

New type of entanglement in protein structures – lassos and links

Joanna I. Sulkowska
Centre of New Technology and Chemistry Department
University of Warsaw

Twenty years after their discovery, knots in proteins are now quite well understood. They are believed to be functionally advantageous [1] and provide extra stability to protein chains. In my talk I will go one step further and show that proteins can be even more entangled than knots – they can form lassos [2] and links [3], which consist of several components. I will discuss conditions that proteins need to meet to be able to form these types of entanglement. Based on the search through the entire Protein Data Bank we identified several sequentially nonhomologous chains that form a Hopf link, a Solomon link, and various types of lassos. I will show that topological properties of these proteins are related to their function and stability, and show that the link topology is characteristic for eucaryotes only. We will also explain how the presence of links and lassos affects folding pathways of proteins. I will present necessary conditions to form Borromean rings in proteins and show, that no structure in the Protein Data Bank forms a link of this type.

- [1] T Christian, R Sakaguchi, AP Perlinska, G Lahoud, T Ito, EA Taylor, S Yokoyama, JI Sulkowska, Ya-Ming Hou, *Nature Structural & Molecular Biology* (2016) 23, 941-948
- [2] P Dabrowski-Tumanski, JI Sulkowska, *PNAS* (2017) 114, 3415–3420
- [3] W Niemyska, P Dabrowski-Tumanski, M Kadlof, E Haglund, P Sułkowski, JI Sulkowska, *Scientific Reports* (2016) 6, 36895