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# PhD or Post-Doc Positions

## Cellular particle uptake using fast super-resolution microscopy and optical tweezers

**Background**: Macrophages, as prominent killer cells in our immune system, take up particles (e.g. bacteria) either by cellular protrusions like filopodia or by direct contact of the particle with the flat cell membrane. We investigate novel approaches and technologies to identify physical rules and related cell mechanical concepts that drive dynamic processes in the cell periphery.

Additional technical goals need to be achieved: the development of novel optical trapping, tracking and imaging methods, which are i) Coherent imaging using 100 Hz label-free ROCS microscopy & multi-scatterer tracking, and, ii) Fluorescence imaging using fast 3D confocal spinning fluorescence microscopy with electro-optical tunable lenses.

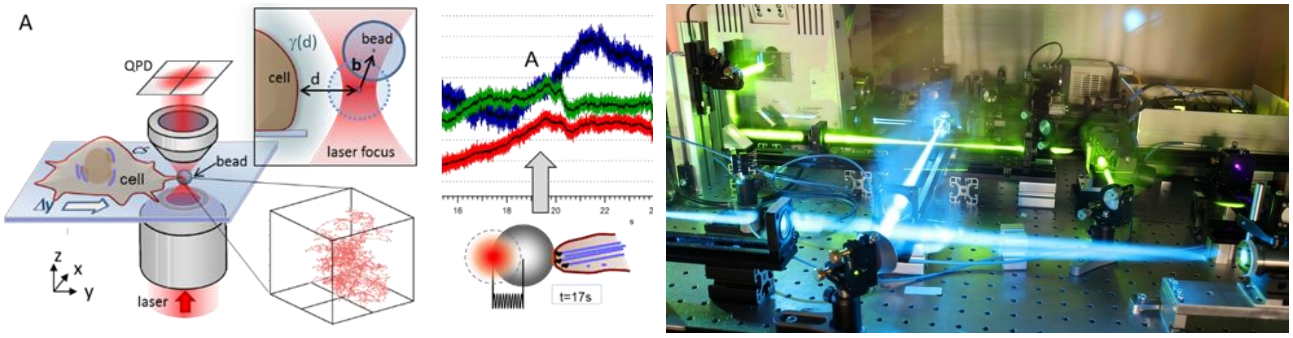


Figure 1: Left: An optically trapped bead fluctuates nearby a living cell. The bead is moved toward the cell membrane and its positions fluctuations (3D trace) are recorded in 3D at 2 MHz temporal resolution via quadrant photo-diodes (QPDs). Center: microsecond nanometer position changes of the bead in the trap are defined by Brownian motion and mechanical forces exerted by the cell peripherie. Right: One of six experimental setups in our labs.

**In a DFG funded project,** the candidate deala with particle binding and uptake mediated by cellular protrusions such as filopodia. This is divided into two main objectives: i) Feedback controlled filopodia sensing: Can cells self-optimize their response or learn? and ii) Discontinuous and ultra-fast transport along filopodia and lamellipodia: is the one transport mechanism beneficial for the other?

**We are seeking** …

…. a motivated candidate with a background/strong interest in biophysics and microscopy/tweezers. The candidates (PhD/PostDoc salary of 66%/100% E13) will culture cells, develop and perform 100Hz super-resolution microscopy (ROCS), 3D high-speed fluorescence scanning, thermal noise tracking, optical tweezing and computer modeling. The goal is to better understand the transition from i) molecular interaction of proteins to ii) cytoskeletal reorganization and to iii) adaptive cell mechanical forces leading to iv) a complex but fascinating response behavior of living cells (macrophages).

We are looking forward to answering your questions!