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# From nano to micro to macro: Electrospun hierarchically structured polymeric fibers for biomedical applications

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## Abstract:

Hierarchically structured polymer fibers encompassing 1-D, 2-D, and 3-D structures with at least one dimension nano- to micro-meters in size have recently received an increasing amount of attention due to their vast potential in such applications as sensing, medicine, energy storage. This review summarizes advancements in the last ten years in the design and fabrication of hierarchically structured polymer fibers *via* electrospinning technologies, including a diversity of electrospinning devices and electrospinning parameters using various polymers. These well-defined, multilevel structures enable the fibers to be used more effectively in applications in the biomedical field, such as drug delivery, tissue engineering, and diagnostics. This review can provide a better understanding of the relationships between the structure and functionality of polymer fibers for further biomedical applications.

## Abbreviations:

0-D zero dimensional

1-D one dimensional

2-D two dimensional

3-D three dimensional

anti-EpCAM anti-epithelial cell adhesion molecule

bFGF basic fibroblast growth factor

BSHFs bead-on-string heterostructured fibers

CFU Colony-Forming Units

CTCs circulating tumor cells

DC direct current

DCM Dichloromethane

DEPA delivery system on an electrospun pillar array

DGNs dextran glassy nanoparticles

DMAc Dimethylacetamide

DMF N,N-Dimethylformamide

DMNs dissolving microneedles

DRG primary dorsal root ganglia

ECs endothelial cells

FDM fast-dissolving drug delivery membrane

HFIP Hexafluoroisopropanol

IBU ibuprofen

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