

DY 47: Closing Talk (joint session BP/ CPP/DY)

Time: Friday 13:15–14:00

Location: H2

Invited Talk

DY 47.1 Fri 13:15 H2

Active control of forces, movement and shape: from biological to non-living systems — •ULRICH S. SCHWARZ — Heidelberg University, Heidelberg, Germany

Animal cells are highly dynamic and continuously generate force, for example for division, migration and mechanosensing. Their main force generators are myosin II molecular motors, whose activity is precisely controlled by biochemical circuitry. We first discuss how this system can be hijacked by optogenetics, thus that cellular force generation can be controlled in time and space using light. Next, we use active gel theory combined with van der Waals theory for myosin II molecules to

demonstrate that cell contractility is sufficient to explain cell migration and that optogenetics can be used to initiate and revert migration. For two myosin II species, we predict the possibility of oscillations. We then move up in scale and analyze force generation in intestinal organoids, which are epithelia with the topology of a sphere. Combining experimental data, image processing and the bubbly vertex model, we show how apico-basal asymmetries can lead to cell extrusion and budding. We finally discuss how force generation and shape changes can be achieved in non-living systems, in particular for nematic elastomers, in which the direction of contraction is imprinted during polymerization and actuation is achieved by temperature control.