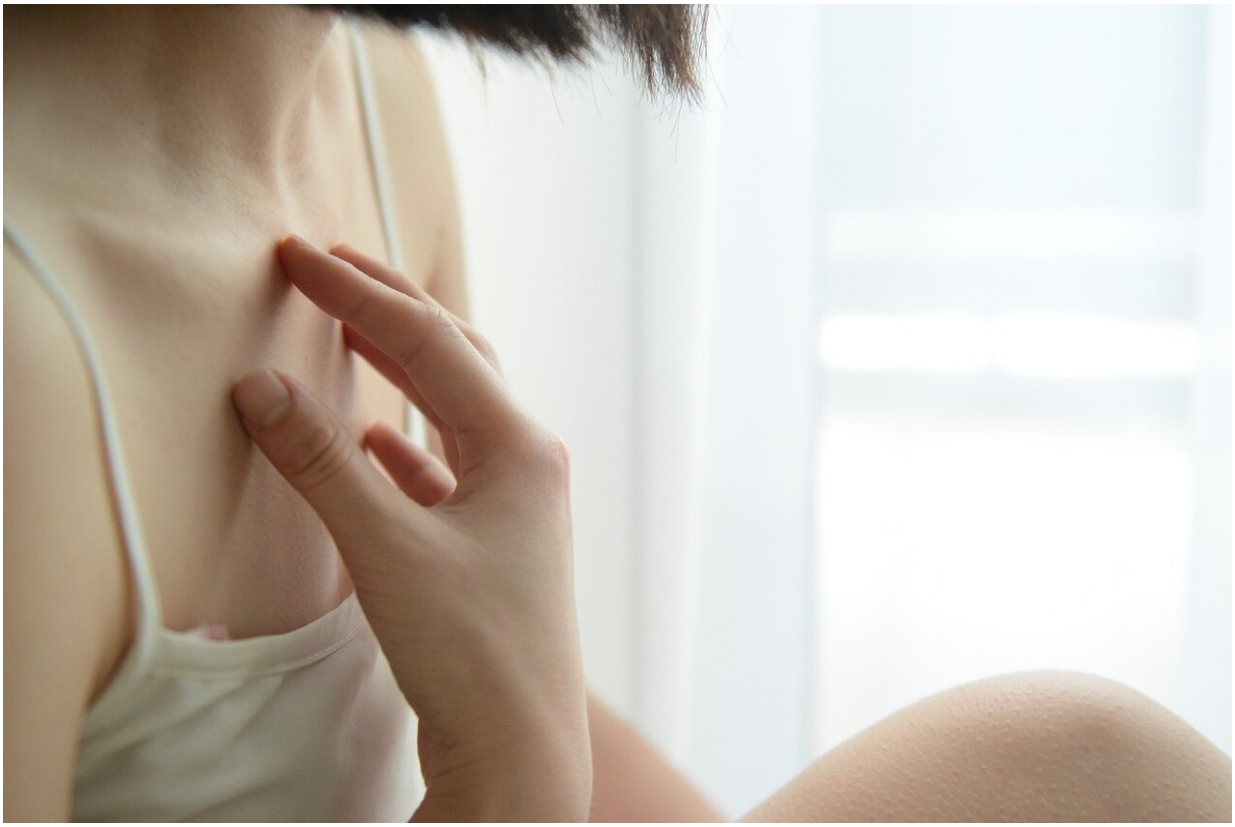
Researchers shed new light on mechanical regulation of epithelial tissue homeostasis

October 1 2021



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An international team of scientists, led by Professor Ana-Sunčane Smith from the Croatian Ruđer Bošković Institute (RBI) and the Friedrich-Alexander University of Erlangen-Nürnberg in Germany, provided fresh

insights on the impact of mechanical properties on the organization and growth of cell tissues. These results could contribute to a better understanding of tissue regeneration as well as in diagnostics of various pathological conditions. The team recently published their findings in the distinguished scientific journal *Physical Review X*, one of the world's leading journals in the field of physics.

During our lifetime, due to a disease or a body injury, the elastic properties of the extracellular matrix change. Adaptations to these changes have so far been analyzed at the cellular level as part of mechanoresponse, however, the impact of the mechanical properties of the micro-environment on the structure of epithelial tissues, those that provide a protective outer layer to organs and the body as a whole, have not been analyzed in detail.

By skilfully combining theoretical and experimental biophysics methods, the researchers have investigated simple model epithelial tissues. They have demonstrated that extracellular matrix stiffness dictates the self-patterning and growth of the tissue at all length scales.

"In our experiments, we have grown epithelial tissues on substrates that produce varying levels of stress on the overlying tissue. On the cellular level, we have found a stiffness-driven transition from squamous to the tubular epithelium. At the tissue level, we have demonstrated that cells self-organize in macroscopic compartments with different cell dynamics and organization. These results pointed to a more complex relationship between cell density and cell motility than previously known. Most interestingly, we found that the organization of epithelial tissues is highly robust despite displaying largely different densities of the homeostatic state for different microenvironment stiffness. These results suggest that in cellular tissues it is a particular topology, and not density, of the tissue that is actively regulated. This fact could have implications in aging or diagnostics of medical pathologies," said professor Ana Sunčana Smith,

who led the research.

More information: Sara Kaliman et al, Mechanical Regulation of Epithelial Tissue Homeostasis, *Physical Review X* (2021). DOI: 10.1103/PhysRevX.11.031029

Provided by Ruđer Bošković Institute