The Torch
Vol. 4 (13)

Spider silk biomaterials for tissue engineering matrices

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Tissue engineering is one of the fastest emerging fields nowadays and plays a vital role in tissue regeneration and regenerative medicine. Tissue engineering requires tissues of a particular lineage and scaffolds or matrix to increase the attachment of the cells. Matrices are usually synthesised using naturally derived materials or synthetic materials like collagen or polylactide-co-glycolide.

The main issue behind the usage of matrices derived from these polymers is their poor tensile strength and early degradation. This has forced scientists to find a substitute with better mechanical strength and degradation properties. Dragline silk, formed by the Nephila sp. spider, has been suggested as one of the alternatives to matrices formed by polymers. The dragline silk is made of five layers including a lipid coat on the exterior as protection, a glyco-coat which ensures water balance and a two-layered skin, the outer and inner core. The dragline silk is usually woven on rectangular frames which form a meshwork of sizes ranging from 10-100 µm.

These frames are sterilised thoroughly and the fibroblasts are introduced into them. After 15 days, keratinocytes are added to produce a skin model. The fibroblasts and keratinocytes proliferate in spider silk fibres. Further, the proteins spidroin 1 and spidroin 2, present in the core layers of the fibre, provide strong mechanical stability to the silk. The stability of the silk fibre at high temperatures makes it a suitable option for matrices. Besides, the silk fibre promotes cell growth and shows a low immunogenic response, thus making it a valuable alternative to matrices. Moreover, well-developed cultivation of skin cells can be easily achieved with the help of silk fibres. Hence, spider silk has created a new modified way of replacing matrices in the field of tissue engineering.

Keywords: Spider silk, Matrix, Tensile strength, Meshwork, Tissue engineering

Citation:
Debraj Maji. Spider silk biomaterials for tissue engineering matrices. The Torch. 2023. 4(13). Available from: https://www.styvalley.com/pub/magazines/torch/read/spider-silk-biomaterials-for-tissue-engineering-matrices.