Characterization of self-assembled nanostructures exhibited by model recombinant Elastin-like polymer $E_{50}A_{40}$.

Álvarez-Mateo, R., Ribeiro, A., R., Arias, F. J., Alonso, M., Rodríguez-Cabello, J.C.
CIBER-BBN, BIOFORGE (Group for Advanced Materials and Nanobiotechnology)
University of Valladolid, Valladolid, Spain.
Email: roca@bioforge.uva.es
Email: ramateo@bioforge.uva.es

Genetically engineered Elastin-like polymers (ELP`s) are interesting biomaterials [1].The structure of ELP`s is generally based on the repetition of the following pentapeptide sequence $(VPGVG)_n$ where V, P, G: valine, proline and glycine, respectively. Recombinant techniques and protocols allowed us the bioproduction of monodispered ELP`s polymers that exhibit an absolute control of amino acid sequence and molecular weight [2]. Outstandingly, self-assembly properties have been attributed to these materials as function of pH, temperature (amongst other). Recently, ELP´s have been envisaged for biotechnological applications such as drug delivery, and tissue engineering. Here, we would like to present our research efforts on the investigation of the structure-properties relationship exhibited by a novel ELP $[(VPGVG)_2$-$(VPGEG)_5$-$(VPGVG)_2]_{10}$-$[(VPAVG)]_{40}$ ($E_{50}A_{40}$), where A is alanine and E is glutamic acid.

$E_{50}A_{40}$, has the structure of an amphiphilic di-block copolymer because its structure comprises two blocks that differ in polarity. The block that contains glutamic acid residues (E) plays the role of hydrophobic block, specially at those pHs where the carboxyl group of the E side-chain is deprotonated and, therefore, negatively charged (pH>4.5). The other block exclusively exhibits non polar side chain in its amino acids, and therefore acts as a hydrophobic block.

The self-assembly features exhibited by $E_{50}A_{40}$ have been investigated first by calorimetric techniques such as DSC and TMDSC as way to determin the range of pH and temperature in which the system is functional [3]. In addition, the structure exhibited by $E_{50}A_{40}$ in the condensed phase has been directly visualized by transmission microscopy (Cryo-TEM)[4]. In this respect, globular structures that resemble micelles have been identified and measured. Furthermore, correlation of the globular assemblies observed with the temperature of the medium has been carried out by dynamic light scattering (DLS). Finally, a complete discussion on the self assembly properties exhibited by $E_{50}A_{40}$ as function of temperature together with possible applications for biopolymer $E_{50}A_{40}$ will be given.

References:

1. Rodríguez-Cabello; J. C., J. Reguera; Girotti, A.; Alonso, M.; Testera, A. M. *Prog. Polym. Sci.* **2005**, 30, 1119-1145.
2. Rodríguez-Cabello, J. C.; Reguera J.; Girotti A.; Arias, F. J.; Alonso, M. *Adv. Polym. Sci.* **2006**, 200, 119-167.
3. J.C. Rodríguez-Cabello, J. Reguera, M. Alonso, T.M. Parker, D.T. McPherson, D.W. Urry. Chem.Phys. Lett. **2004**, 388 (1-3), 127-131.
4. Jun Hong Yao,Khine Yi Mya,Xu Li, Manoj Parameswaran,Qing-Hua Xu,Kian Ping Loh, and Zhi-Kuan Chen, *J. Phys. Chem. B* ***2008,*** *112, 749-755*