

Bio-inspired 3D microenvironments: a new dimension in tissue engineering

Datenbank

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Deskriptoren

Tissue-Engineering; Biomaterial; dreidimensionale Struktur; additive Fertigung; Biologie; Mikromaßstab

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Abstract

Biomaterial scaffolds have been a foundational element of the tissue engineering paradigm since the inception of the field. Over the years there has been a progressive move toward the rational design and fabrication of bio-inspired materials that mimic the composition as well as the architecture and 3D structure of tissues. In this review, we chronicle advances in the field that address key challenges in tissue engineering as well as some emerging applications. Specifically, a summary of the materials and chemistries used to engineer bio-inspired 3D matrices that mimic numerous aspects of the extracellular matrix is provided, along with an overview of bioprinting, an additive manufacturing approach, for the fabrication of engineered tissues with precisely controlled 3D structures and architectures. To emphasize the potential clinical impact of the bio-inspired paradigm in biomaterials engineering, some applications of bio-inspired matrices are discussed in the context of translational tissue engineering. However, focus is also given to recent advances in the use of engineered 3D cellular microenvironments for fundamental studies in cell biology, including photoresponsive systems that are shedding new light on how matrix properties influence cell phenotype and function. In an outlook for future work, the need for high-throughput methods both for screening and fabrication is highlighted. Finally, microscale organ-on-a-chip technologies are highlighted as a promising area for future investment in the application of bio-inspired microenvironments.

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