Developing a tunable biomaterials platform to mimic the intercellular interface

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Cells form specialized types of adhesions with their surrounding environment, amongst them the integrin-based focal adhesions (cell-ECM) and cadherin-based adhesions (cell-cell) [1]. Both of these cell-adhesion types are able to sense mechanical environmental cues and influence cell behavior [2, 3]. Moreover, there is evidence that they can establish a close mechanical crosstalk, with some studies showing a competitive relationship [4, 5] and others a cooperative [6]. To further study the nature of the interplay between integrin and cadherin-based adhesions, a platform that allows for the fine tuning of the mechanochemical properties of two orthogonal interfaces is needed. Using poly(acrylamide), an inexpensive, cytocompatible material widely used for mechanobiology studies [7], our group is developing a 2.5D artificial microenvironment that allows for independent, orthogonal tuning of both mechanical and chemical properties. The method involves a soft molding step allowing for the separate polymerization of two hydrogel layers with different coupling chemistries. This platform has the potential to become a powerful tool for studying mechanosensing at the cell adhesion level, as well as for unraveling the intricacies of the crosstalk stablished between cell-cell and cell-matrix adhesions.

[1] C. Collins, PNAS 114, E5835 (2017)

[2] A. Totaro, Nature Communications 8, 15206 (2017)

[3] Q. Le Duc, Journal of Cell Biology 189, 1107 (2010)

[6] H. Yamamoto, Nature Communications 6, 6429 (2014)

[4] W. Guo, Biophysical Journal 90, 2213 (2006)

[5] Y. Wang, Proc Natl Acad Sci U S A 103, 1774 (2006)

[7] A.K. Denisin, ACS Appl. Mater. Interfaces 8, 21893 (2016)