Investigating the mechanical properties of amyloid gels through their mesoscopic structure

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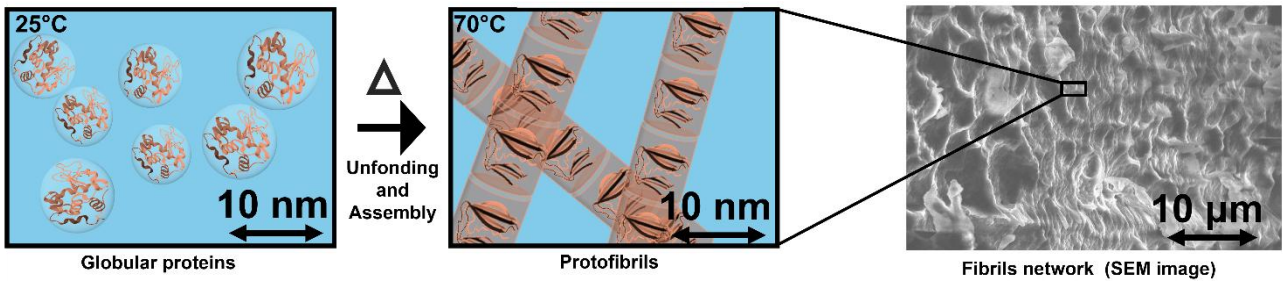

Amyloid fibers gels are used as adhesive throughout the marine animal kingdom [1]. These materials have shown a wide range of interesting properties as bio-based underwater adhesives. Upon heating, some proteins are able to refold, then assemble into fibers, forming highly inter-connected networks. We aim to better understand these gel networks across multiple scales to create a bio-inspired underwater adhesive.

We've been able to create hydrogel from Hen Egg-White Lysozyme (HEWL) and Bovine Serum Albumin (BSA) within a rheometer. Beyond the analysis of their mechanical and adhesives properties, these gels were characterized through atomic force microscopy, light and X-rays scattering, and scanning electron microscopy to probe their mesoscopic structure. We investigated how key physicochemical parameters, such as pH, ionic strength, protein concentration and behavior in aqueous environments affect network formation and established correlations with resulting mechanical properties.

A deeper understanding of these parameters is the key to formulate and tune these materials for an actual usage.

[1] D. E. Barlow, G.H. Dickinson, and B. Orihuela, Langmuir 2010, 26 (9).