Investigation of mechanical properties of cell membranes

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It has been observed that subtle changes of mechanical properties of cells are correlated with changes in the state of their health. A theory is presented to describe the nonlinear mechanical properties of living cell membranes, and in particular the response to probing by Atomic Force Microscopy (AFM). The general theory of liquid crystal bilayer surfaces with local bending resistance is used in a variational setting to obtain the equations that describe equilibrium states. This analysis will guide the development of a new generation of cantilever-based MEMS/NEMS for *in vivo/vitro* investigation of microbiological systems. Refinements associated with global constraints on the enclosed volume, and contact with a rigid substrate, taking the cytoskeleton into consideration are introduced and discussed. A procedure is also given for identifying material constants for the cell membrane through correlation with AFM data.