β-sheet forming peptide hydrogels: from self-assembly to functional biomaterials

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The use of non-covalent self-assembly to construct materials has become a prominent strategy in biomaterials science offering practical routes for the construction of increasingly functional materials for a variety of applications ranging from tissue engineering to in-vivo cell and drug delivery.[1-2] A variety of molecular building blocks can be used for this purpose, one such block that has attracted considerable attention in the last 20 years is *de-novo* designed peptides.[3] Peptides offer a number of advantages to the biomaterial scientists. The library of 20 natural amino acids offers the ability to play with the intrinsic properties of the peptide such as structure, hydrophobicity, charge and functionality allowing the design of a wide range of materials. Synthetic peptides are chemically fully defined and being build form natural amino acids they result usually in low toxicity and low immune response when used in-vivo. Our group has focussed on the development of a technological platform for the design of novel biofunctional materials exploiting the self-assembly of β-sheet forming peptides.[4-6] The β-sheet motif is of increasing interest as short peptides can be designed to form β-sheet rich fibres that entangle and consequently form stable hydrogels. These hydrogels can be easily functionalised using specific biological signals and or drugs. Through the fundamental understanding of the self-assembly and gelation of these peptides [5-7] we have been able to design hydrogels with tailored properties for a range of applications including cell culture[8-11], cell and drug delivery[12-13] and bio-printing[14]. We will present our group's journey from molecular self-assembly to bio-functional materials and their commercialisation.

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