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Designing Elastin-Like Recombinamers for Therapeutic and Regenerative Purposes

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3.1 Introduction

The field of biomedicine relies on the development of advanced systems that mimic the extracellular matrix (ECM) to allow *in vitro* studies of cell–matrix interactions and subsequent implementation *in vivo*. The principal matrices for biomedical applications are hydrogels, which are hydrophilic polymer networks that can absorb a large volume of water in resemblance to natural tissues (see Chapter 1). The materials used to obtain these biomimetic scaffolds include a large variety of synthetic polymers such as polyethylene glycol (PEG) [1], as well as biopolymers, mostly proteins from animal tissues such as collagen [2] (see Chapter 2). Combinations of natural and synthetic polymers have also been tested to improve the properties of hydrogels [3].

Essential characteristics for the development of hydrogels for general biomedical applications include (i) an ability to provide a structural support to the surrounding cells, thus promoting natural and adequate cell growth that helps complete integration of the scaffold into the natural surrounding tissue and provides mechanical stability, (ii) an ability to mimic the ECM topography of tissues, (iii) an ability to mimic the natural environment so that cells can develop their normal functions and help restore damaged tissue, (iv) an ability to absorb and retain large quantities of water while maintaining their structures, thereby maintaining the hydration levels found in most tissues, (v) an ability to modulate their structures to match the shape and the size of defects, (vi) an ability to be easily manipulated, and, particularly, (vii) biocompatibility and biodegradability [4–7]. Depending on the final application, hydrogels for use in regenerative medicine will need specific requirements in order to simulate the tissue to be repaired, such as cell adhesion or growth factors, which could also be included in the scaffold.

☆ equal contribution

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