1. Publishable summary (2pages)

This section normally should not exceed 2 pages.

It shall be of suitable quality to enable direct publication by the REA or the Commission. You may extract this wholly or partially from the website of the project, if suitable, but please ensure that this is set out and formatted so that it can be printed as a stand-alone paper document.

Please include:

• a summary description of the project objectives,

• a description of the work performed since the beginning of the project,

• a description of the main results achieved so far,

• the expected final results and their potential impact and use (including the socio-economic impact and the wider societal implications of the project so far).

You should update this publishable summary at the end of each reporting period.

Please include also, as appropriate, diagrams or photographs illustrating and promoting the work of the project, the project logo and relevant contact details.

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Today, it is well-known that spinal cord injuries are associated with a cascade of pathological events, including primary cellular necrosis, followed by secondary events such as the formation of glial scars, inflammation, oedema, ischaemia, excitotoxicity and increases in free radicals. Several synthetic and natural materials have been proposed to generate the necessary coverage of the damaged area to prevent scar tissue formation and facilitate healing; however they often lack the functionality or the biocompatibility to perform adequately. Mankind has been trying to replace damaged or lost cells with new ones for centuries. The ability to repair tissue in the body is vital for modern day medical science; so-called “cell therapy” can be used to treat a plethora of disorders which are known to deteriorate the quality of life, and in some cases, terminate it. Here, within the HYCELT project, we propose the use of polymer-peptide hydrogels for cell therapy. HYCELT is to produce cost-effective neuronal stem cell scaffolds for central nervous system regeneration using a fibrous gel that has all the necessary requisites for fast clinical translation: cell-instructive, biocompatible, injectable and biodegradable. Peptides can produce suitable gelatinous environments for cell growth at extremely low concentrations (1% peptide). The tri-peptide arginine-glycine-aspartic acid (RGD) is a well-studied cell binding motif for specific transmembrane proteins and is involved in cellular adhesion to the extracellular matrix. There is continuous interest in the development of RGD-based therapeutics. Here, we use phenylalanine (F) to direct self-assembly. These materials supra-molecularly self-assemble to form nanoscale fibres, which entangle to form a 3-dimensional scaffold able to accommodate large volumes of water (known as a supramolecular hydrogel).

It is also found that short peptide derivatives (di) and (tri) can provide suitable building blocks for development of cell culture matrices. Two different libraries of peptides have been synthesised. Firstly, a library of di and tri peptides were synthesised by using solution phase peptide synthesis. The next family was RGD-based peptides, which synthesised by solid phase peptide synthesis. For both routes, an Fmoc strategy was used. Gel Permeation Chromatography (GPC), Fourier Transform Infrared (FTIR) Spectroscopy and 1H Nuclear Magnetic Resonance (NMR) Spectroscopy were used to characterise all peptides. The behaviour of these materials in water was studied. Microscopic images, Rheology measurements, SEM studies and XRD were taken for all the self-assemblies. The materials were used in collaboration with the Centre for Medical Molecular Virology, University College London, for cell culture studies.

Peptide molar mass (*M*n) and dispersity (*M*w/*M*n, *Đ*) were measured using GPC and the high purity of the RGD–peptide material is apparent from the near-Gaussian shapes of the GPC traces. Success of the coupling reactions and high purity of the final conjugates were confirmed by 1H NMR. FTIR Spectroscopy confirmed the presence of all of the expected functional groups in the final conjugate. From physical appearance and microscopy images, it is clear that dipeptides form nanofibers, DF2 tripeptide and RGD peptides form hydrogels. The cell culture results shows that the in RGD peptides medium is good for cell growth.

HYCELT scientific results are predicted to contribute to both European excellence and competiveness by the development of more stable and more efficient biomaterials for cell therapy. The results already obtained, and currently being generated, are expected to lead to a number of publications. HYCELT produced low molecular weight peptide gelators, made from very simple, small building blocks, so that they are facile to synthesise, inexpensive and will pass from the body safely following use.