Engineering Injectable HA Hydrogels for Therapeutic Applications

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Hydrogels represent a class of biomaterials that have great promise for the repair of tissues, particularly due to our ability to engineer their biophysical and biochemical properties. Hydrogels can provide instructive signals through material properties alone (e.g., mechanics, degradation, structure) or through the delivery of therapeutics that can influence tissue morphogenesis and repair. Importantly, hydrogel design should reflect both the clinical context and the natural healing cascades of the damaged tissue. Here, I will give examples of the design of hydrogels based on hyaluronic acid (HA) for applications in 3D printing and in the repair of cardiovascular tissues that have limited natural repair processes. In both applications, the development of shear-thinning and self-healing hydrogels is important, to permit extrusion-based printing or the injection of hydrogels directly into tissues. This is possible through the introduction of relevant chemical groups onto HA, such as guest-host chemistry. Further, I will introduce our work on how the modification of HA influences the ability of these molecules to interact with HA receptors (e.g., CD44).