Supporting Information

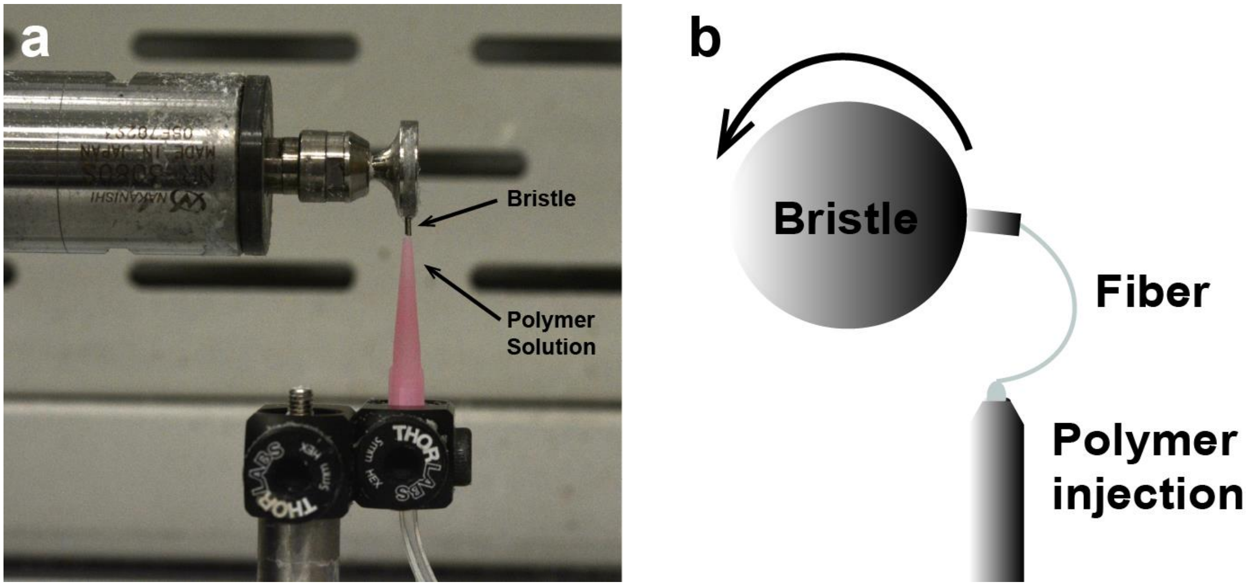

Figure S1. Image illustrating the pull spinning system used for nanofiber fabrication.

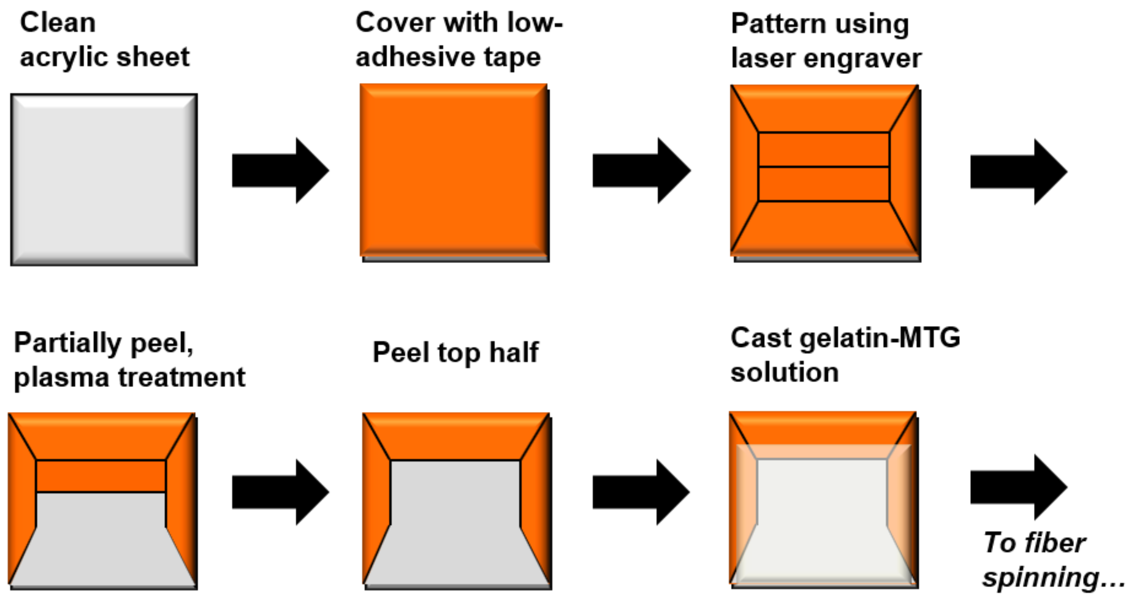

Figure S2. Schematic diagram showing the preparation of gelatin MPS substrates before spinning the fibers.

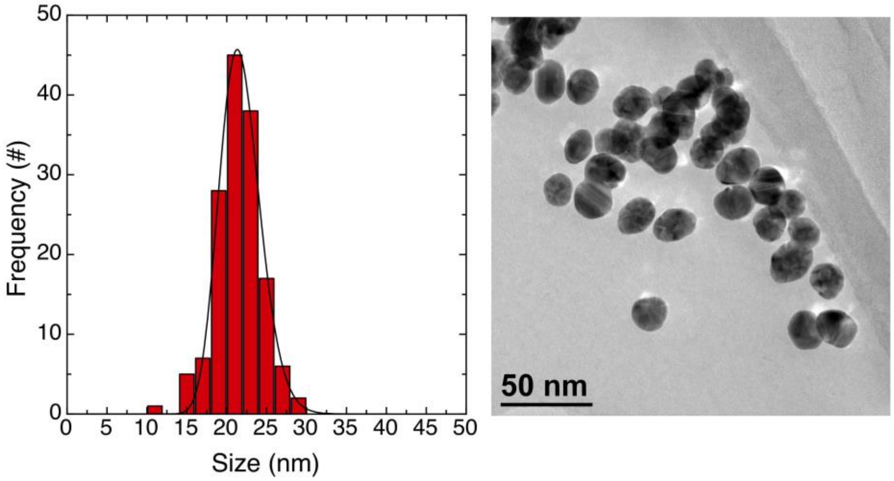

Figure S3. TEM Feret size distribution for the Ag nanoparticles.

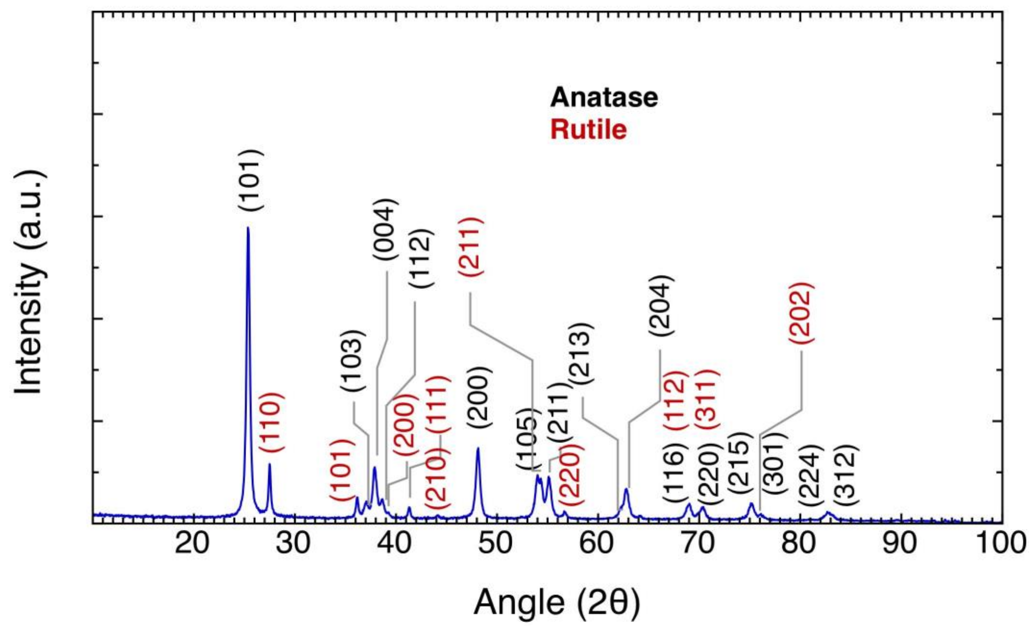

Figure S4. XRD Pattern for the TiO_2 Degussa P25.

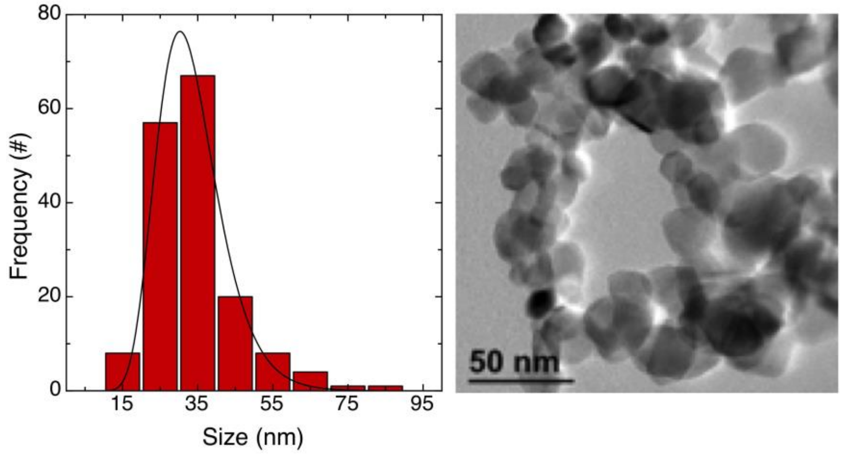

Figure S5. TEM Feret size distribution for the TiO_2 Degussa P25.

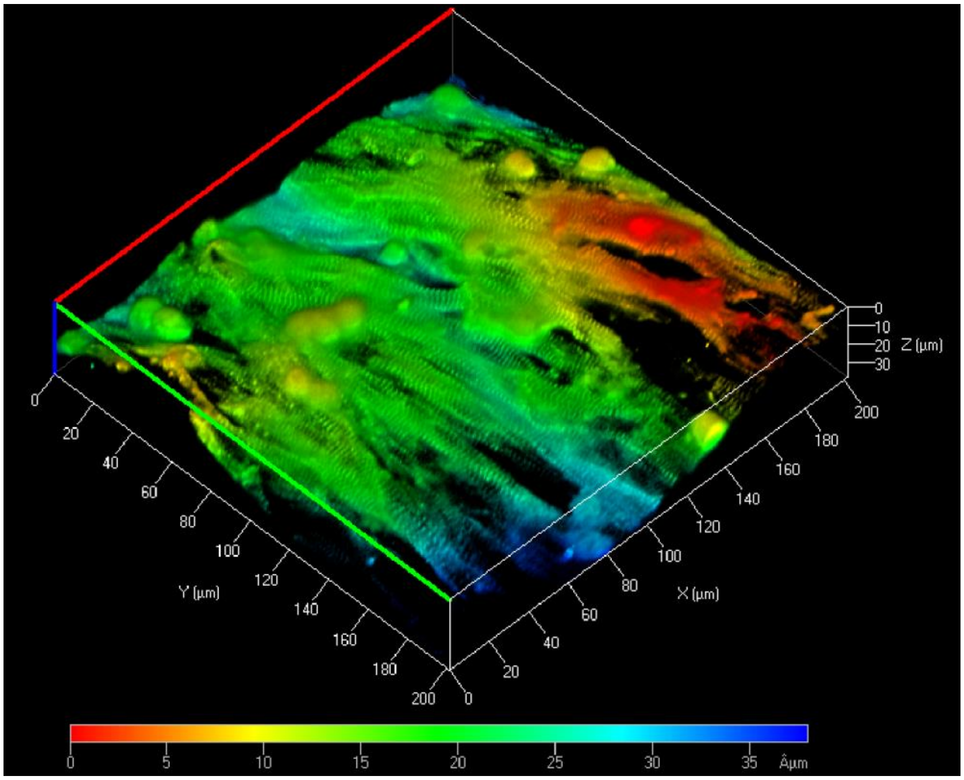

Figure S6. Representative 3D reconstruction image of z-stacked confocal images of NRVMs grown on PCL/PDA nanofiber scaffold with a color depth.

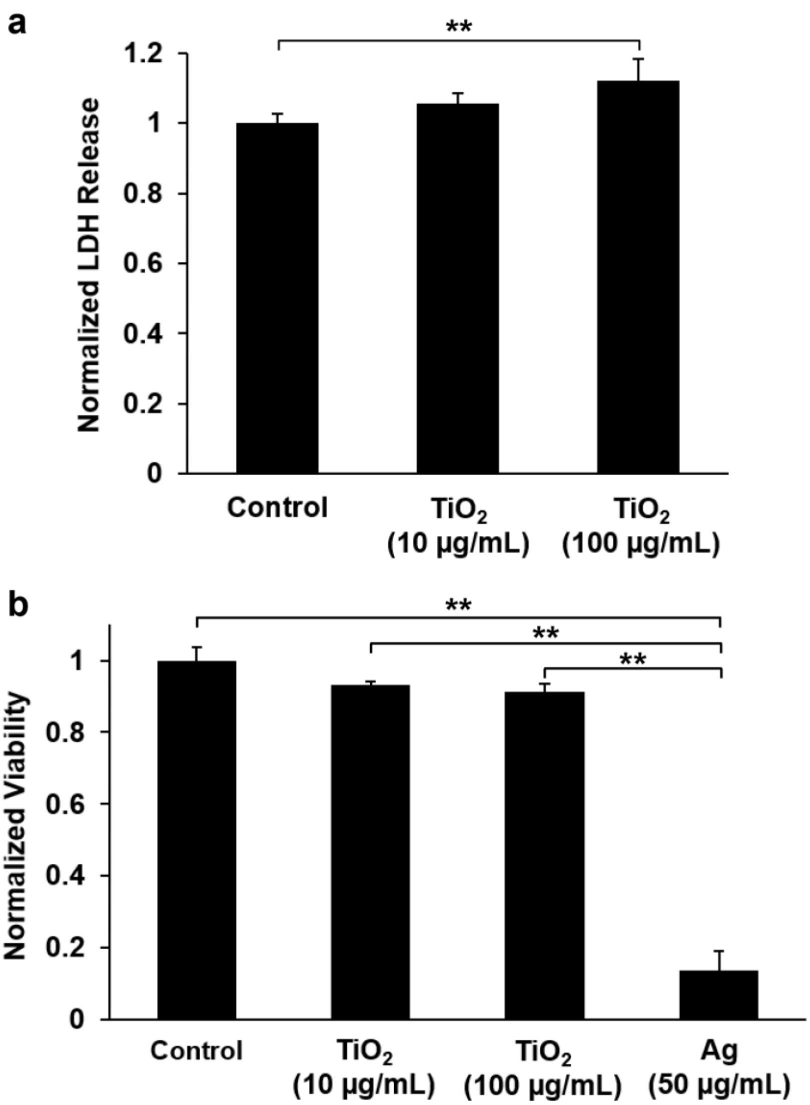

Figure S7. Cytotoxicity tests for cardiomyocytes cultured on fiber MTFs. a) Comparison of lactate dehydrogenase (LDH) release of cardiomyocyte MTFs, pre- and post-exposure to TiO_2 at 10 and 100 µg/mL. b) Comparison of cell viability based on MTT assay for cardiomyocytes unexposed and exposed to 50 µg/mL Ag nanoparticles. Bars represent standard error, n=8 per condition for LDH assay, n=16 for MTT assay. For statistical comparison, $^{**}p<0.05$.

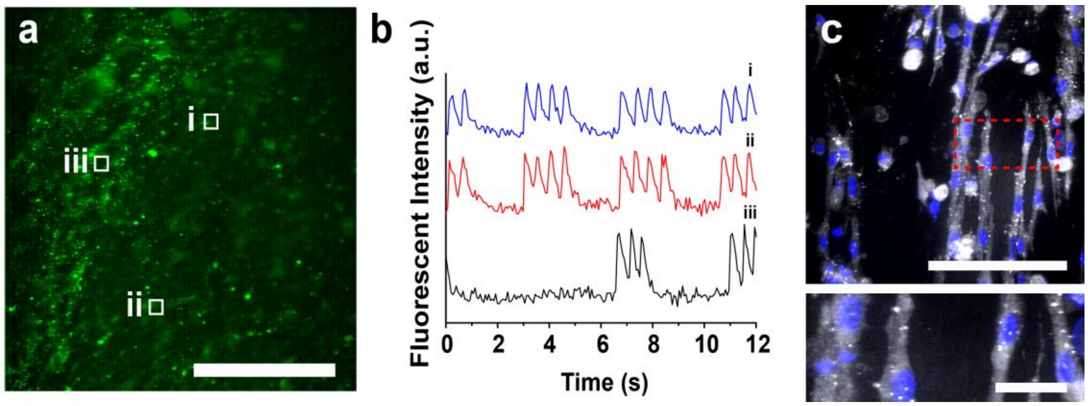

Figure S8. Effect of silver nanoparticle exposure. a–b) Confocal images of calcium dye fluorescent (green) with calcium transient at the specific points (white boxes) for Ag (50 µg/ml) exposure. Scale is 500 µm. c) Confocal image of cardiomyocytes on nanofiber, stained for nuclei (blue) and α-actinin (grey). Scales are 100 µm (for the top panels) and 20 µm (for the bottom panels). The bottom panels are the zoom-in images from the red dots of the top panels.

Table S1. Morphological and structural properties of ENMs

	Primary Particle Size				Crystal Structure	
ENM	**SSA (m^2/g)**	**d_{BET} (nm)**	**d_{TEM} (nm)**	**d_{XRD} (nm)**	**Crystal System**	**Crystallinity (%)**
TiO_2 P25	46.45 ± 2.32	29.76 ± 1.49	28.82 ± 11.07	Anatase: 21.3 Rutile: 30.40	Anatase 81.4% Rutile 16.2%	81.4
Ag – citrate capped	N/A	N/A	21.58 ± 2.83	N/A	N/A	N/A

ENM, engineered nanomaterial; SSA by nitrogen adsorption/Brunauer-Emmett-Teller (BET) method; d_{BET}, d_{TEM} and d_{XRD}, particle

Table S2. Physical properties of ENMs

ENM	Shape Factors			Porosity		ρ_{raw} (g/cc)
	Aspect ratio	**Circularity**	**Roundness**	**TPV (cc/g)**	**APS§ (nm)**	
TiO_2 P25	1.276 ± 0.162	0.926 ± 0.034	0.795 ± 0.094	0.119	5.14	4.38±0.01
Ag – citrate capped	1.175 ± 0.111	0.999 ± 0.025	0.858 ± 0.078	N/A	N/A	N/A

ENM, engineered nanomaterial; TPV and APS, total pore volume and average pore size, respectively determined by nitrogen adsorption/Brunauer-Emmett-Teller (BET) method; ρ_{raw}, the raw density of ENMs determined by nitrogen volume displacement (pycnometry); §TEM did not confirm the presence of pores but interparticle spacing instead.

Table S3. Chemical and biological properties of ENMs

ENM	Chemical Elemental Composition				Recombinant Factor C (EU/mg)[£]	Sterility (bacterial growth observed)[†]
	Trace Metal Analysis (%)	Carbon Content (%)*	Stoichiometry XPS	Stoichiometry ICP-MS		
TiO_2 P25	99.98±4.86 Ti	0.22±0.13	$TiO_{1.93}$	$TiO_{1.86}$	< LOD	No growth
Ag – citrate capped	99.69±0.60 Ag	0.17±0.21	N/A	N/A	4.870	No growth

ENM, engineered nanomaterial; LOD, limit of detection; *Elemental plus organic carbon content (w/w); [£]Suspension tested at 10 µg/ml, endotoxins in PBS is 76 EU/ml; [†]suspension tested at 50µg/ml;

Table S4. Percentage of cantilevers beating during the time point of MPS optical recording.

Condition	% Cantilevers Beating
Control (0 μg/mL)	95.0%
TiO_2 (10 μg/mL)	91.7%
TiO_2 (100 μg/mL)	55.6%
Ag (50 μg/mL)	28.6%

Supplementary Movies

Movie 1. NRVM contraction on PCL/PDA nanofiber scaffolds. Scale is 100 μm.

Movie 2. NRVM contraction on fiber-coated gelatin MPS. Scale is 2 mm.

Movie 3. NRVM contraction on fiber-coated cardiac microphysiological device with embedded contractility sensors.

Movie 4. Time-series images of a calcium-sensitive dye from cardiomyocytes grown on the fiber-coated MTF sample without nanoparticle exposure.

Movie 5. Time-series images of a calcium-sensitive dye from cardiomyocytes grown on the fiber-coated MTF sample with a low-dose TiO_2 (10 μg/ml) nanoparticle exposure.

Movie 6. Time-series images of a calcium-sensitive dye from cardiomyocytes grown on the fiber-coated MTF sample with a high-dose TiO_2 (100 μg/ml) nanoparticle exposure.