UNIVERSITÉ DE GENÈVE

PRESS RELEASE

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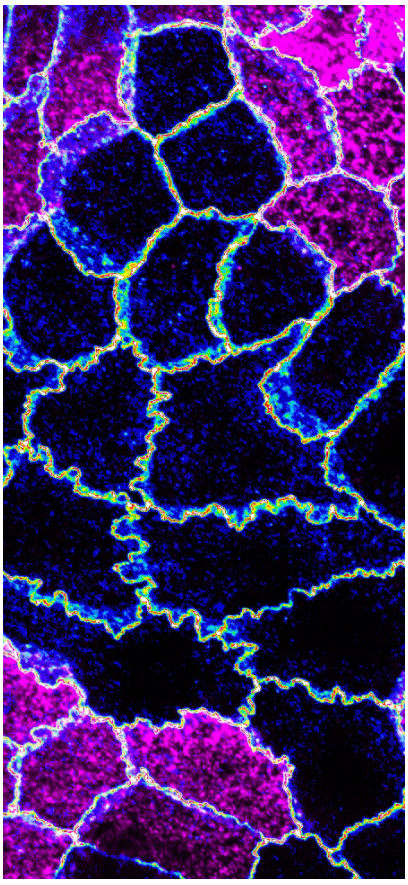
The fine control of cell mechanics

UNIGE scientists have revealed the key role played by a form of actin in the mechanics of epithelial membranes and the dynamics of components of cell-cell junctions.

Our skin and mucous membranes are protected by epithelial cells. This "barrier" tissue performs its function thanks to specialized structures called "junctions". They ensure cell cohesion and regulate exchanges across the space between cells. Researchers at the University of Geneva (UNIGE), in collaboration with the National University of Singapore (NUS) and the Institute of Physical Chemistry (IPC) in Göttingen, have studied the role of a specific protein, gamma-actin, in the organization and mechanics of epithelial cells and their junctions. Their work, published in *Nature Communications*, reveals a mechanism of interdependence of different forms of the cytoskeletal proteins actin and myosin, and their functions. The team also demonstrates the key role of gamma-actin in the rigidity of cell membranes and the dynamics of junctional proteins, which may provide a mechanism of hearing loss.



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In pink, wild type cells expressing gamma actin. In black, knock-out cells that do not express gamma actin. The yellowish lines reveal the tortuous nature of the junctions.

High resolution pictures

The epithelium is a tissue of fundamental importance, that covers the surface of the body and lines the interior of many organs. Composed of tightly bound epithelial cells, it plays a crucial protective role against external aggressions, such as pathogens. This function relies to a large extent on the presence of "adherens" and "tight junctions," veritable protein locks linking neighboring cells and ensuring tissue tightness. Tight junctions regulate the passage of molecules in and out of organs. For example, they facilitate nutrient absorption in the intestine and help filter substances in the kidneys.

The laboratory of Sandra Citi, Associate Professor in the Department of Molecular and Cellular Biology at the UNIGE Faculty of Science, is interested in how tight junctions interact with the cytoskeleton - the internal framework of cells - to regulate cell architecture, as well as the various functions performed by the epithelium.

A possible cause of deafness?

In this recent study, the researcher and her team analyzed the role of gamma-actin - one of the components of the cytoskeleton - in the organization of junctions between cells, and discovered that in its absence another form of actin, beta-actin, is produced in greater quantities, and this is linked to an increase in a specific form of myosin. "These changes make the apical membrane - the top of the cell – less stiff and certain constituents of the tight junctions more mobile, without however affecting the barrier formed by these junctions," explains Marine Maupérin, postdoctoral fellow in the Department of Molecular and Cellular Biology at the UNIGE Faculty of Science and first author of the study.

Gamma-actin therefore confers increased rigidity to the apical membrane, forming a network of filaments that is stronger and stiffer than that made up of beta-actin filaments. “This result is particularly interesting because the stiffness of the apical membrane is essential for auditory function,” explains Sandra Citi, who led this research.

Indeed, gamma-actin-deficient mice show altered architecture of the apical surface of epithelial cells and progressive hearing loss. A stiffer cortical membrane may be required to withstand the constant mechanical stimuli to which the hair cells lining the inner ear are exposed. A deeper investigation into the role of gamma-actin in maintaining cell integrity could thus help to understand the pathologies of hearing loss, for example.

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