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Cell stimulation with optically manipulated microsources. HOLGER KRESS, JIN-GYU PARK, CECILE MEJEAN, JASON FORSTER, JASON PARK, SPENCER WALSE, DIANQING WU, Yale University, ORION WEINER, UC San Francisco, TAREK FAHMY, ERIC DUFRESNE, Yale University — Many cells can sense spatial and temporal heterogeneities in concentrations of soluble molecules. The cellular signal transduction which forms the basis of this ability consists of signaling cascades and loops whose length and time scales are largely unknown. The systematic investigation of these networks requires control over the chemical microenvironment of cells. We present a novel technique to create molecular concentration patterns that are chemically, spatially and temporally flexible. Our approach uses optically manipulated colloidal particles which act as microsources of soluble molecules. This technique for flexible cell stimulation is combined with quantitative live cell microscopy measurements of cellular responses. We demonstrate the method by inducing chemotaxis in neutrophils. We quantify the intracellular calcium release, actin distribution, shape and motility of single cells. The possibility for quantitative stimulus-response measurements on single cells makes this method applicable to a wide range of systems biology studies.

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