**Advanced Self-assembled Biomimetic Protein Platform**

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**Introduction** Resilin mimetic proteins (RMPs) are a class of stimuli-responsive biopolymers which can undergo phase transitions in response to the changes in intensive solution parameters such as temperature, pH, and light. For such protein-based polymers, the information required for stimulus-responsive phase transitions is encoded in their amino acid sequence. Here, we report some of the key physical principles that govern the phase transitions of these intrinsically disordered protein polymers (IDPPs). These are disordered proteins with repetitive amino acid sequences, which also exhibit dual phase behaviour. The highly cooperative and intermolecular nature of the coacervation process is modulated by the sequence of various RMPs, which also modulate the growth of various assemblies and co-assemblies with other rigid and hydrophobic proteins. The RMPs could also be harnessed as templates for synthesis of noble metal nanoclusters. They could be developed into tunable elastic, responsive hydrogels [1-4] that employed physical interactions, photo dynamic chemical crosslinking, and double network structure. While it is a promising material for a range of applications, however, the elevated LCST and low modulus displayed by the material limits its suitability for many potential applications.



**Figure 1**. CD spectra: Effect of addition of poly-L-proline to rec1-resilin

**Aims** The aim of this work is to develop an understanding of the role of the environment and the effect of molecular architecture of a few sequence specific residues on rec1-resilin’s structure-property relationship. We selected various macromolecules including, a synthetic stimuli-responsive polymer, a rigid and a flexible peptide, and a rigid naturally occurring polymer.

**Methods** Hybrid materials formed through physical and chemical interactions of rec1-resilin with these materials have been investigated using circular dichroism (CD). Hydrodynamic radius and global charge of the protein solution have been determined from dynamic light scattering using Nano-zetasizer and structure through scattering studies.

**Results & Discussion** CD results reveal that the addition of the rigid peptide, poly-L-proline, resulted in a conformational change of the rec1-resilin structure. The circular dichroism spectra demonstrate that the rec1-resilin structure changes from random coil to predominantly polyproline-II helical with increasing proportion of poly-L-proline (Fig.1). The hierarchical structure of the fabricated hydrogels is quite complex composed of hydrophobic (crystalline) and hydrophilic (mesophase and amorphous) domains in the nanoscale, whereas water pores/channels in the microscale.

**Conclusion** The study confirms that the self-assembly behavior of RMPs can be tailored on demand. This will enable us to tune the elasticity and other responsive properties through macromolecular modification making it suitable for a wide range of prominent biomedical applications

**References**

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