Curve and cut: membrane trafficking *in sillico*

Anđela Šarić [1],

[1]University College London, Gower St, London, UK
a.saric@ucl.ac.uk

Cellular membranes constantly need to be cut and reshaped to sustain inter- and intracellular trafficking and enable life. The cell has developed a wide array of strategies for forming and reshaping its membrane structures, just as pathogens have evolved their own means of breaching the outer cell layer. These are at their heart physical processes, which require mechanical work and involve action across various scales.

Our group develops minimal coarse-grained computer models to investigate membrane remodeling strategies, in close collaboration with experimental colleagues [1-5]. Here I will first present our findings on the evolution of membrane-crossing nanoparticles (unpublished). Then I will discuss our results on how heterogeneity of the membrane composition can increase the membrane selectivity to this nanoparticle uptake [1]. Finally, I will present our recent model on active membrane cutting from the inner side of the membrane neck, driven by ESCRT-III nanomachinery (Figure 1) [2].

The physical principles revealed by our simulations can help us understand how the nanomachinery of life operates and can guide the design of man-made structures to manipulate cell membranes and deliver materials to cells.

References

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Figures

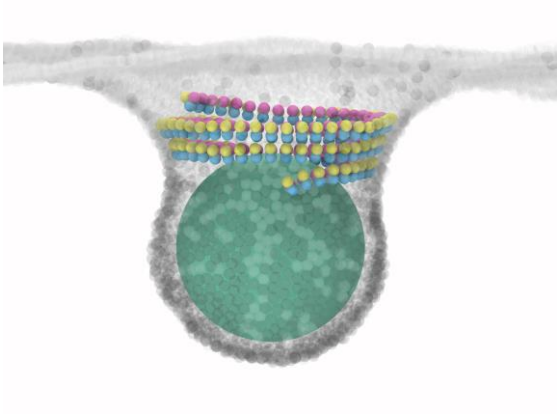

Figure 1. Cargo release by ESCRT-III machinery