

Development of a hybrid scaffold with a cell-deposited extracellular matrix within a synthetic polymeric fiber mat

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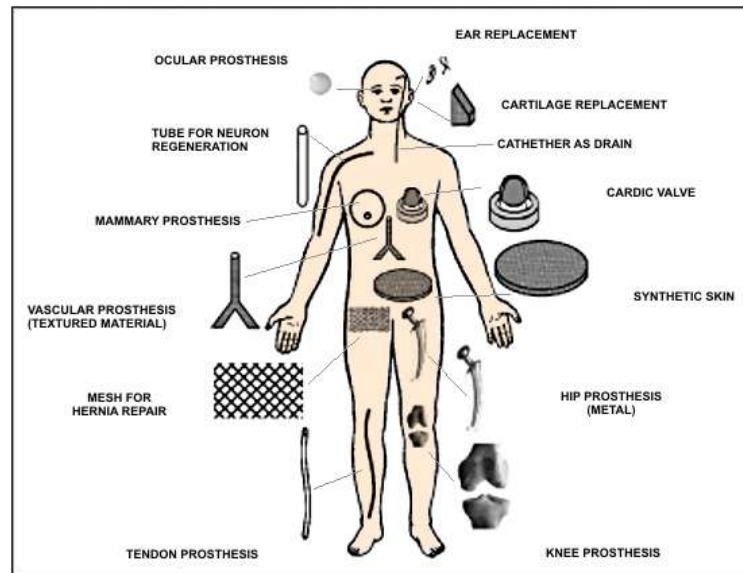
Combining extracellular matrix (ECM) with synthetic material will capture the advantages of both

Cell-derived ECM

- Pros:
 - Tissue-appropriate chemical and physical cues
- Cons:
 - Fragile

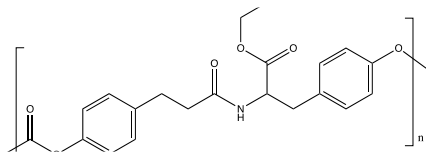
Synthetic scaffolds

- Pros:
 - Strong
 - Reproducible properties
- Cons:
 - Lack essential bioactivity



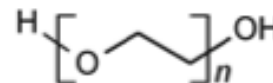
Tyrosine derived polymers are readily processable and biocompatible

Poly (DTE carbonate)
PDTEC



poly (desaminotyrosyl-tyrosine ethyl
ester carbonate)

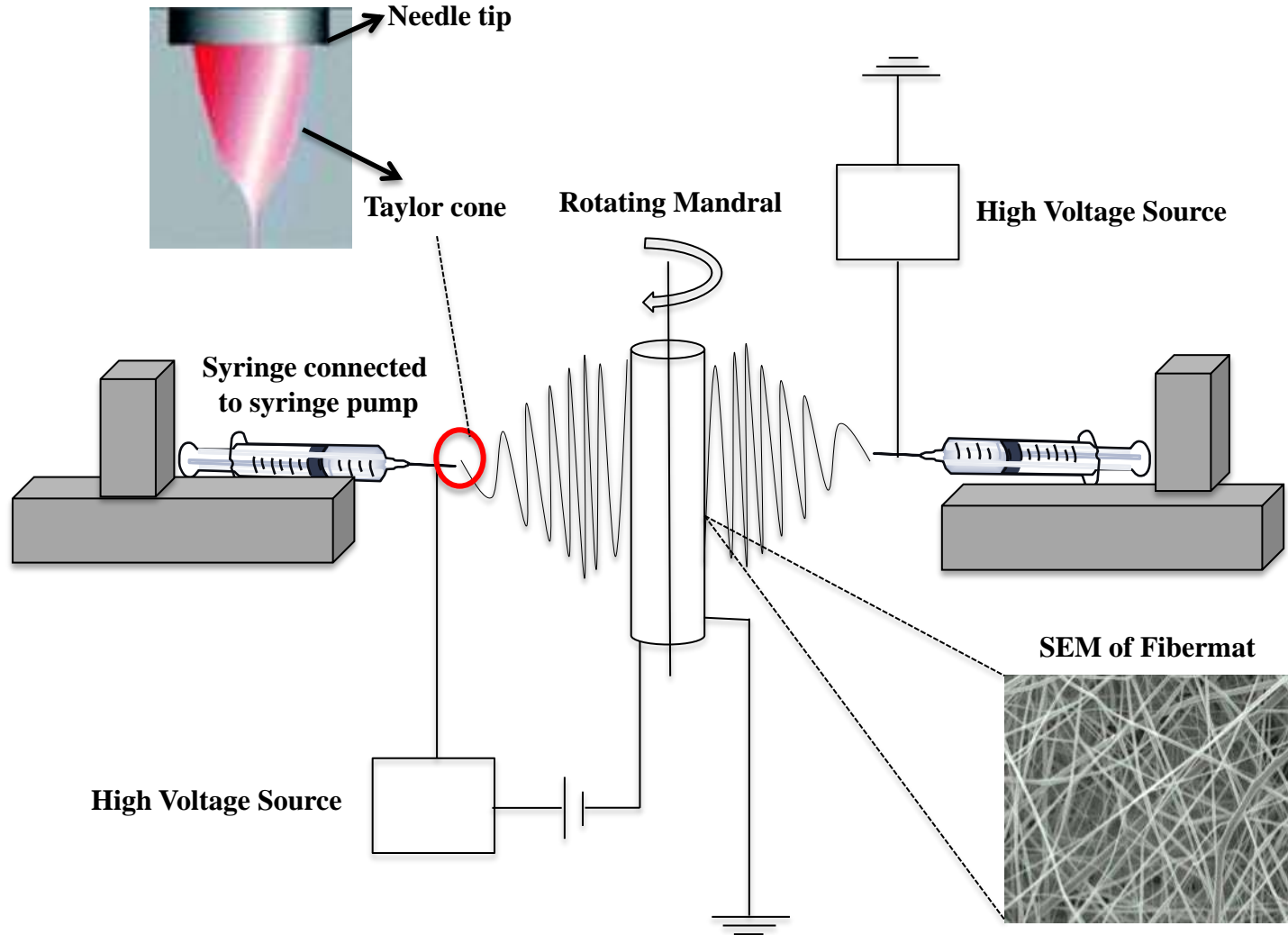
Poly (ethylene glycol)
PEG



PDTEC alone

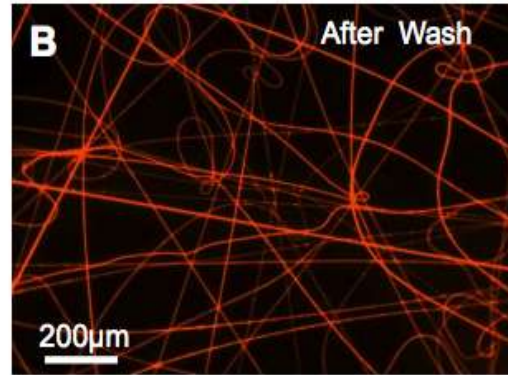
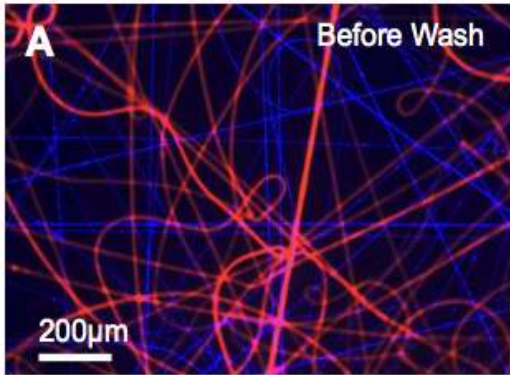


Fabrication of PDTEC:PEG co-electrospun fiber mats



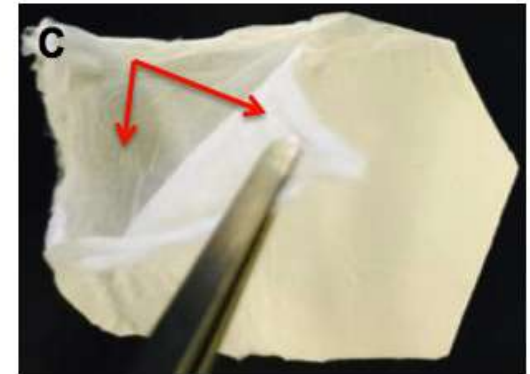
PDTEC:PEG electrospun mats have a layered and porous structure

I. Fluorescent microscopy



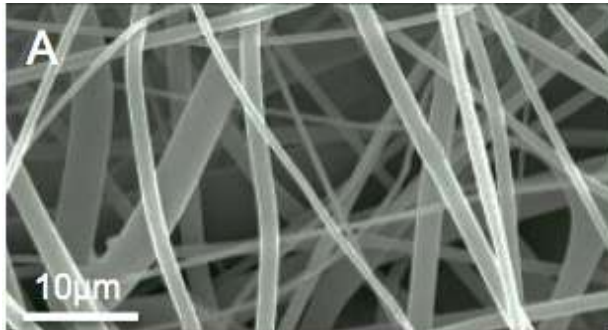
PDTEC/PEG

II. Phase microscopy

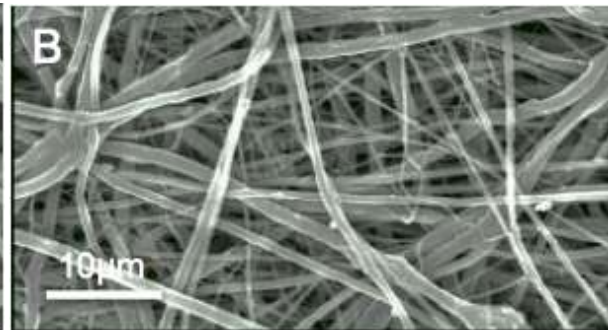


III. SEM

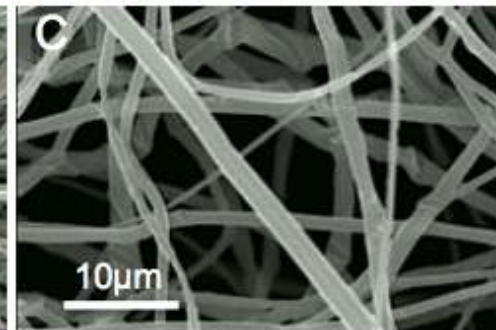
PDTEC alone



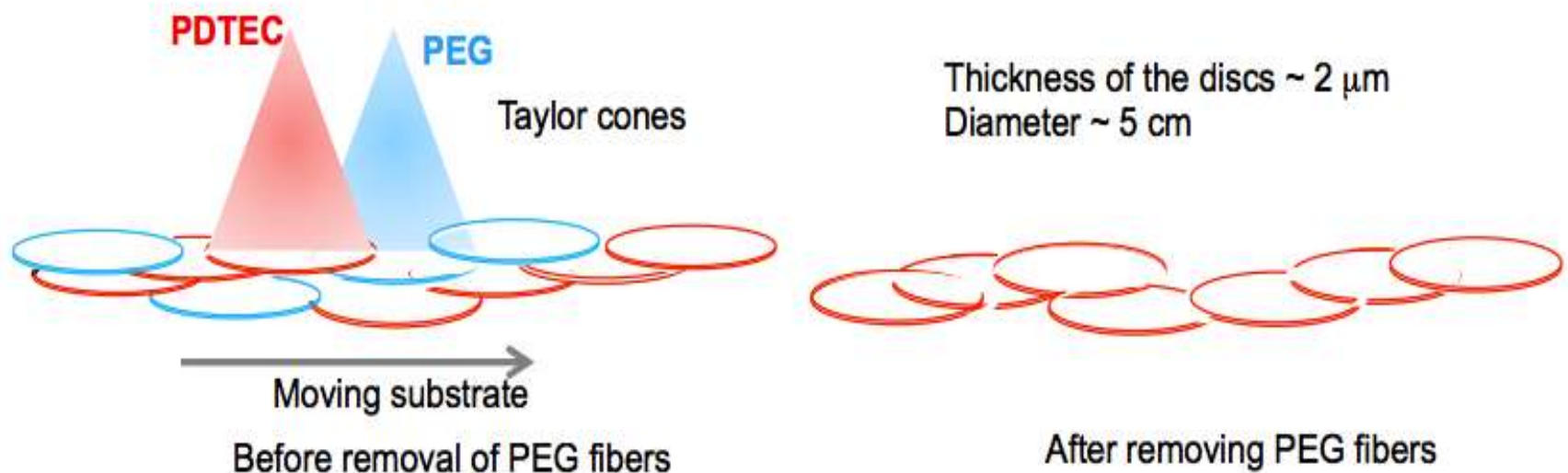
PDTEC+PEG (co-spun) Before wash



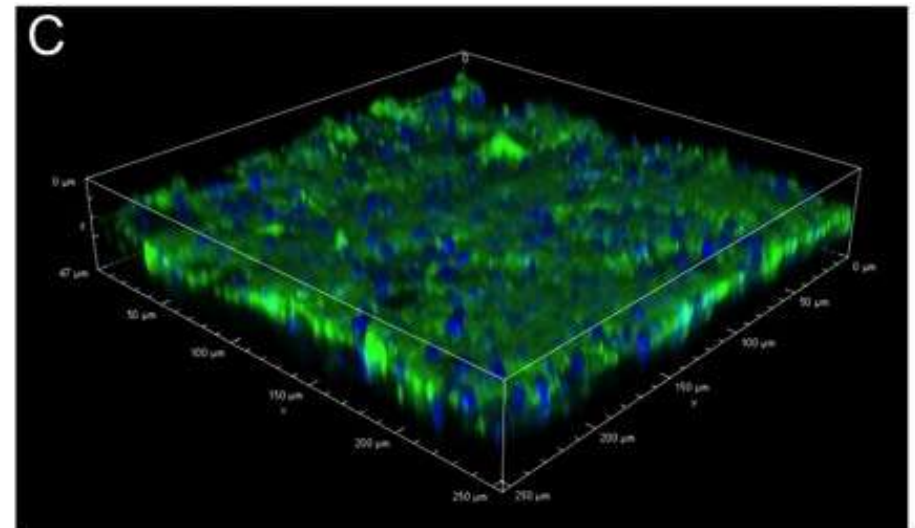
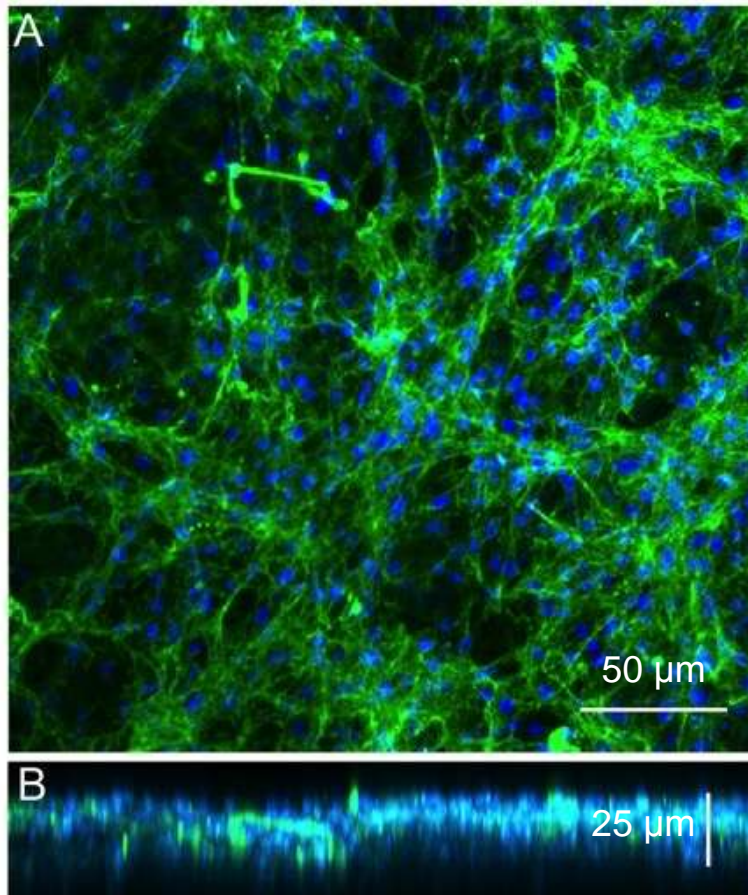
PDTEC+PEG (co-spun) After wash



PDTEC:PEG domains form layers because they are physically separated but weakly linked

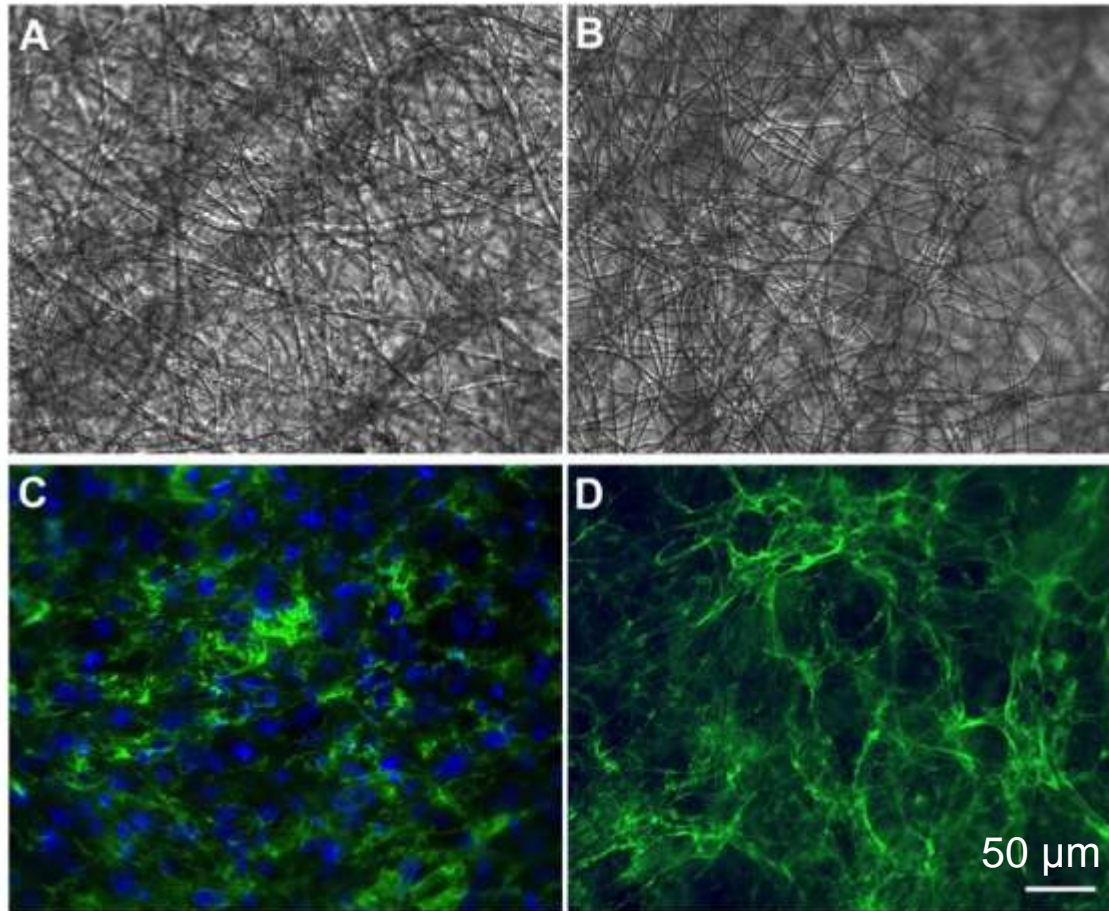


Cell integration and matrix deposition in a PDTEC:PEG fiber mat



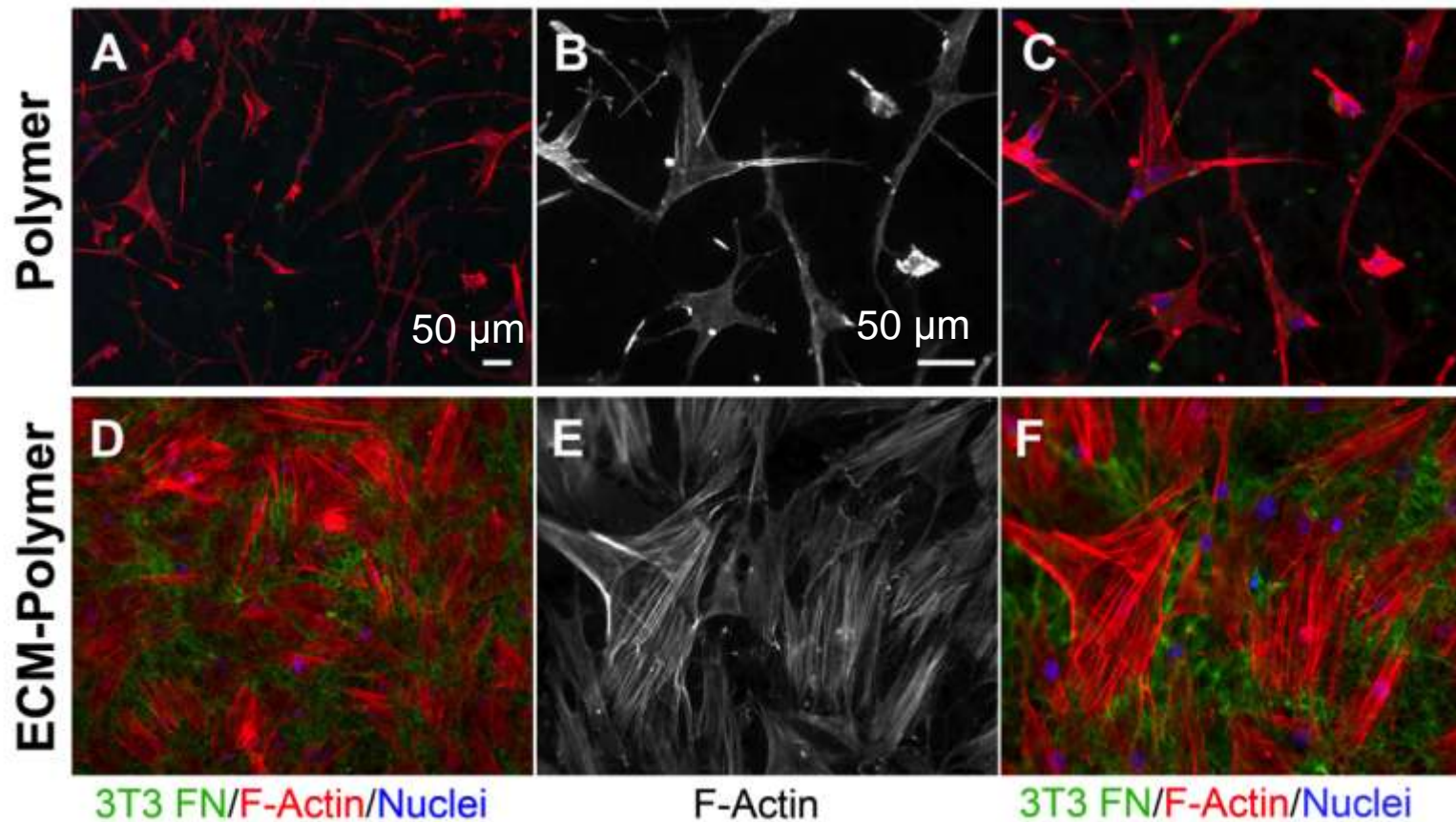
Decellularization does not perturb the structure of the matrix or the fiber mat

Before decellularization After decellularization

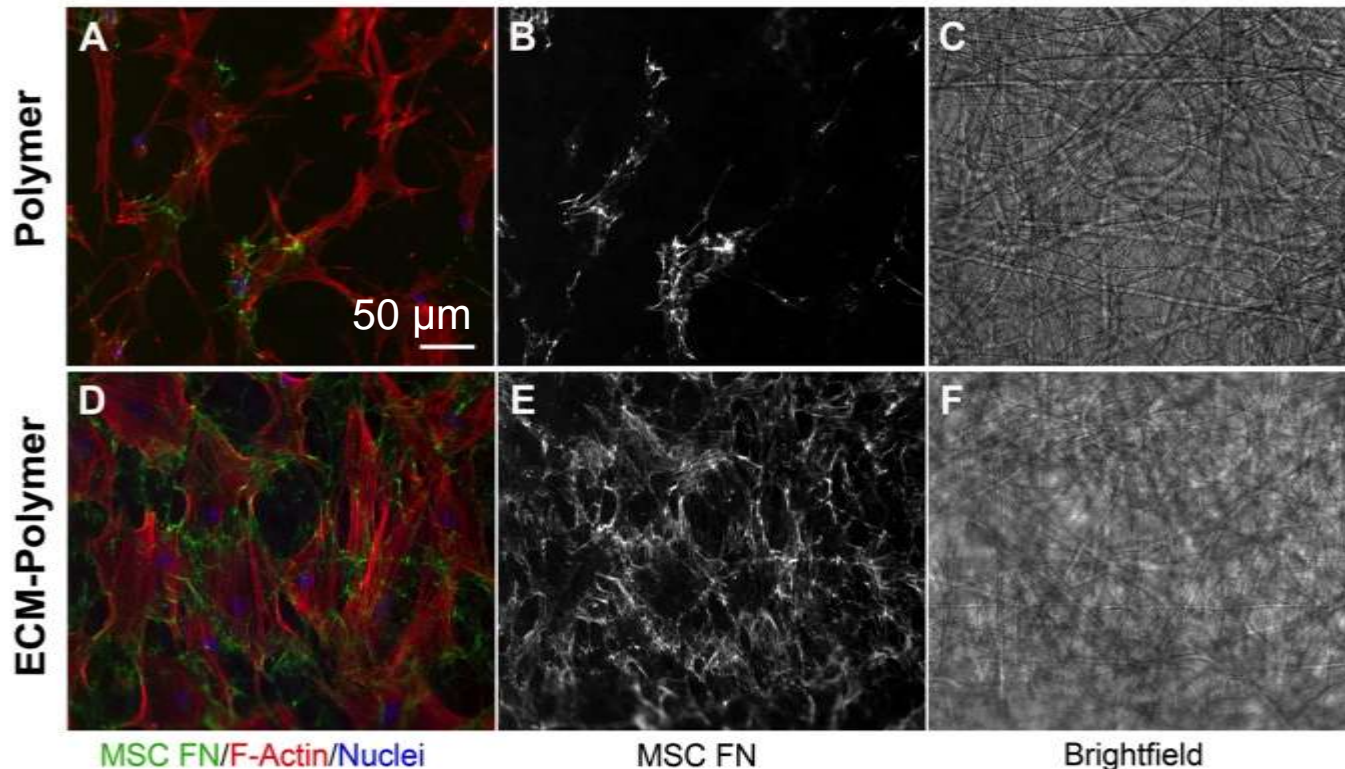


Fibronectin/Nuclei

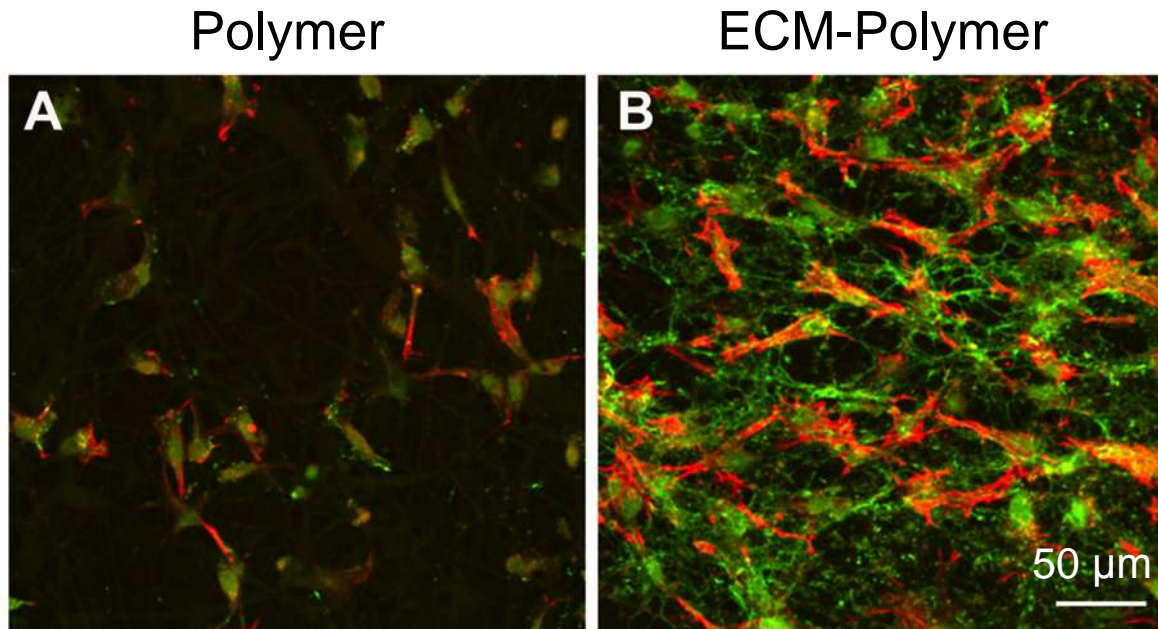
Mesenchymal stem cells (MSCs) adhere and spread better on a hybrid ECM-polymer scaffold than on polymer scaffold alone



MSCs assemble more fibronectin (FN) matrix on a hybrid ECM-polymer scaffold



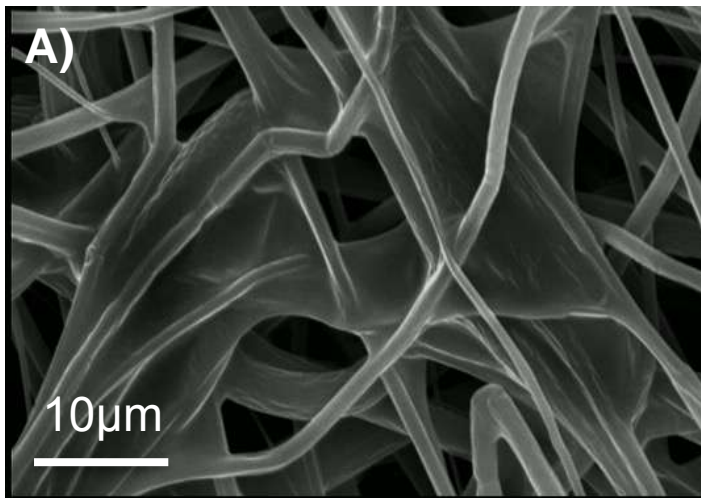
Fibrosarcoma cells also assemble more FN matrix on a hybrid ECM-polymer scaffold



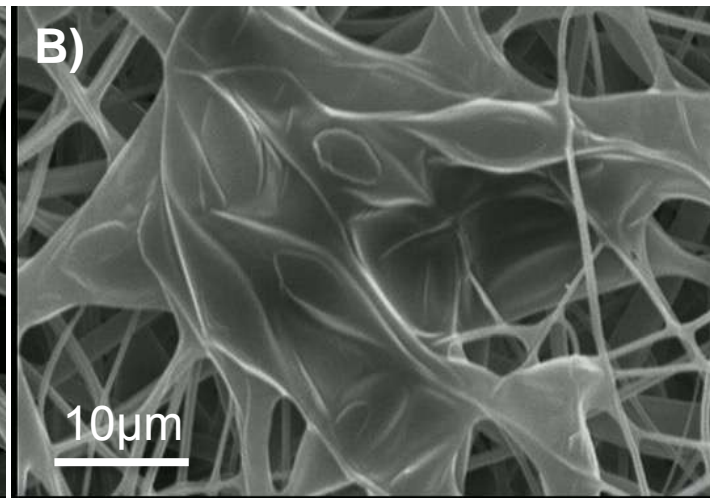
ECM-scaffold hybrid provides tissue-mimetic niche superior to either material individually

- Removal of PEG sacrificial polymer yields pore sizes large enough for cell integration and ECM deposition.
- The presence of a natural ECM enhances cell interactions with the fiber mat.

Human dermal fibroblasts

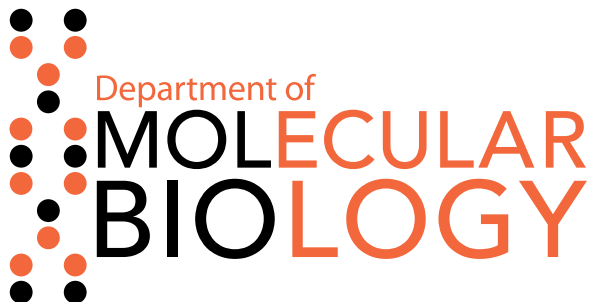


Human MSCs

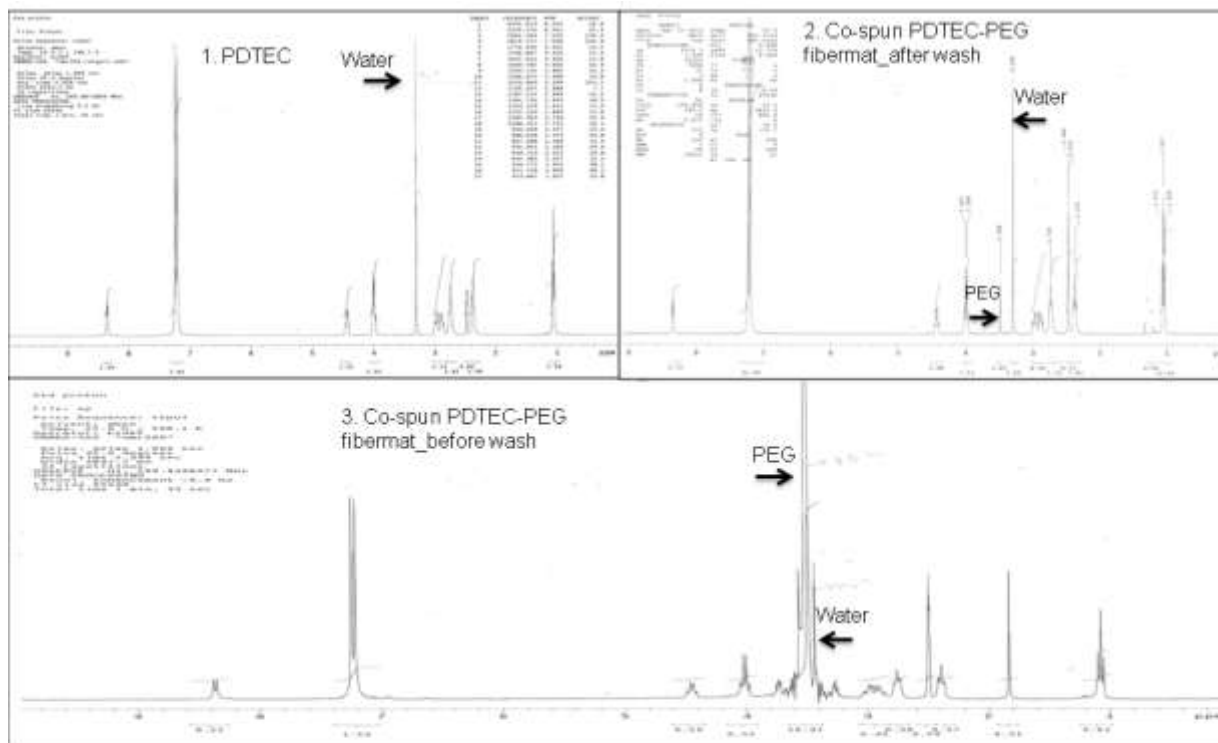


Acknowledgements

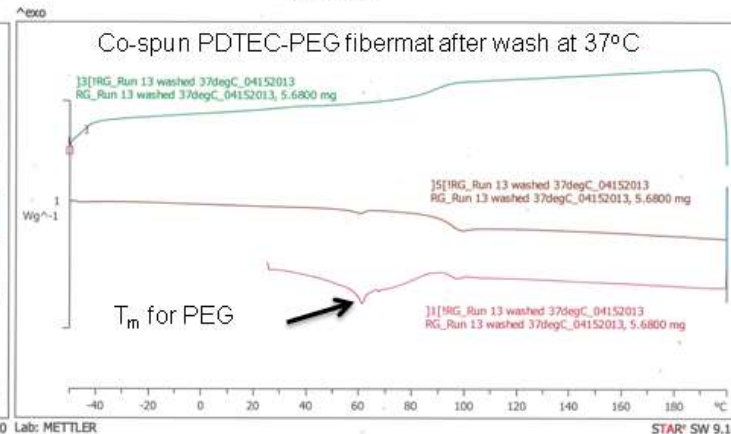
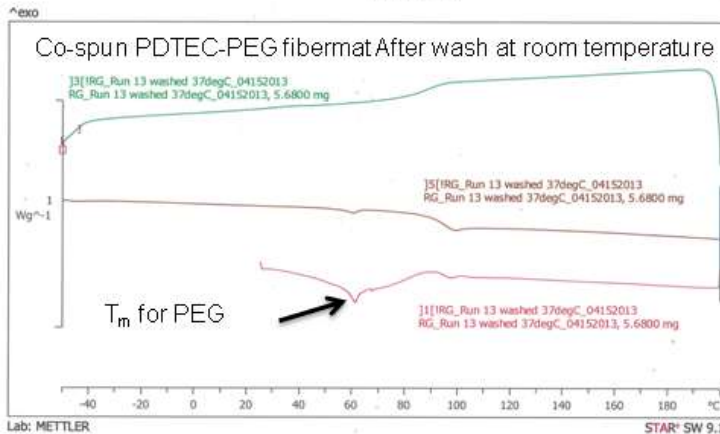
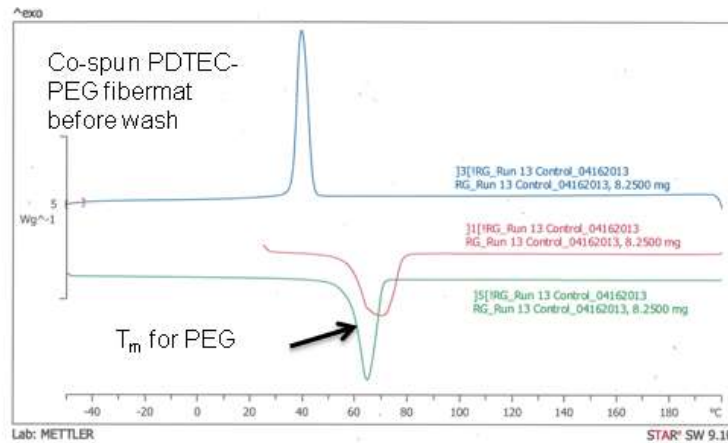
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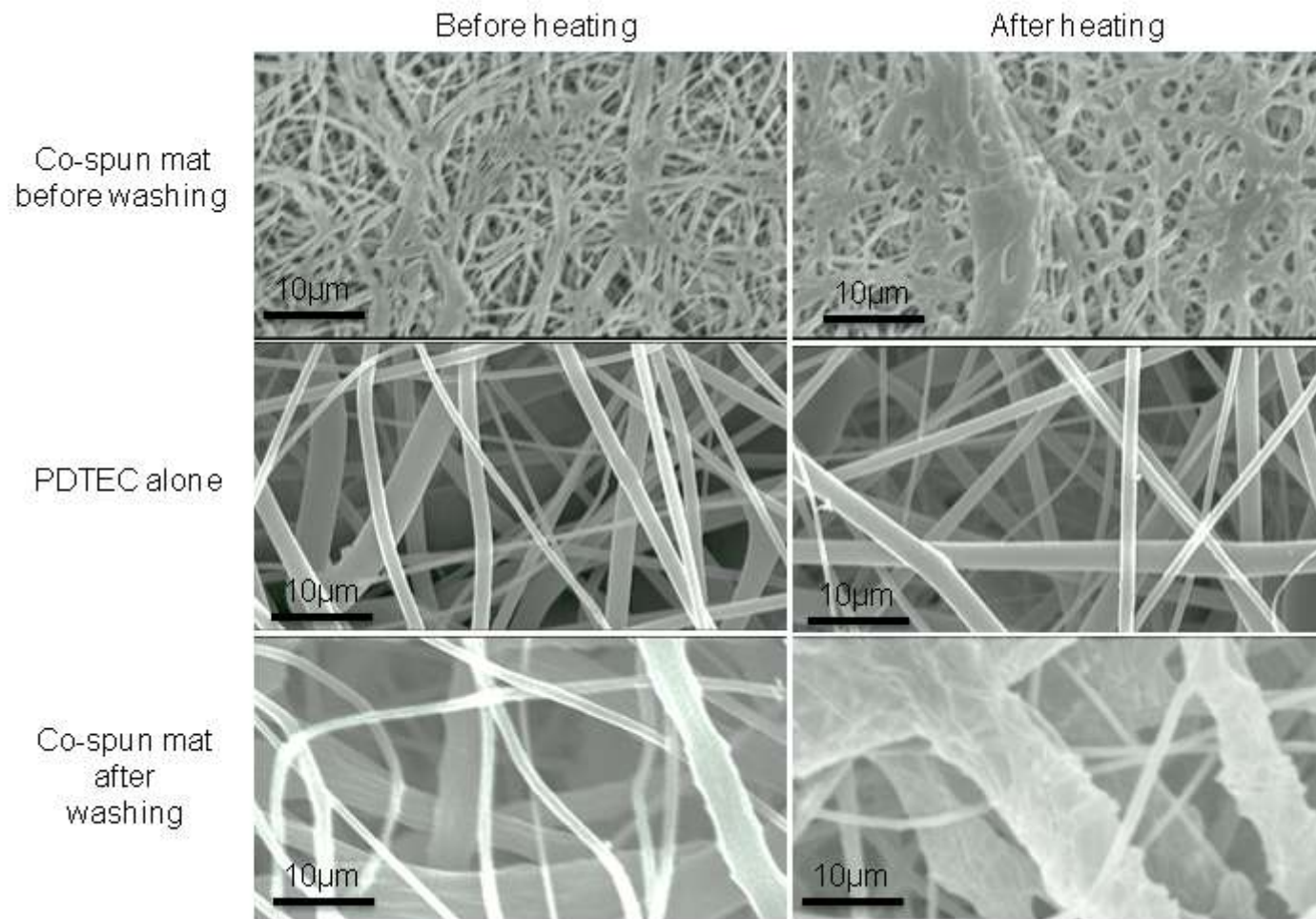


$^1\text{H-NMR}$ spectra to show the presence of PEG in washed co-spun mats.



DSC scans to show the presence of residual PEG as a weak endotherm at $\sim 60^{\circ}\text{C}$ during first heat in washed co-spun mats at 22°C and 37°C





Reproducibility of fiber mat preparation procedure

