

Biomaterials for bottom-up Tissue Engineering

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Abstract: The possibility of regenerating organs and tissues would bring new possibilities of improving current treatments or find solutions for untreatable situations, thus having a massive impact in the quality of life of patients. Tissue Engineering has been integrating principles of materials science and engineering, chemistry, biology and health sciences in order to develop regenerative-based therapeutic strategies combining stem cells and biomaterials. Hydrogels can be obtained from modified natural-based macromolecules, including polysaccharides and proteins, and be used as platform to support and control cellular activity, including systems with distinct shapes, internal organization and sizes. Sophisticated strategies have been employed to develop micro-sized hydrogels or basic biomaterials units that could be ordered into larger tissues to be used in tissue engineering. The relevance of such bottom-up strategies is highlighted and exemplified with biomaterials and technologies developed at the COMPASS Research Group from the University of Aveiro. Hydrogel or smart polymeric microparticles prepared using innovative methodologies are able to support the activity and the assembly of cells. In a larger scale such objects can be incorporated inside liquified compartments to generate self-regulated devices able to develop humanised micro-tissues that could be useful in bone tissue engineering applications. Bioprinting technologies can be as well utilized to produce clinically relevant structures with complex geometries and containing cells. New biomaterials and protocols are also shown in order to process completely free-form hybrid devices.