morphology, but not cellular traction; and that there are specific vinculin architectures that reflect distinct states of cellular contractility and motility.

**2908-Pos Board B600**
**Microrheology Inside Cancer Cells on Micropatterened Substrates**
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Microrheology is the investigation of the mechanical deformation of a given material in response to an applied stress at the micrometer scale. Microrheology allows to probe the microenvironment inside the cell in passive or active manner. Here we measure the cytoplasm viscoelastic properties using intracellulaer active microrheology technique. We user optical trapping coupled to cell micropatterening to probe the local mechanical properties of normal and cancer cells in a standardized manner.

**2909-Pos Board B601**
**The Activation of Directional Stem Cell Motility by Green Light-Emitting Diode Irradiation**
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Light emitting diode (LED) irradiation is potentially a photostimulator to manipulate cell behavior by opsin-triggered phototransduction and thermal energy supply in living cells. Directional stem cell motility is critical for the efficiency and specificity of stem cells in tissue repair. We explored that green LED (530 nm) irradiation directed the human orbital fat stem cells (OFSCs) to migrate away from the LED light source through activation of extracellular signal-regulated kinases (ERK)/MAP kinase/p38 signaling pathway. ERK inhibitor selectively abrogated light-driven OFSC migration. Phosphorylation of these kinases as well as green LED irradiation-induced cell migration was facilitated by increasing adenosine triphosphate (ATP) production in OFSCs after green LED exposure, and which was thermal stress-independent mechanism. OFSCs, which are multi-potent mesenchymal stem cells isolated from human orbital fat tissue, constitutionally express three opsins, i.e. retinal pigment epithelium-derived rhodopsin homolog (RRH), encephalopsin (OPN3) and short-wave-sensitive opsin 1 (OPN1SW). However, only two non-visual opsins, i.e. RRH and OPN3, served as photoreceptors response to green LED irradiation-induced OFSC migration. In conclusion, stem cells are sensitive to green LED irradiation-induced directional cell migration through activation of ERK signaling pathway via a wavelength-dependent phototransduction.

**2910-Pos Board B602**
**Towards a Mechanistic Understanding of Cellular Uptake**
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Budding of cell membranes initiates intracellular vesicle transport and has been studied for a variety of soft matter systems. Using a continuum model, we study wrapping of a single nano-particle as an interplay of the membrane deformation energy and the adhesion energy between particle and membrane. With the help of numerical energy minimization using triangulated surfaces, we investigate the role of shape and size of the particle as well as of the membrane's elastic parameters on nano-particle wrapping.
For rod-like and disc-like particles, we find a higher binding-affinity to the membrane compared with spherical particles. However, such particles have a lower uptake to cells, as confirmed by experiments. All more complex particle shapes, such as a Hauser's cube and superegg, have stable partially-wrapped states with shallow and high wrapping fractions for sufficiently high adhesion strengths. Partially-wrapped particles can be advantageous both from an application point of view as well as from a biological point of view. Rod-like particles, for example filamentous-viruses like Ebola and Marburg, preferentially bud in tip-first orientation.
Similarly, a mechanistic understanding of how the malarial merozoite invades the erythrocyte is lacking. Assuming an asymmetric egg-like shape for the parasite, we have investigated the role of the membrane properties for the invasion mechanism. We propose a concentration gradient of adhesive molecules to be responsible for reorientation of the merozoite towards the tip before invasion and membrane spontaneous curvature from cytoskeletal re-modelling or secretion of unstructured membranes to assist motor forces for the parasite to invade a red blood cell.
References
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**2911-Pos Board B603**
**Mechanochemical Model of Endocytosis in Yeast**
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The process of endocytosis in yeast occurs in combination with the formation of small patches of polymerized actin at the cell membrane. These exert force on the membrane that counteracts the large opposing force from turgor pressure. We investigate the mechanism by which polymerized actin can exert forces with the required orientation and magnitude. To investigate this question, we develop and implement a model of actin-based force generation on a membrane, based on treating a polymerized actin patch as an active gel. The gel grows in the region near the membrane, or shrinks as a result of actomyosin contraction. The polymerization varies laterally along the contact area between the actin gel and the membrane. Using this model, we investigate three possible mechanisms leading to endocytic invagination: a) Lateral segregation of NPFs into an inner core and an outer ring creates curvature-generating forces via differences in polymerization rates; b) actin polymerization around the tubule creates inward pressure that buckles a coat protein layer; and c) Myo3/5 motor activity creates a contractile ring that buckles a coat protein layer. We find that mechanism a) is the most likely to produce invagination by itself, but either mechanisms b) or c) can reduce the force and mechanical requirements for mechanism a).

**2912-Pos Board B604**
**Nuclear Deformability is Critically Dependent on Lamin A/B**
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During metastasis, single cells or clusters of cells leave an initial tumor, intravasate the blood system and form secondary metastasis at distinct locations of the body. Thereby, they migrate through the extra cellular matrix and squeeze through tiny pores in the collagen mesh. That is why the cells' ability to penetrate the collagen mesh plays a crucial role for healing and survival prognosis. Here, we investigate the link between cell rheology, i.e. cell stiffness and deformability, and the intermediate filament lamin. It has been suspected previously that high lamin A levels limit nuclear deformability [1,2] and increase cell viscosity, which decreases nuclear remodeling under stress [3]. We created stably transfected lamin-A-GFP and lamin-B2-mCherry U2OS and HEK293 cell lines of a wide range of lamin expression levels. We use a series of micron-scale constrictions (2-10 μm) to test the dependence of their nuclear and cytoskeletal rheology on lamin levels by measuring the cells' size and transit time through the channels. We find an interesting dependence of the cells' transit properties on lamin A and B2 expression, underlining the importance of nuclear lamins for cell migration and squeezing.
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**2913-Pos Board B605**
**Contractile Forces During ECM Rigidity Sensing are Regulated by Tropomyosin-1**
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Extracellular matrix (ECM) rigidity is a critical regulator of important cellular processes such as survival, proliferation, and differentiation. To measure ECM rigidity, cells form actomyosin-based contractile units at the lamellipodium that pull on the matrix with forces proportional to its stiffness. However, the mechanisms that regulate force production are unknown. Here we show that generation of force involves constant step-wise movements of myosin that are controlled by tropomyosin-1. Nanometer- and millisecond-scale measurements of fibroblasts pulling on elastomeric PDMS pillars show that pillar displacement occurs by discrete steps of ~1 nm. In contractile pairs, simultaneous steps of opposing pillars give a net movement of ~2.2 nm, independent of rigidity. Changes in the stepping patterns on different rigidities indicate that the level of force is critical for sensing pillar stiffness. Importantly, knockdown of tropomyosin-1 causes larger steps and increased forces that result in aberrant rigidity sensing. These results indicate that tropomyosin-1 is critical for rigidity sensing by controlling myosin movements on actin.