Injectable materials that can conform to the shape of a tissue volume, or promote repair of an injury. This talk will explore the development of injectable materials that are based on assembled particle building blocks, for tissue repair. We find that using microparticle building blocks to build the scaffold generates a porous network by the space left behind between adjacent building blocks. Due to the injectability of this microporous material we have explored its wide applicability to tissue repair applications ranging from skin to brain wounds.

We find that in the skin our particle scaffold promotes wound closure and granulation tissue thickness more than widely used polymeric crosslinked hydrogels. In both the brain and the skin our particle scaffolds result in reduced inflammation.

A second part of the talk will focus on nanoparticles for growth factor delivery based on protein nanocapsules. These nanocapsules are synthesized through in situ radical polymerization directly on the protein surface generating a polymeric skin on the protein surface. The polymeric skin is crosslinked with protease degradable peptides, which control growth factor release by proteases contained in the wound sites. To introduce temporal control, the D enantiomer of the crosslinking peptide is used. Because the D enantiomer is digested by the protease 10 times slower, when mixing L and D protease degradable peptides different degrees of degradation can be obtained. Using this approach we can deliver one protein factor sustainly or two or more factors sequentially.

Conflict of interest: both of the technologies described above have been patented and the patent has been licensed. Prof. Segura is a founding member of Thempo Therapeuctics, which aims to commercialize the particle hydrogel.