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Processivity and collectivity of molecular motors pulling membrane tubes FRANCISCO FONTENELE ARAUJO, CORNELIS STORM, Eindhoven University of Technology — In every cell, directed transport involves proteins that convert chemical energy into mechanical work. Molecular motors responsible for this vital task are mostly too weak to carry biological cargo by themselves and some cannot even take more than a single step before unbinding from their cytoskeletal track. By acting collectively, however, they can muster the required forces. In this talk, we discuss interactions among motors and their collective effects on the extraction of membrane nanotubes. Via a force balance coupled to binding kinetics, we sketch the phase diagram of tube formation. Three regimes are identified: (1) tip clustering, in the sense that the driving force is concentrated at the tip of the tube, (2) viscous extraction, in which motors axially drag membrane, and (3) hybrid extraction, such that tip clustering and axial drag are equally important. Comparison with experiments indicates that synthetic membranes mostly fall into regime (1), while biological membranes tend to fall into regime (2). Our model suggests a unifying picture of tube extraction by both processive and nonprocessive motors.

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