Wolfgang Alt, **Martin Bock**, Sina Krokowski, Benjamin Schneid, Torsten Tauscher, Carina Wollnik
IZMB, Theoretical Biology, Bonn University, Germany
mab@uni-bonn.de

On Crawling Human Epidermal Keratinocytes

We present some results on biometrics and simulation of migrating human epidermal keratinocytes. Outlines of both cell body and lamella are determined by stochastic active contours that are driven by brightness gradients in time-lapse micrographs. The corresponding cell trajectories exhibit characteristic correlation features in protrusion and directionality [3cd]. In order to reproduce these features in a whole-cell model, we employ the continuum theory of reactive interpenetrating flow [2] and generalize an earlier approach to approximate the cell periphery [1]. The flow dynamics of the cytoplasmic sol- and gel-phases is represented by quadratic finite elements on a two-dimensional ring-like domain with free boundary [3ab]. Mutual coupling of intracellular actin network and transmembrane focal adhesions gives rise to stochastic translocation forces, which induce piecewise persistent cell motion.

[1] RT Tranquillo and W A (1996) Stochastic model of receptor-mediated cytomechanics and dynamic morphology of leukocytes. Journal of Mathematical Biology 34:361–412

[2] W A, M B, and C Moehl (2010) Coupling of cytoplasm and adhesion dynamics determines cell polarization and locomotion. In: (A Chauviere, L Preziosi, and C Verdier, eds.) Cell Mechanics: From Single-Scale Based Models to Multiscale Modelling. Chapman & Hall / CRC, pp. 86–125

[3] Diploma and Bachelor theses of a) S K, b) B S, c) T T, d) C W, Bonn University, 2011-2012