

Supplementary Information(SI)

A contractile force measurement system for hiPSC-derived cardiac tissue integrated with an ultrathin, stretchable nanomesh

Shogo Iwai, Daisuke Sasaki, Tetsutaro Kikuchi*, Katsuhisa Matsuura, Kenjiro Fukuda, Sunghoon Lee*, Tatsuya Shimizu, Takao Someya, and Shinjiro Umezu*

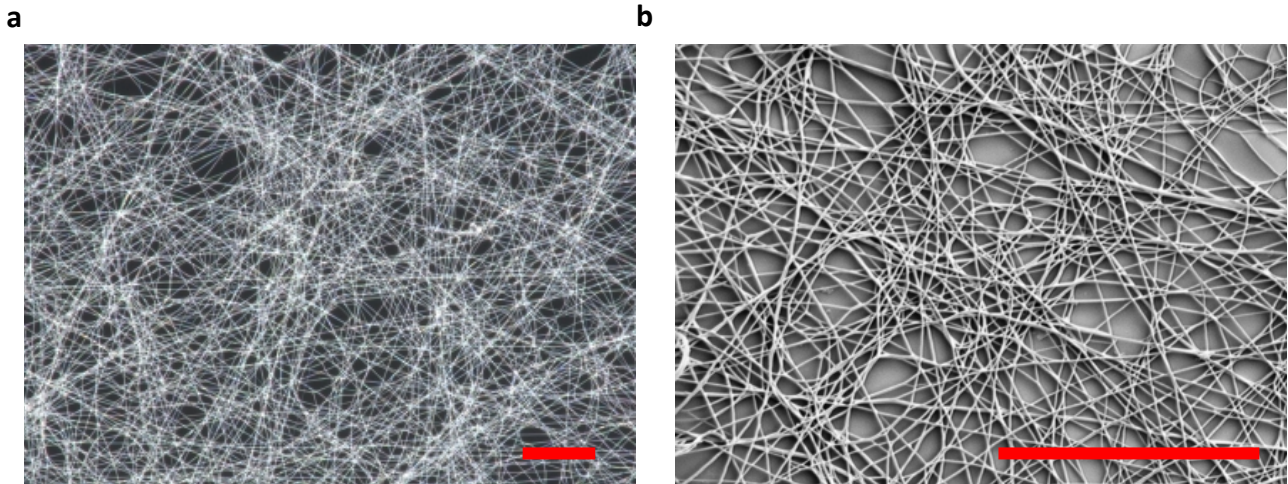


Fig. S1 PU nanomesh image. (a) Microscope image. Scale bar: 50 μ m. (b) SEM image. Scale bar: 50 μ m.

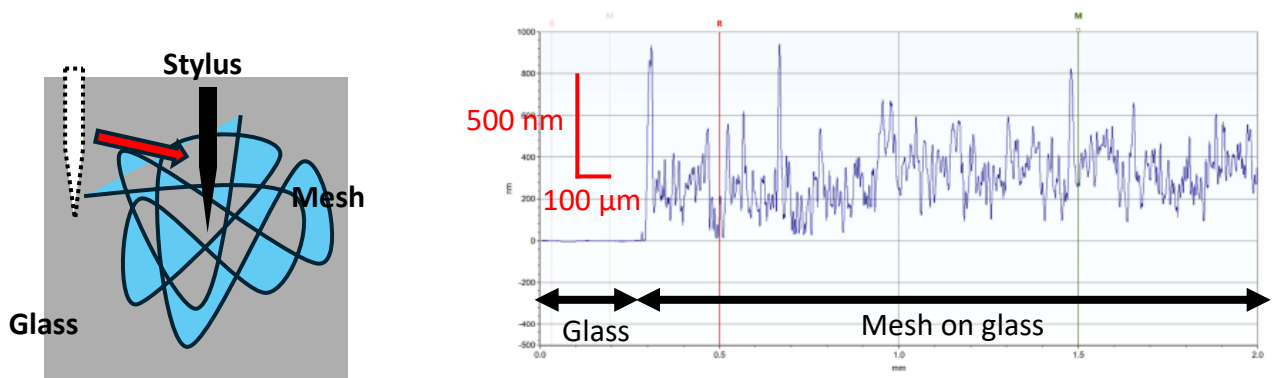
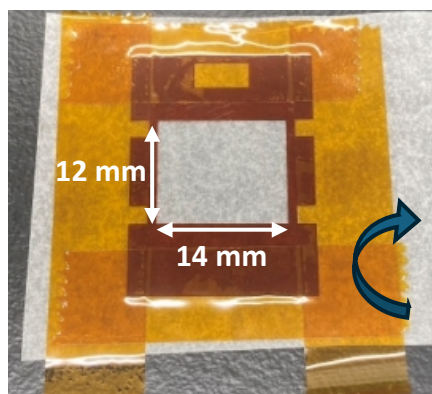


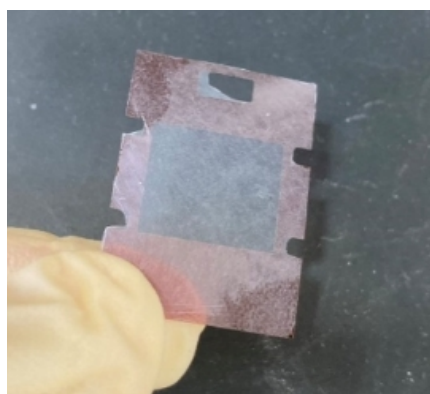
Fig. S2 The thickness of the nanomesh was measured using a surface profilometer.



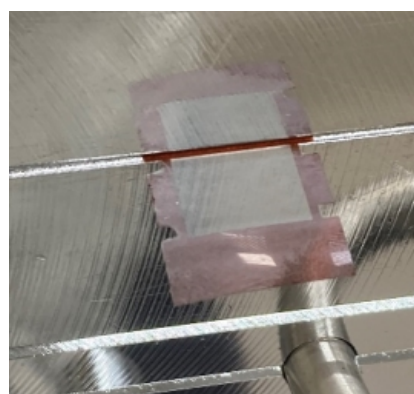
① The PI frame was attached to the nanomesh on cooking paper using Kapton tape.



② Peeling off the tape simultaneously detached the nanomesh from the cooking paper.



③ The Kapton tape was then removed.



④ Adhesion between the PI frame and the nanomesh was reinforced by heat pressing.

Fig. S3 The nanomesh was transferred onto a PI frame. Dimensions are indicated by arrows in the first panel and apply to all images.

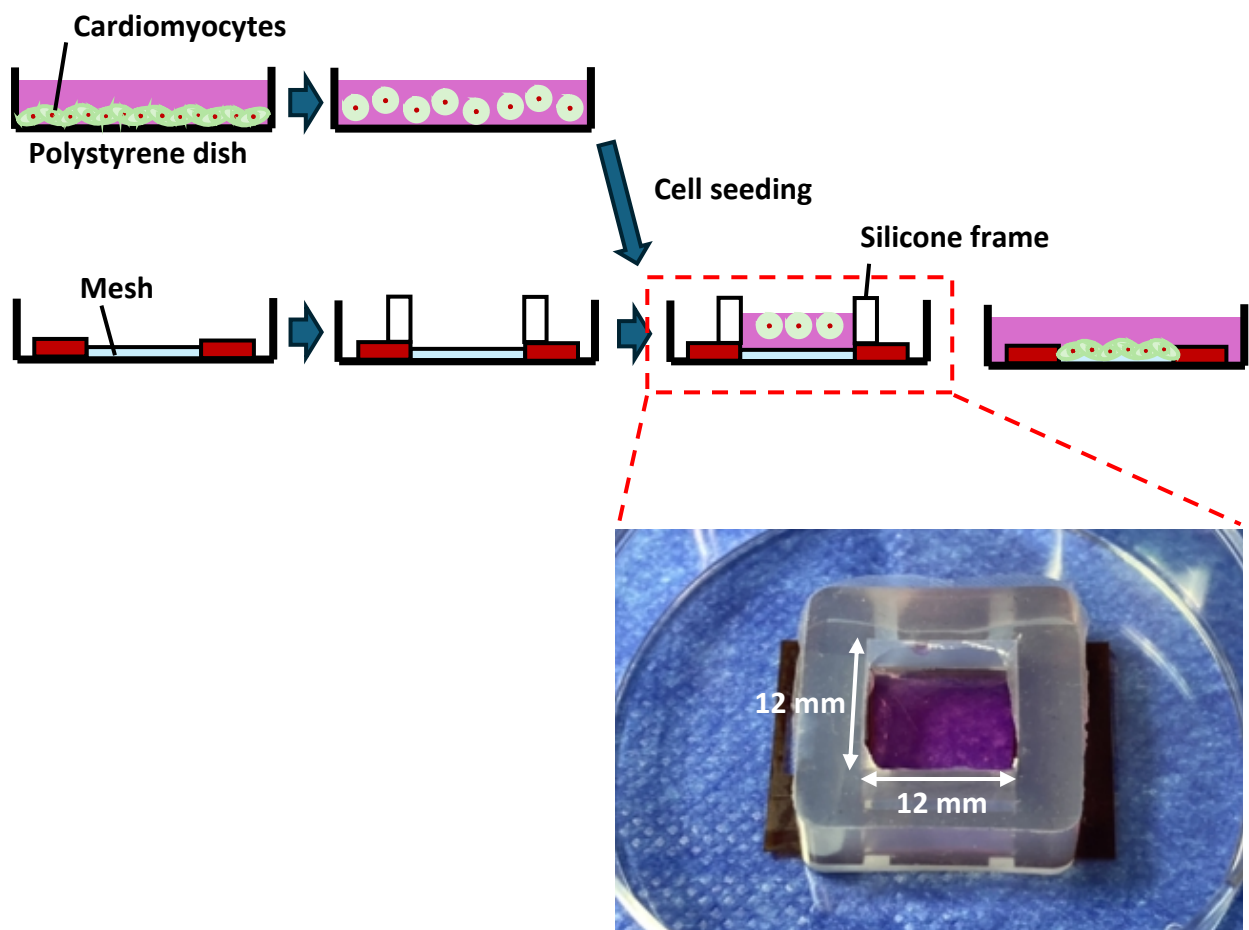


Fig. S4 Cardiomyocytes were seeded onto the nanomesh.

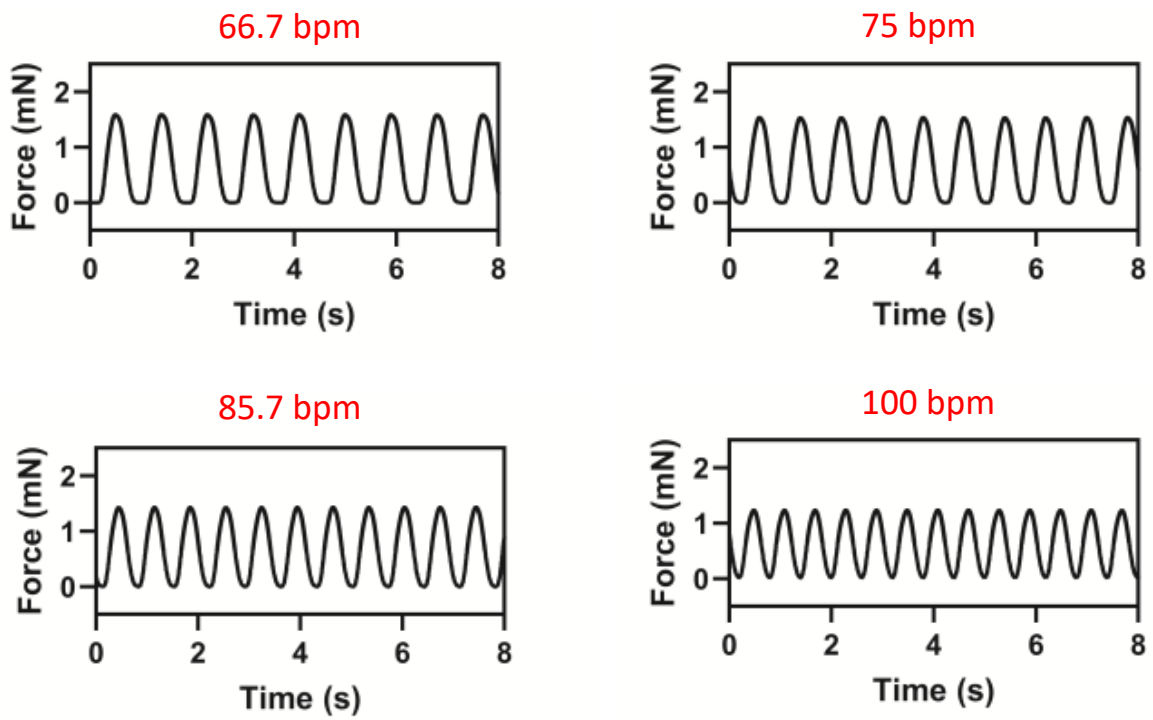


Fig. S5 Electrical stimulation results at various frequencies

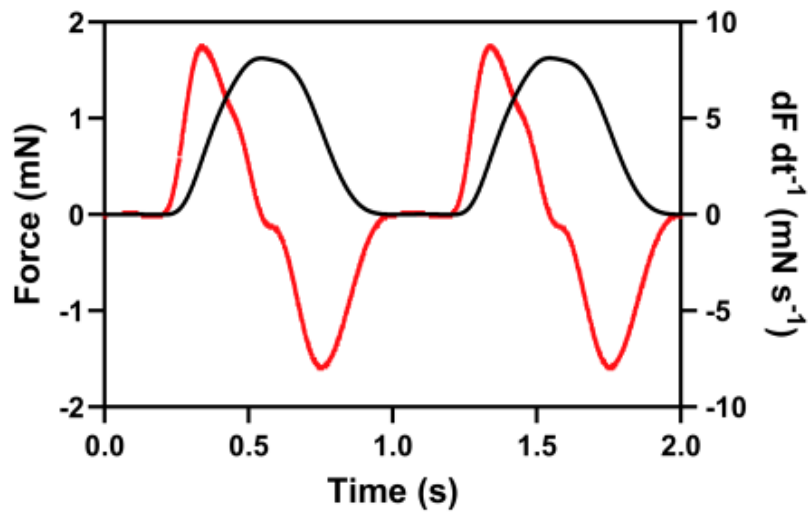


Fig. S6 Contraction waveforms and their derivatives.
Black: contraction waveform; Red: derivative waveform

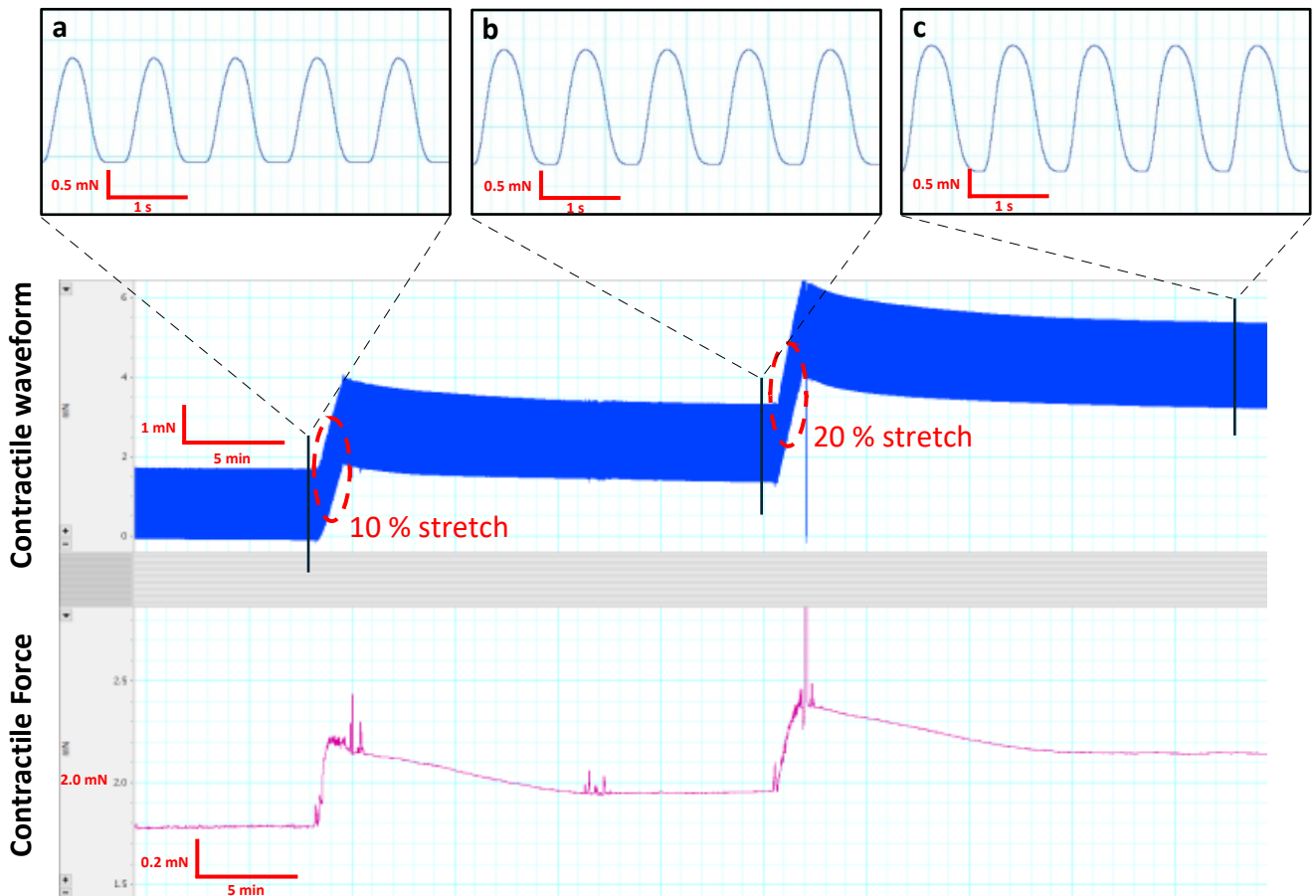


Fig. S7 Mechanical stretch test

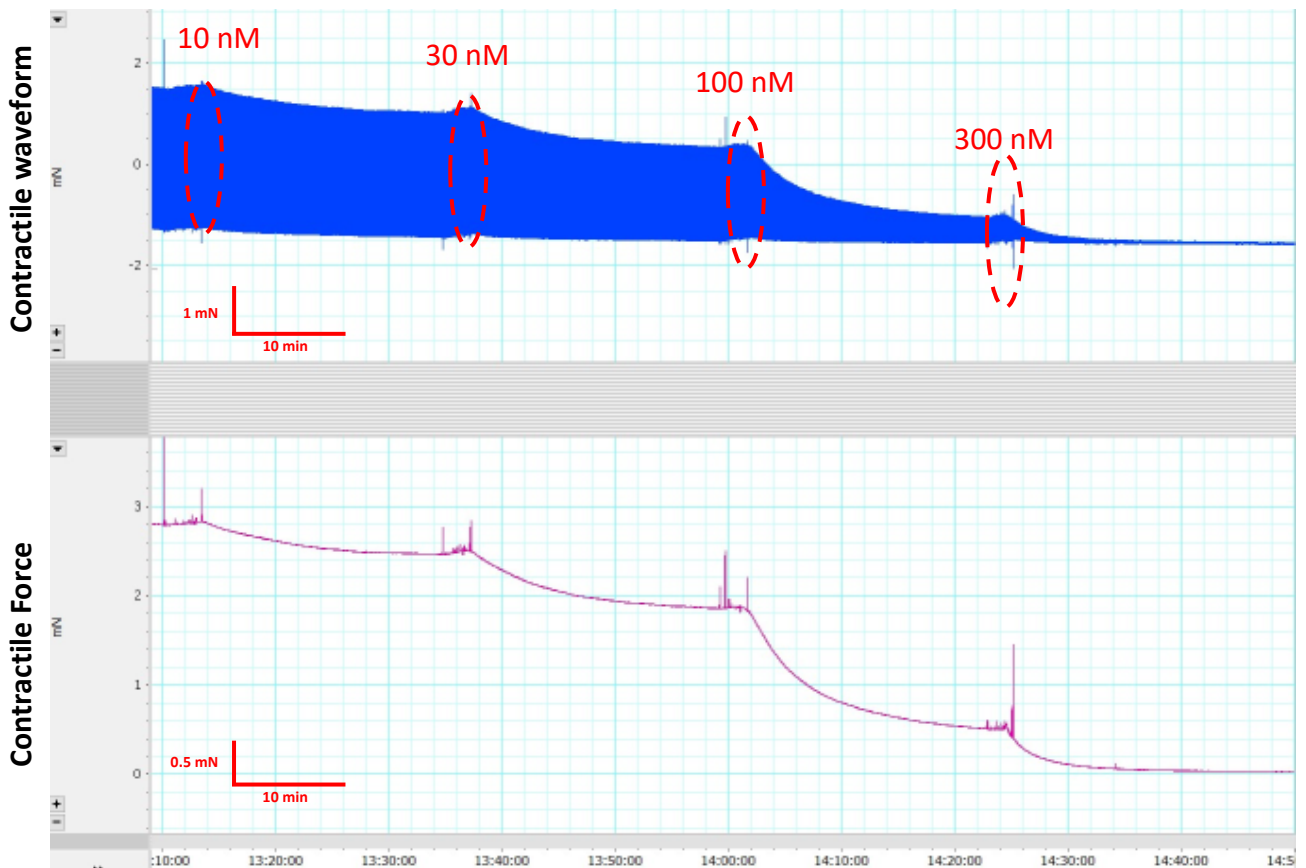


Fig. S8 verapamil drug test

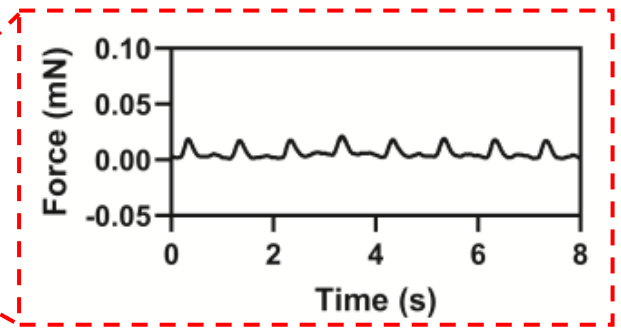
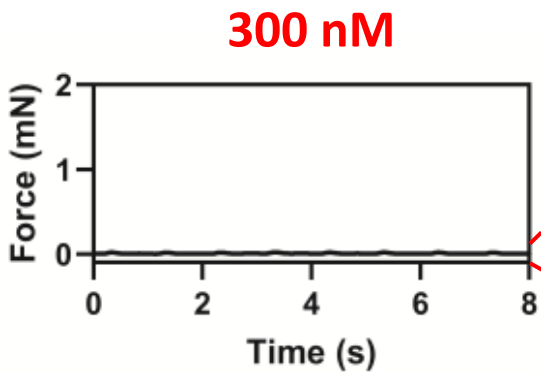
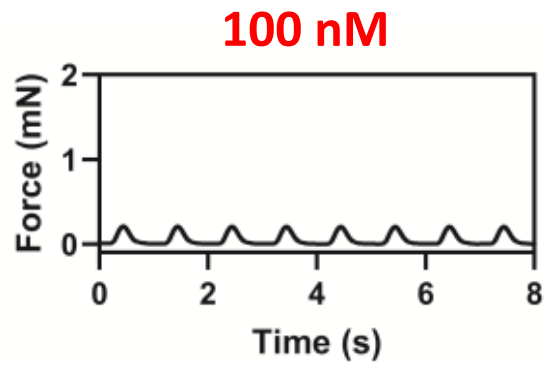
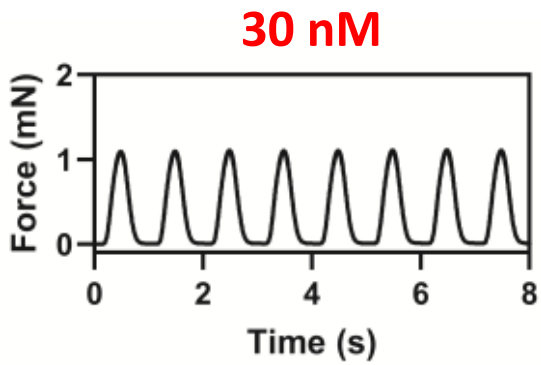
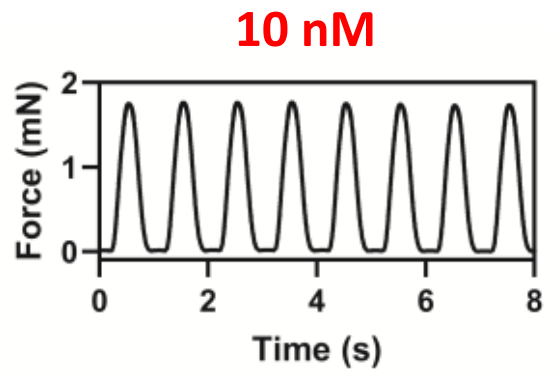
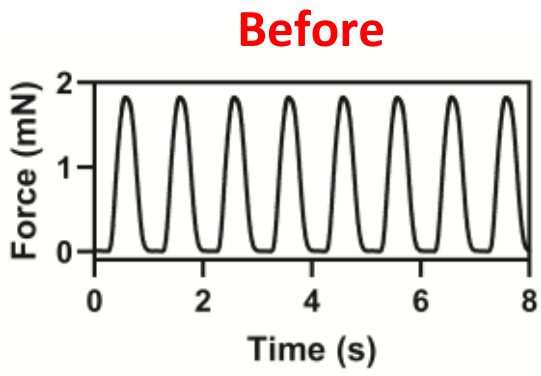


Fig. S9 Waveforms following administration of verapamil

Ref number	Material	Thickness (μm)	Stretchability (%)
13	Hydrogel mixture matrix (collagen base)	300 ※ ¹	125~
14	Hydrogel mixture matrix (collagen base)	2000 ※ ²	75~
15	Hydrogel mixture matrix (collagen base)	N/A	50~
16	Hydrogel mixture matrix (collagen base)	N/A	125~
17	Hydrogel mixture matrix (collagen base)	500 ※ ¹	70~
18	Hydrogel mixture matrix (collagen base)	N/A	31~
19	Hydrogel mixture matrix (fibrin base)	500 ※ ¹	75~
20	Hydrogel mixture matrix (fibrin base)	3000 ※ ²	30~
21	Hydrogel mixture matrix (fibrin base)	N/A	16~
22	Hydrogel sheet (gelatin base)	200	20~
23	Hydrogel sheet (fibrin base)	1500	20~
24	PDMS	292.4	20~
This study	PU nanomesh	~1	70

※¹ For the hydrogel mixture matrix type, the tissue thickness is assumed to be equivalent to the substrate thickness.

※² The thickness of the hydrogel mixture matrix type is based on the thickness of the mold during the initial seeding stage.

Table S1 quantitative comparison of substrate with previous.