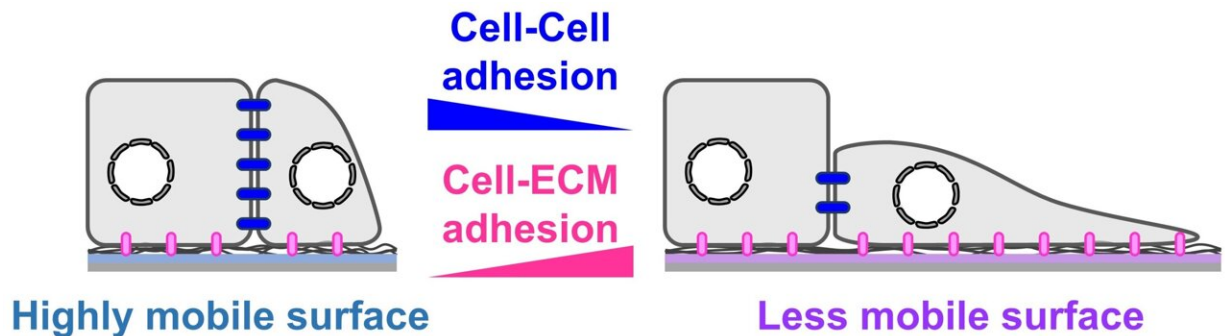


Bringing cells closer to form new tissues

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A highly mobile surface promotes cell-cell adhesion and inhibits cell-ECM adhesion (Left). A less mobile surface promotes cell-ECM adhesion and inhibits cell-cell adhesion (Right). Credit: Department of Organic Biomaterials, TMDU

The field of tissue engineering is constantly exploring the possibility of using different properties of various biomaterials to achieve tissue regeneration. However, a key factor in creating effective tissues that can ameliorate and act as physical barriers is the strength of cell-cell adhesion.

In a study published this October as an editor's-choice HOT article in *Biomaterials Science*, researchers from Tokyo Medical and Dental University (TMDU) have shown that culturing epithelial [cells](#) on a biomaterial surface using polyrotaxane can ameliorate cell-cell adhesion to repair the damaged tissues for regeneration.

Polyrotaxanes are [supramolecular polymers](#) that, at a molecular scale, resemble a beaded chain. Polyrotaxanes can exhibit molecular mobility, which is the movement of certain molecules in relation to others, such as sliding or rotation of ring-shaped molecules along an axle molecule. When cells are cultured on this [biomaterial](#) the molecular mobility of polyrotaxanes can affect cell–[cell adhesion](#) through one of its main players, a protein called yes-associated protein (YAP). "We knew that cell–cell adhesion is closely related to the subcellular localization of YAP," says Ryo Mikami, one of the lead authors of the study. "For instance, increasing cytoplasmic YAP localization promotes the organization of tight junctions, which are specialized connections between two adjacent cells. Therefore, we hypothesized that cell–cell adhesion of epithelial cells could be enhanced by YAP being affected through the molecular mobility of polyrotaxane surfaces."

The researchers used cells derived from mouse lung as a model of [epithelial cells](#). They cultured them on the polyrotaxane surfaces with different mobility and investigated their proliferation and morphology. Using fluorescent staining, they visualized the subcellular localization of YAP to assess whether it was in the cytoplasm or in the nucleus. Polyrotaxane surfaces with high mobility led to cytoplasmic localization of YAP, while those with low mobility induced nuclear YAP localization. These results suggest that polyrotaxane surfaces with higher mobility induce cytoplasmic YAP localization, leading to stronger cell–cell adhesion due to an increased number of tight junctions. "In the future, polyrotaxane-based biomaterials with tuned molecular mobility represent promising implantable biomaterials for reinforcing the physical barrier function of epithelial tissues and inhibiting the progression of inflammation", says Nobuhiko Yui, senior author on the study. For example, a potential application could be in clinical dentistry, where damage to tight junctions due to bacterial infections is known to cause periodontal disease, including gingivitis and periodontitis. In this context, biomaterials that ameliorate cell–cell [adhesion](#) are expected to

not only support the reconstruction of biological tissues but also to heal and repair the damaged tissues by reducing inflammation restoring the physical barrier to microorganisms.

More information: Ryo Mikami et al, Improved epithelial cell–cell adhesion using molecular mobility of supramolecular surfaces, *Biomaterials Science* (2021). [DOI: 10.1039/D1BM01356D](https://doi.org/10.1039/D1BM01356D)

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