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The effective dynamic elastic modulus of cancer cells as function of temperature and membrane order

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The precise characterization of the mechanical properties of cells, e.g., by employing atomic force spectroscopy (AFS), is important for both fundamental research, and numerous applications. AFS delivers information about the topography, viscoelasticity of cells and adhesive forces. Here, we systematically compare differences in the results depending on the measurement concept. For A375 melanoma cells we find local differences in the Young's modulus E covering about one order of magnitude and a logarithmic dependence of E on the loading rate, as known for binding forces between single proteins. Moreover, we compare different tip geometries and fit models resulting in considerable differences, stressing the limitations of comparability of the data between publications. Comparing AFS data using tipless cantilevers with the results of deformation analysis of cells in microchannels we find good agreement of the obtained effective Young´s moduli. Finally, we employ rheological measurements on Hela cells to correlate membrane order and mechanical properties as function of the temperature.