

Plenary Talk PV I Mon 8:30 H1
Response of live cells to mechanical stress — ●SAMUEL SAFRAN
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Recent research at the interface of physics and biology has shown that cellular processes such as proliferation, differentiation and tissue development, are controlled by the mechanical properties of cells and their environment. This talk reviews current experiments on cell mechanics and their relation to recent theoretical models. The theory includes non-equilibrium cell activity (related to the fact that the cell is alive), local elastic equilibrium, and random forces to determine cell response to static and dynamic stress. Cells also respond to stress via curvature induced-forces and we calculate how the competition of cell contrac-

tility and curvature energy allow for different orientations of cells on curved substrates, depending on cell type and substrate curvature. To understand how substrate rigidity determines the polarization of cells, we have generalized the theory of elastic inclusions in solids to living inclusions whose active polarizability, analogous to that of non-living matter, results in feedback in response to matrix stresses. We use this to explain recent observations of the non-monotonic dependence of stem cell polarization on matrix rigidity. These findings provide a mechanical correlate for the existence of an optimal substrate elasticity for cell differentiation and function.

Theoretical collaborations: Y. Biton, B. Friedrich, R. De, A. Zemel and experimental interactions: A. Bershadsky, A. Brown, D. Discher, B. Hoffmann, R. Kemkemer, R. Merkel, F. Rehdfeldt.