Addition of MAX1 to the common cell culture Dunlbecco's Modified Eagle's Medium (DMEM) of 165 mM salinity and pH 7.4, results in hydrogelation after 30 minutes (Kretsinger et al. 2005). Inclusion of cells in DMEM allows entrapment in MAX1 but forms a cell sediment due to a lengthened gelation time. Replacement of one cationic lysine at position 15 with an anionic glutamic acid residue was sufficient to allow self-assembled hydrogelation within one minute of mixing with DMEM ensuring homogenous entrapment of encapsulated cells. Its cytocompatibility and ability to promote cell proliferation highlights the potential use of the MAX peptides in biomedical engineering particularly within the tissue regeneration and 3D cell culture fields. This is further evidence of the sensitivity and responsiveness of this group of peptides to a variety of physiological conditions.

A group of ionic self-complementary β-sheet oligopeptides (RAD16-I and RAD16-II), derived from the model ionically complementary EAK16 peptide (Jun et al. 2004), are composed of a primary sequence of alternating cationic arginine, alanine and anionic aspartate residues (Holmes et al. 2000). This RAD sequence resembles the RGD cell adhesion motif often utilized to promote cell attachment and growth. This allows complementary electrostatic interactions and formation of β-sheet secondary structures. Optimal hydrogelation occurs at an ionic strength and pH (7.4) similar to that utilized in tissue culture media (RPMI 1640: 24 mM $NaHCO_3$/103 mM NaCl) and phosphate buffered saline (5 mM NaPO4/150 mM NaCl). Therefore RAD16-I and RAD16-II have potential application in both tissue and cell regeneration. Most promisingly, RAD peptides allow neuronal cell attachment, differentiation and significant outgrowth with the same degree of success as extracellular matrix proteins such as laminin, fibronectin, and collagen but without the need for synthetic materials to increase mechanical strength and tissue-like properties. This has successfully translated to the Puramatrix® technology (CH_3CO-$[RADA]_4$-$CONH_2$) widely used as a cell culture media but is also set to undergo clinical testing for use as a haemostasis product (as PuraStat®); an aid in endoscopic mucosal resection and to promote tissue regeneration as a filler for voids in dental bone. Similar research by the Aggeli group developed β-sheet-forming peptide hydrogels (QQRFEWEFEQQ) responsive to pH/ionic strength and capable of hydroxyapatite nucleation, leading to enamel remineralization and repair of dental decay in the oral cavity (Kirkham et al. 2007). Delivery to the area as a peptide-based solution aided administration. Anionic groups on the peptide side chain were capable of binding to calcium resulting in phosphate salt precipitation within dental caries.

The Stupp group developed a separate group of gelators termed peptide amphiphiles. As their name suggests these molecules are composed to two separate hydrophobic and hydrophilic sections. Amphiphilic peptides are composed of a 6–12 amino acid segment coupled via an amide bond to a fatty acid chain that varies from 10 to 22 carbon atoms in length. The hydrophilic section often provides biofunctionality with most containing an aliphatic hydrophobic portion enabling self-assembly (Hartgerink et al. 2001). A hydrophilic peptide, $C_{16}H_{33}$-VVVAAAEEE-COOH, shows promise as a hydrogel tissue scaffold for brain, spinal cord and heart regeneration. Gelation results from screening of charged amino acid residues, in the case of $C_{16}H_{33}$-VVVAAAEEE-COOH, positively charged divalent calcium (from calcium chloride, $CaCl_2$) negated anionic charge of glutamic acids (E). The Stupp group also discovered