Interactions of elastin-like polypeptides with lipid membranes

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Abstract

We evaluate in Giant Unilamellar Vesicles (GUVs)[1] the lipid bilayer permeability to a new class of elastin-like polypeptides[2] designed to penetrate the membrane of living cells upon a temperature trigger. Membrane translocation by the peptides is investigated as a function of penetrating amino acid content both in the presence and absence of peptide self-assembly. We found not only that self-assembled phospholipid bilayers of DOPC are impermeable to ELPs, but also that they are good substrates to selectively bind the peptides according to their molecular structure or self-assembled state. Our results point to a subtle solution of the controversy[3] about passive/active penetration: by passively binding the appropriate peptides, the membrane matrix is able to control the effective number of molecules that can be actively taken up by the cellular mechanisms.

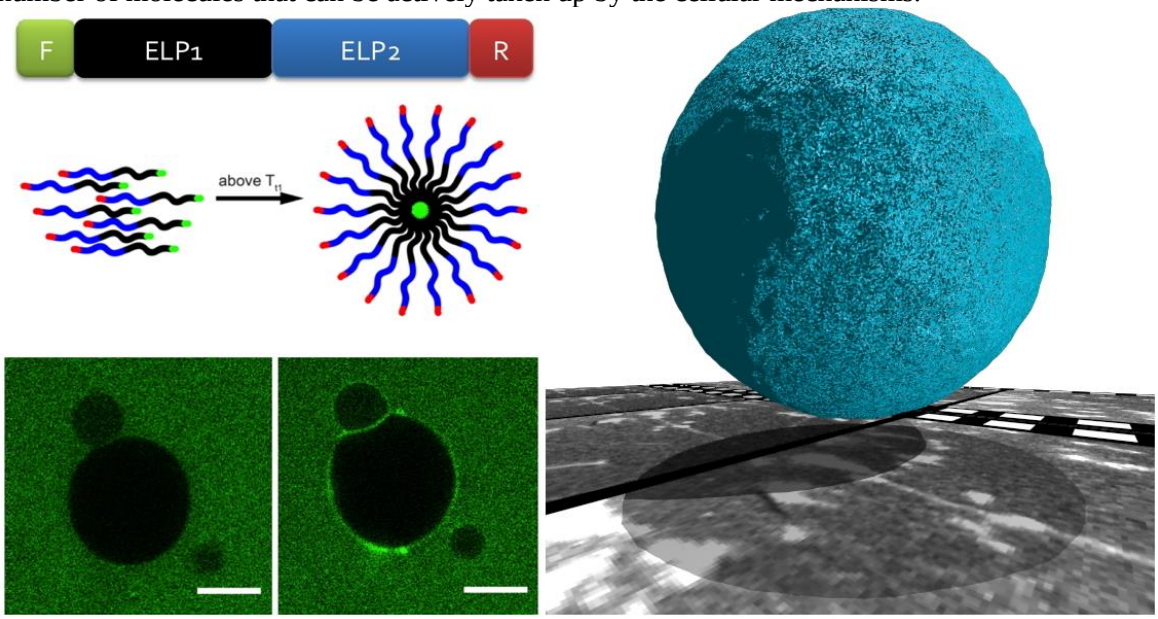

Figure 1. Right: schematics of a phospholipid GUV. Left above: the elastin-like polypeptides used in this study (F a fluorophore, R a cell-penetrating amino acid sequence), and a representation of their self-assembly properties. Left below: GUVs exposed to a solution of fluorescently- labelled ELPs, below (left) and above (right) their micellization temperature. Size bar is 20 micrometers.

References

1. Weinberger et al., Gel-Assisted Formation of Giant Unilamellar Vesicles, Biophysical Journal (2013), http://dx.doi.org/10.1016/j.bpj.2013.05.024

2. M. R. Dreher, A. J. Simnick, K. Fischer, R. J. Smith, A. Patel, M. Schmidt, and A. Chilkoti. Temperature triggered self-assembly of polypeptides into multivalent spherical micelles. J. Am. Chem. Soc., 130(2):687–694, 2008.