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CHITOSAN HYDROGELS FOR TISSUE ENGINEERING: TOWARDS THE UNIVERSAL BIOREACTOR?

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Chitosan physical hydrogels are particularly well suited for tissue engineering and tissue repair, since the chemical structure of chitosan is similar to other glycosaminoglycans found in mammal's extra-cellular matrix. The physical structure of hydrogels also partly mimics that of natural tissues, and can be adjusted to enable or alternatively to limit cell invasion of the hydrogel materials.

The physico-chemical aspects of hydrogel formation are well understood in terms of hydrophilic/hydrophobic interaction balance, including the case of multi-membrane onion-like architectures [1] (see figure 1). Such multimembrane objects are obtained by interrupted neutralization of an alcohol (1,2 propanediol) chitosan physical gel. The interest 3D architectures for the engineering of complex multimembrane tissues can be illustrated in the case of various cell mono cultures and co-cultures (mixed cell types and separated cell types). The synergistic effects of separated cell co-culturing can be well evidenced, showing that membranes in onion-like structures act as permeable walls for inter-cellular communication.

Such chitosan multimembrane hydrogels open promising research in blood vessels substitute regeneration, cartilage and bone tissue regeneration and repair, stem cell amplification and controlled differentiation.

In view of the wide cellular range addressed by multimembrane chitosan physical hydrogels, these systems could be considered as bioreactors, 'universally' biocompatible with multiple mammalian cells and tissues, but capable of modulating the phenotype of cells, depending on their origin.

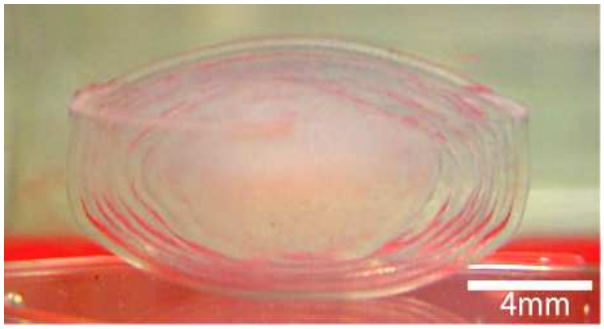

Fig. 1. Multimembrane Physical Hydrogel of Chitosan constituted by 5 independent membranes separating inter-membrane cell culture chambers. The inner part is a chitosan gel. (from ref [1])

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REFERENCES

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