T cell stiffness is enhanced upon formation of immunological synapse

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To exert their effector functions, T cells need to form an intimate contact with their cognate target cells, which is termed the immunological synapse (IS). Mechanobiology has been receiving increasing attention, given its indispensable and previously ignored role in regulating cell functions. In terms of T cells, they can sense the stiffness of targets/substrates and generate force upon IS formation, which are important for their effector functions. However, how the stiffness of T cells per se is regulated upon IS formation still remains elusive. In this work, we determined stiffness of different cell parts in detail during the processes of IS formation in T cells. To this end, we established a method to investigate live T cells on functionalized co-verslips by atomic force microscopy (AFM) based Peak Force Quantitative Na-noscale Mechanical Characterization (Peak Force QNM), which enables simulta-neous determination of the surface profile and stiffness of live T cells. Using primary human CD4⁺ T cells, we found that upon IS formation, T cells were substantially stiffened at the cell body as well as at the lamellipodia. In general, the stiffness at the lamellipodia is significantly higher than that at the cell body. Furthermore, we identified that calcium is involved in regulation of this IS formation-induced T cell local stiffening at lamellipodia [1].

[1] Jung P, Zhou X, Iden S, Bischoff M, Qu B.: T cell stiffness is enhanced upon formation of immunological synapse, eLife 2021;10:e66643 (2021).