DK Seminar

June 10, 2015, 14:00 - 15:30
Vienna University of Technology,
Freihaus, green area, 4th floor, 101C

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Wound Healing Within Cells

If cells are spread out too thinly on a substrate, a spontaneous hole in the lamellum or lamellipodium of the cell may appear. The lamellipodium is the part of the cytoskeleton that the cell uses to crawl along a surface. It consists of a meshwork of actin-filaments, interspersed with several proteins that stabilize the lamellipodium and connect it to the substrate. Filaments are also connected to the membrane which wraps around the cell. In the last years, our group has put considerable effort to mathematically model the dynamics of such lamellipodia and to use these models as a basis for (realistic) simulations of the movement of a single cell.

When a wound appears in the lamellum (the part between a lamellipodium and the nucleus), the membrane ruptures and retracts until actomyosin strings prevent the wound from opening further. Interestingly, at the wound margin a lamellipodium is built (in the beginning by branching of actin filaments) and through its pushing action the wound is closed. During my diploma thesis, I worked on a simplified model (that did not include branching of filaments) and simulations for the lamellipodium of a healing wound. The simulations showed that the modeling assumptions did not suffice to produce biologically realistic results.

In recent years, branching of filaments has been included in the modelling of lamellipodia. In this talk I will present some deterministic and stochastic models for the branching of actin filaments in the setting of wound closure.

This is work in progress together with Christoph Winkler. His work is concerned with simulating a lamellipodium around the wound, assuming stochastic branching. The mathematical models should give bounds resp. estimates on the time it takes to close a wound.