compatible with micropatterning and microfluidics technologies, which should contribute to their wider use in the biomedical field. Some important issues remain to be tackled however, as the precise understanding of the impact of the chemical structure on this coupling (especially in buffered conditions) have not been systematically explored. In addition, the use of visible light curing should be further studied to reduce cell toxicity and allow the use of these biomaterials for clinical applications. Such developments will enable the study of cell biology and tissue formation in 3D, with better control of important parameters such as the density of cell adhesion motifs, matrix mechanics, degradability and matrix remodelling.

Self-assembling Peptide Hydrogels

Hydrogels can be formed by the self-assembly of certain peptide molecules which are rationally designed to assemble into nanofibers under specific conditions. To trigger self-assembly, different stimuli and methods have been used, including pH (controlled pH adjustments), ionic strength (addition of counterions), temperature (heating or cooling), enzyme-catalyzed reactions (hydrolysis of self-assembling peptide precursors), and light (selective irradiation). At sufficiently high concentration, the entanglement of these nanofibers leads to gel formation (Fig. 2).

A number of building blocks have been explored for developing hydrogels by self-assembly, but peptides offer many important advantages. They can be designed to incorporate structural and bioactive domains and form discrete nanostructures that emulate not only the physical architecture but also the chemistry of the extracellular matrix (ECM). Researchers have been using self-assembling motifs—β-sheets (Freeman et al. 2015), α-helices and coiled-coils (Woolfson 2010)—found in structural proteins (amyloidogenic proteins, silk fibroin, collagen) to drive peptide self-assembly and short peptide sequences (RGDS, IKVAV, YIGSR, DGEA, GFOGER) derived from cell-adhesive proteins (fibronectin, laminin, collagen) to signal cells and guide regenerative processes. Due their small size, they can be easily obtained through

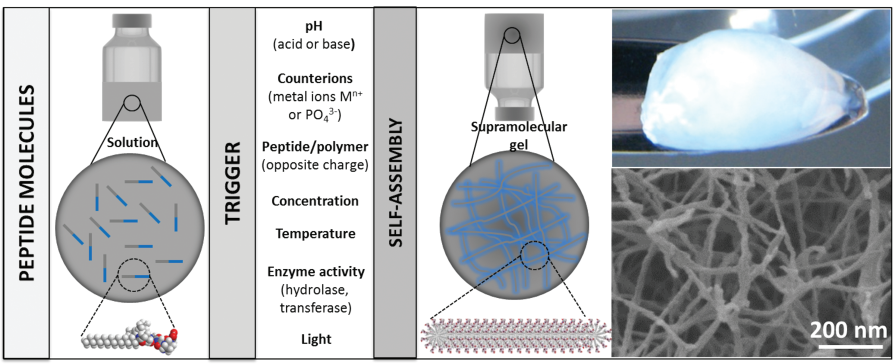

Fig. 2. Peptide self-assembly and the formation of a supramolecular gel. Peptide molecules are initially in solution and when a trigger is applied they are able to associate with each other and assemble into ordered nanofibers that entangle to form a 3D nanofiber network.