

## Modular Protein Polymers-expression, screening and synthesis methods.

PhD-fellow: M.D. Golinska,  
monika.golinska@wur.nl  
Supervisors: Prof. Dr. M.A. Cohen Stuart (Physical Chemistry and  
Colloid Science, WU)  
Dr. F.A. de Wolf (Agrotechnology & Food Innovations)  
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### Introduction

The protein polymers are very promising materials with broad medical and pharmaceutical application. However, the extraction from their natural sources (as they are mainly obtained from animals) is often difficult, expensive and gives potential risk with respect to transmittable diseases. That is why, the challenge is to produce safe, recombinant proteins that can be highly expressed and form nanostructured gels under desirable conditions. The focus was put into fibrous proteins like silk or elastin that are able to self-assemble and form cross linked systems (hydrogels).

Silk-like proteins, like spider dragline silk are a very strong fiber with the repetitive octapeptide structure  $(GA)_3GE$ . They can form  $AGAGA$   $\beta$ -sheets bordered by  $GXG$   $\gamma$ -turns. The presence of glutamic acid residue in silk  $GA$  repeats influence the pH-responsive properties.

Elastin like proteins (ELPs) are based on the pentapeptide repeat motif  $VPGXG$  (where the  $X$  can be any of the natural amino acids except Pro) that form characteristic  $\beta$ -spirals on coacervation of the molecule. Elastin as a tissue protein provides elasticity, flexibility and strength in the extracellular matrix. Characteristic feature of ELPs is phase separation upon increasing temperature.

### Aim

The aim of these project is to construct a stable genes that encode polymer blocks with highly repetitive sequence that are successfully express in modified yeast and investigate physical behaviour of these protein-based polymers.

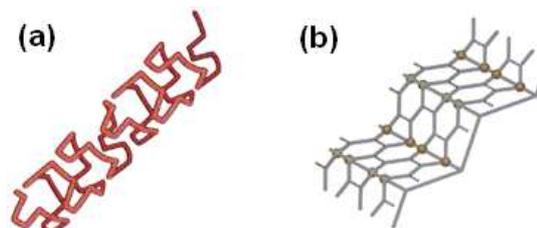


Figure 1 (a)  $\beta$ -spirals structure of elastin like polymers (b)  $\beta$ -sheets structure of silk like polymers

### Research

Research is focused on the construction of genes that encode a specific polypeptide, the enhancement of their expression level in a methylotrophic yeast *Pichia pastoris* and characterization of their behaviour.

The different types of polypeptides will be tested that have a specific response to physicochemical parameters like pH or temperature. Additionally, rheological properties, secondary structure, electrical charge etc. will be investigated.

### References

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2. Werten, M.W.T; Moers, A.P.H.A; Vong, T.H; Zuilhof, H; van Hest, J.C.M. and de Wolf, F; "Biomacromolecules 2008. 9 (7): p.1705-1711