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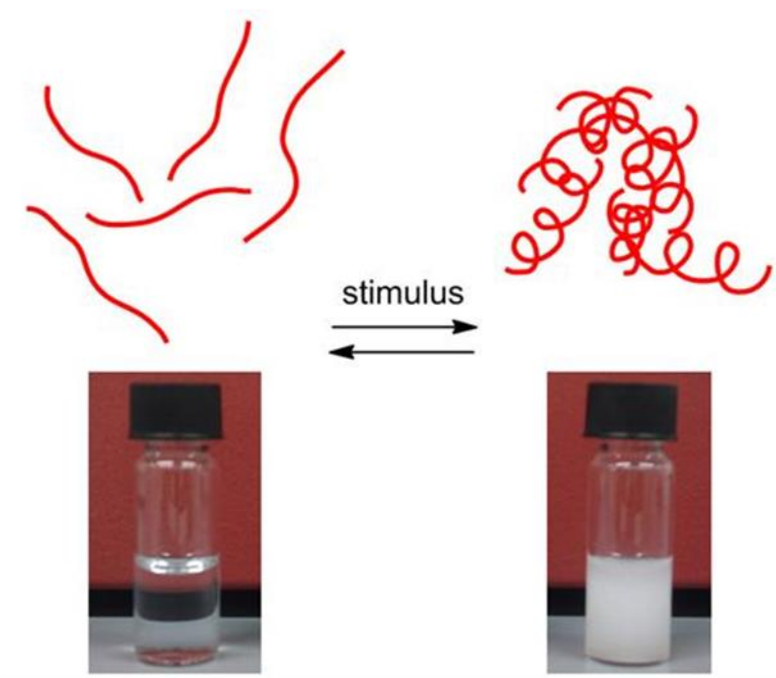
Elastin-Like Polypeptides (ELP)

Protein-based polymers, which are composed of repeat units of natural or unnatural amino acids, have recently emerged as a promising new class of materials. They are attractive from a fundamental materials science perspective because their genetically encoded synthesis provides precise control, to levels unattainable using chemical polymerization techniques, over the primary architectural features of polymers, namely sequence, chain length, and stereochemistry. Furthermore, these materials frequently also have desirable mechanical, chemical, and biological properties (e.g., biocompatibility, biodegradation) that makes their use appealing as biomaterials and tissue engineering scaffolds. (Meyer, 2002)

Elastin-Like Polypeptides:

- Have repeated sequence VPGXG sequence where X is any residue except for proline
- Have a Phase Transition is that is entropically driven
    - Soluble below transition temperature
    - Insoluble above transition temperature
    - ELP's purified rapidly using inverse temperature cycling (ITC)



Reference: http://www.ru.nl/bio-orgchem/research/research_projects/mark-van-eldijk/

ELPs are an interesting class of polypeptides because they undergo an inverse temperature phase transition. ELPs are soluble in aqueous solution below the inverse transition temperature (Tt, also known as the lower critical solution temperature or LCST). However, when the temperature is raised above the Tt, they undergo a sharp (2 °C range) phase transition leading to desolvation and aggregation of the polypeptide. The transition can be induced by changes in temperature, ionic strength, or pH and is completely reversible. Numerous applications of ELPs in biotechnology and medicine have been proposed. (Meyer, 2002)

ELPs also exhibit a variety of biological effects on fibroblasts that play an important role in dermal remodeling. These include enhanced chemotactic activity, increased fibroblast proliferation, and up-regulation of collagenase in cultured fibroblasts. (Koria, 2010)

References:

Dan E. Meyer and Ashutosh Chilkoti. "Genetically Encoded Synthesis of Protein-Based Polymers with Precisely Specified Molecular Weight and Sequence by Recursive Directional Ligation: Examples from the Elastin-like Polypeptide System." Biomacromolecules 2002, 3, 357-367.

Piyush Koria, Hiroshi Yagi, Yuko Kitagawa, Zaki Megeed, Yaakov Nahmias, Robert Sheridan, and Martin L. Yarmush. “Self-assembling elastin-like peptides growth factor chimeric nanoparticles for the treatment of chronic wounds.” Edited by Robert Langer, Massachusetts Institute of Technology, Cambridge, MA 02139, and approved November 30, 2010 (received for review July 9, 2010)