Electronic Supplementary Material (ESI) for Analyst.

Supplementary information
For
Enhancement of Cardiac Contractility Using Gold-coated SU-8 Cantilevers and Their Application to Drug-induced Cardiac Toxicity Tests

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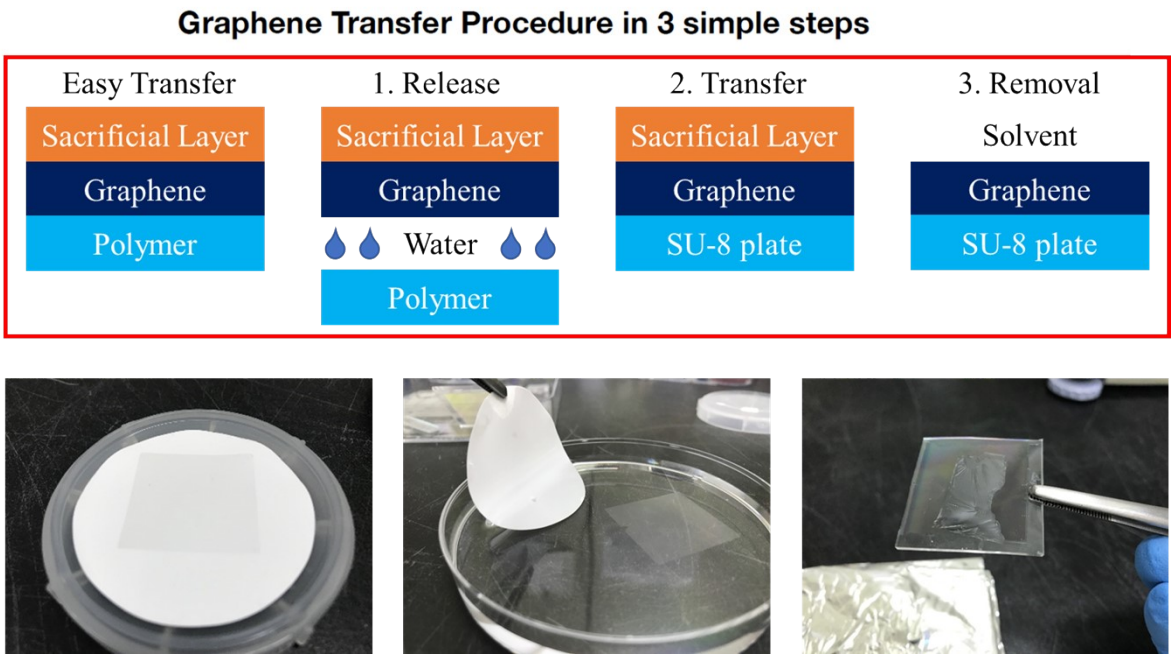

Fig. S1. Photograph shows the detailed fabrication process flow of the graphene coated SU-8 Substrate.

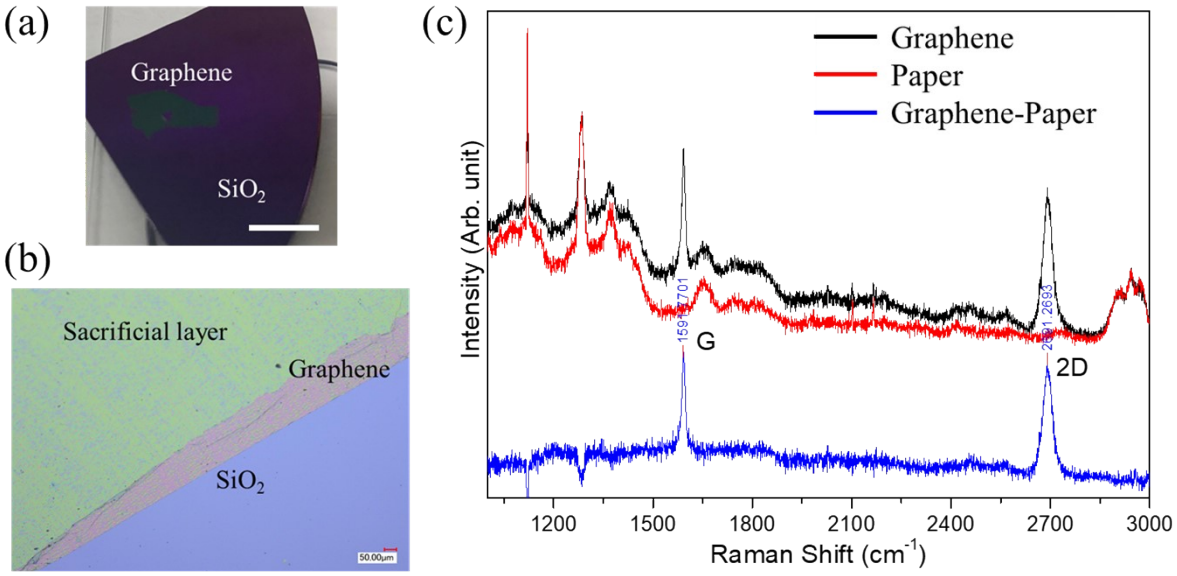

Fig. S2. Graphene transferred silicon wafer image. (a, b) Graphene is distinguishable through color differences, such as in images after transfer to SiO_2 wafer, and (c) RAMAN spectra of the graphene. Scale bar represent 1 cm.

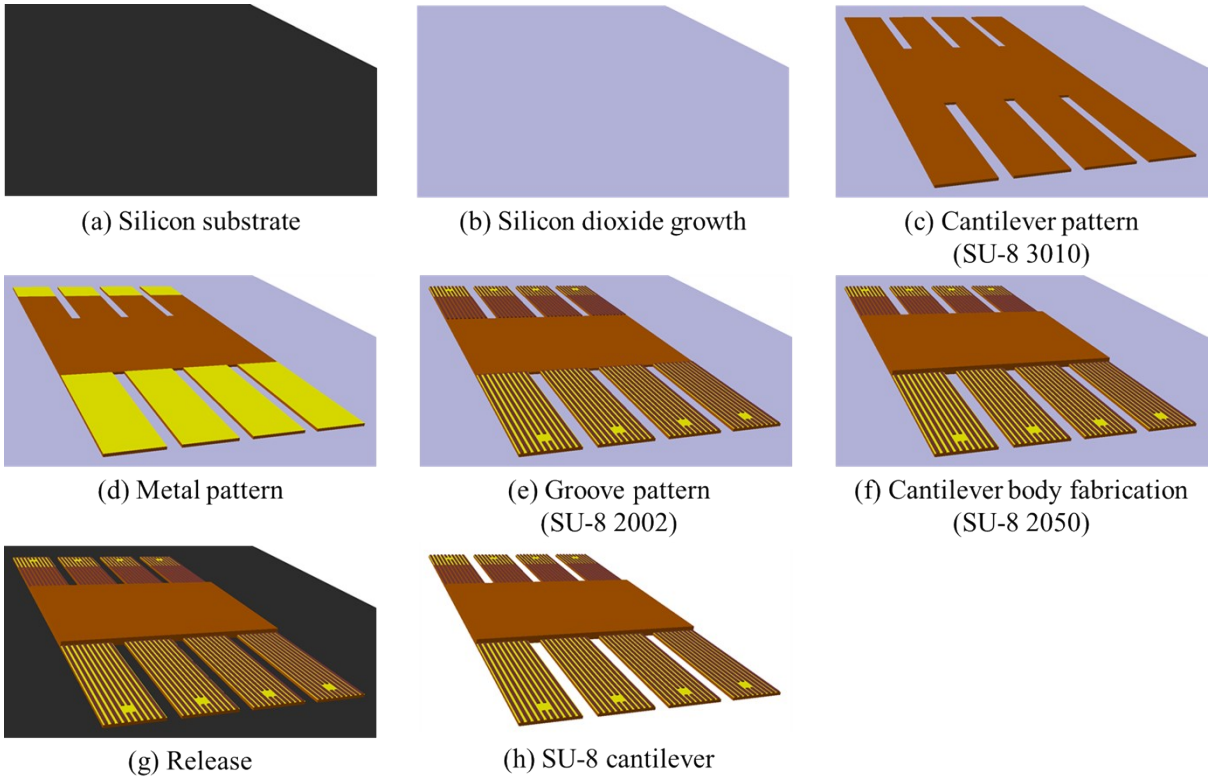

Fig. S3. Fabrication process flow of the SU-8 cantilever; (a)silicon substrate, (b) 300 nm thick SiO_2 sacrificial layer growth on Si wafer, (c) cantilever pattern using SU-8 3010, (d) metal pattern, (e) groove pattern using SU-8 2002, (f) cantilever body fabrication using SU-8 2050, (g) release, and (h) SU-8 cantilever array.

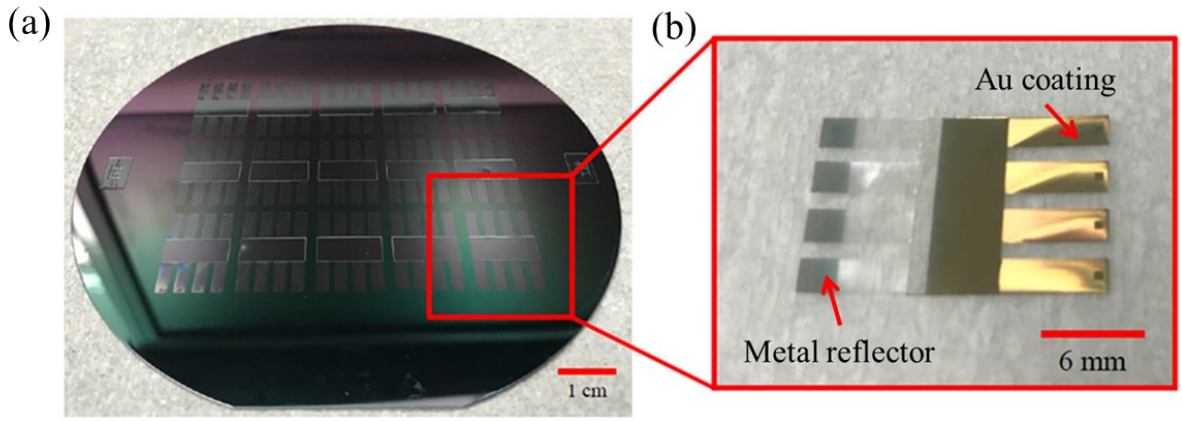

Fig. S4. Optical images of the SU-8 cantilever arrays (a) fabricated using a 4-inch silicon wafer, (b) with and without gold deposition.

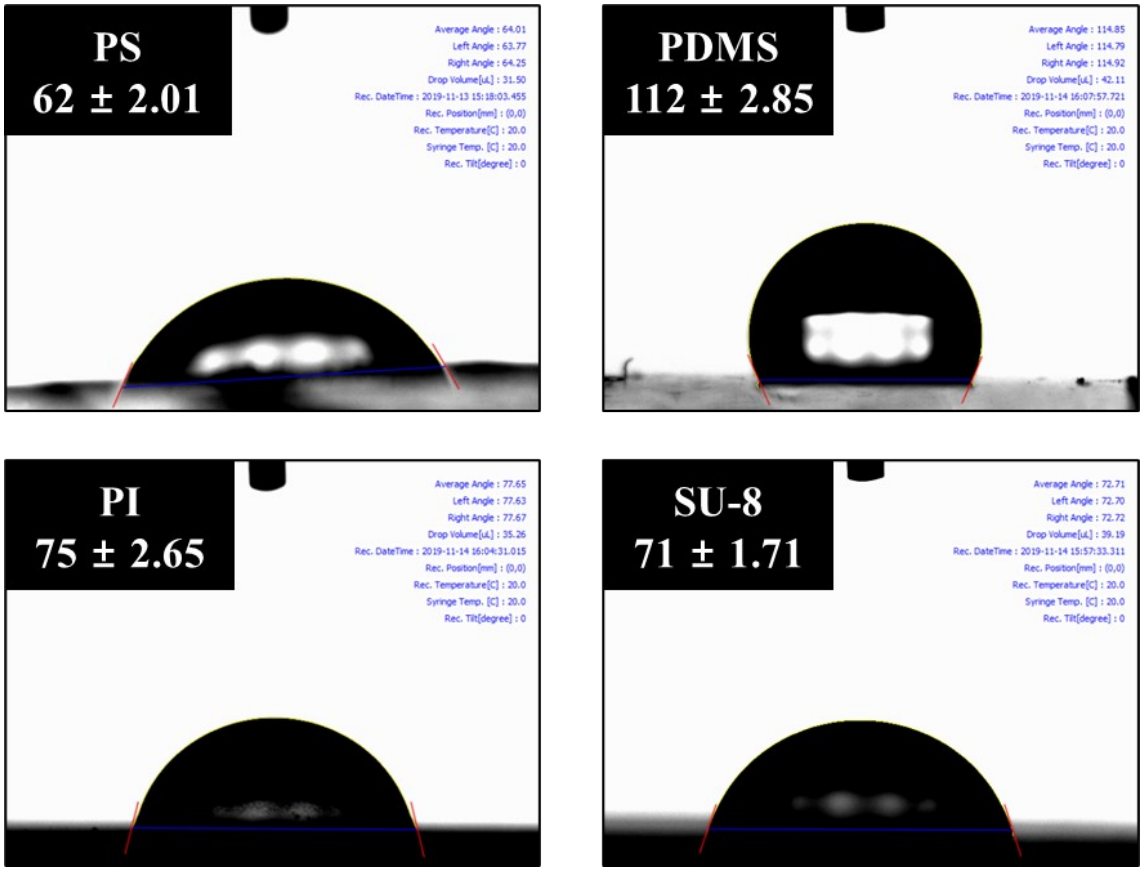

Fig. S5. Water contact angle images according to various substrates such as PS, PDMS, PI and SU-8.

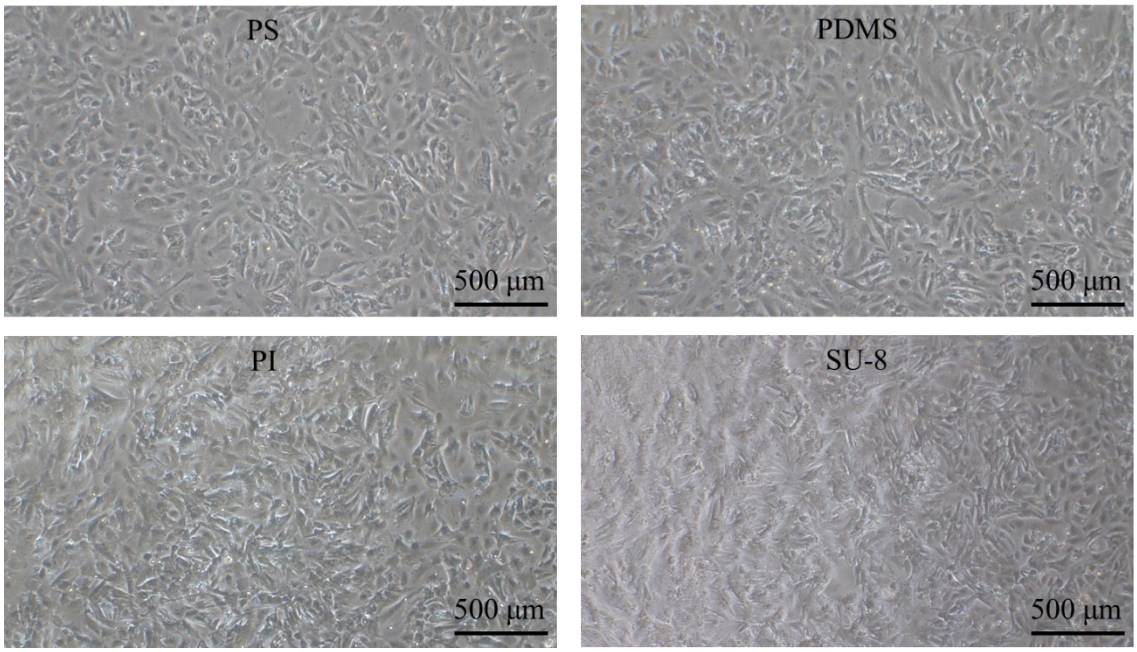

Fig. S6. (a) Optical images of cardiomyocytes cultured for 3 days on PS, PDMS, PI, and SU-8 substrates.

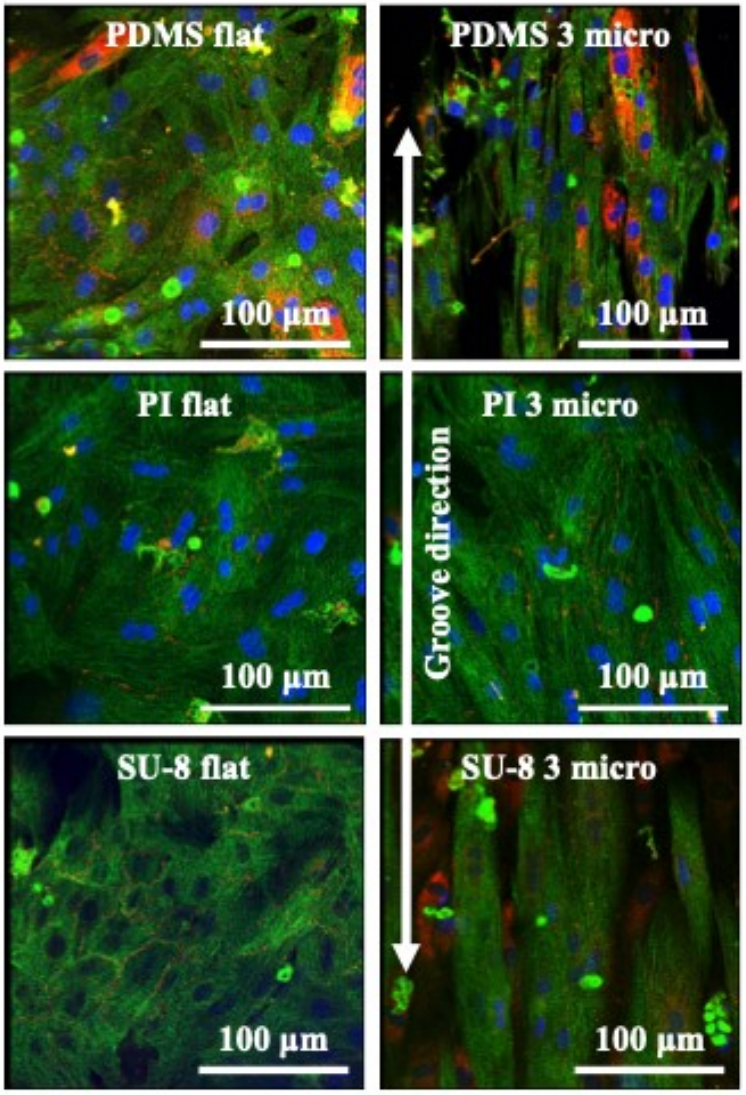

Fig. S7. Staining images of cardiomyocytes cultured on various micro grooved substrates such as PDMS, PI, and SU-8.

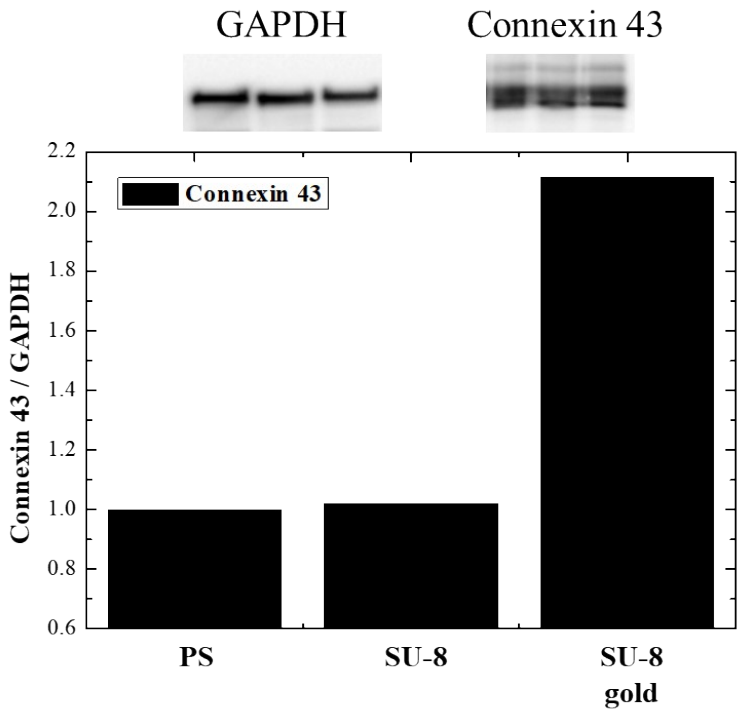

Fig. S8. Cx43 protein expression of cardiomyocytes cultured on PS, bare SU-8, and Au-coated SU-8 substrate.

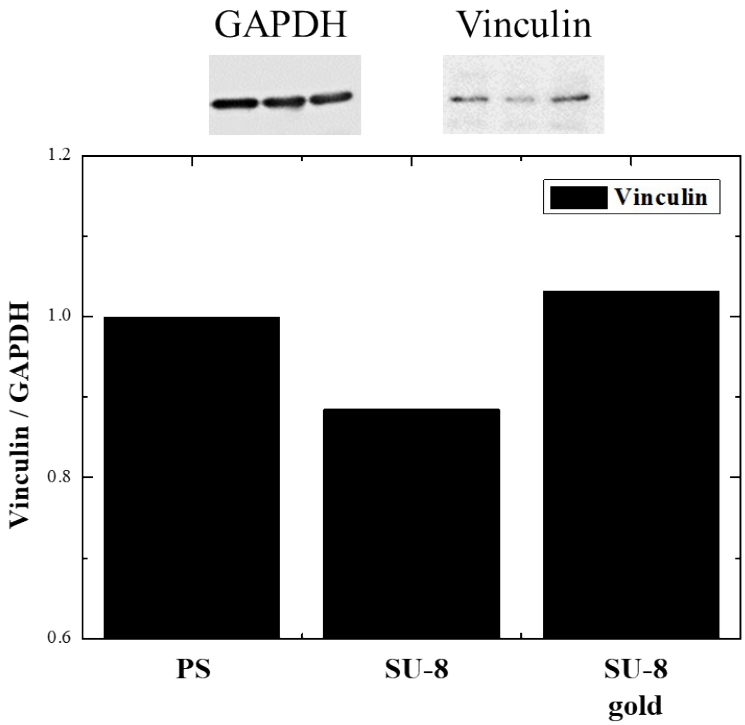

Fig. S9. Vinculin protein expression by cardiomyocytes cultured on PS, bare SU-8, and Au-coated SU-8 substrate.

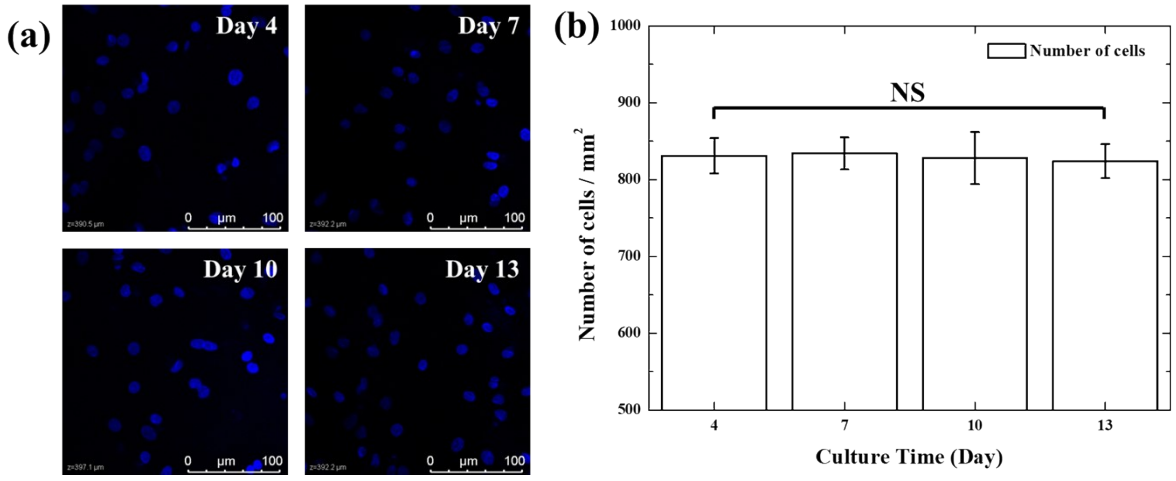

Fig. S10. (a-d) Confocal images of the cultured cardiomyocytes monitored in 250 μm × 250 μm area on SU-8 cantilever from day 3 to 10 after seeding. (e) Bar plot shows the number of active cells on SU-8 cantilever. Error bars are mean ± s.d., (n = 4).

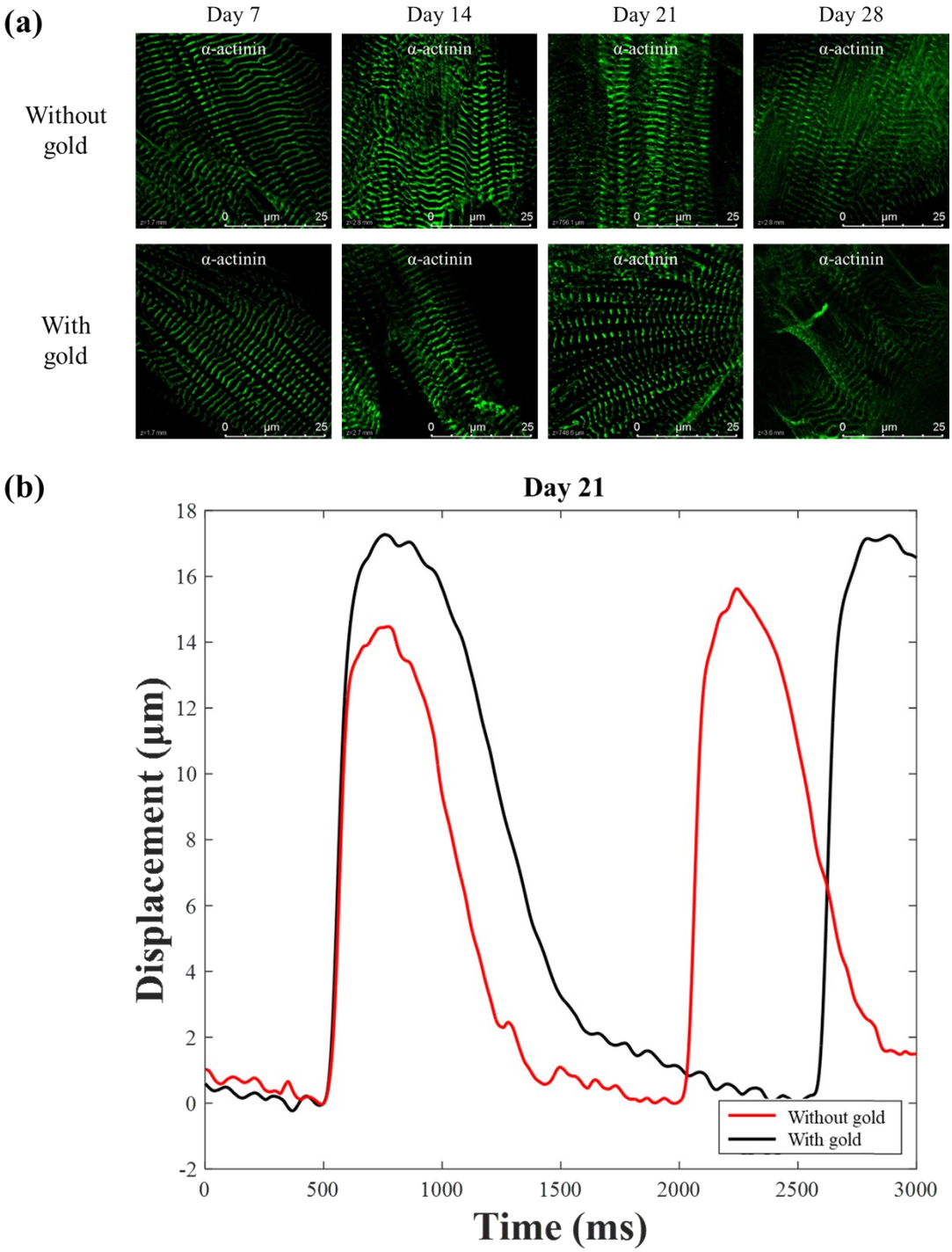

Fig. S11. (a) Staining images of the cardiomyocytes cultured on bare SU-8 cantilever and Au-coated SU-8 cantilever. (b) Cantilever displacement owing to the contraction and relaxation of cardiomyocytes cultured on bare SU-8 cantilever and Au-coated SU-8 cantilever on day 21.

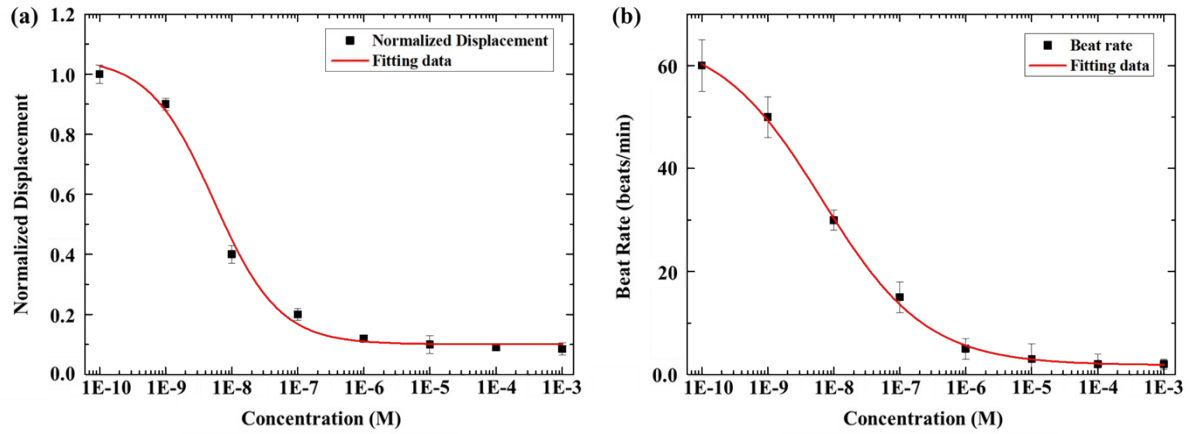

Fig. S12. Verapamil drug-dose response curve. (a) Inotropic and (b) chronotropic effect of cardiomyocytes cultured on bare SU-8 cantilever. The bars and error bars indicate the mean ± s.d., (n = 10).

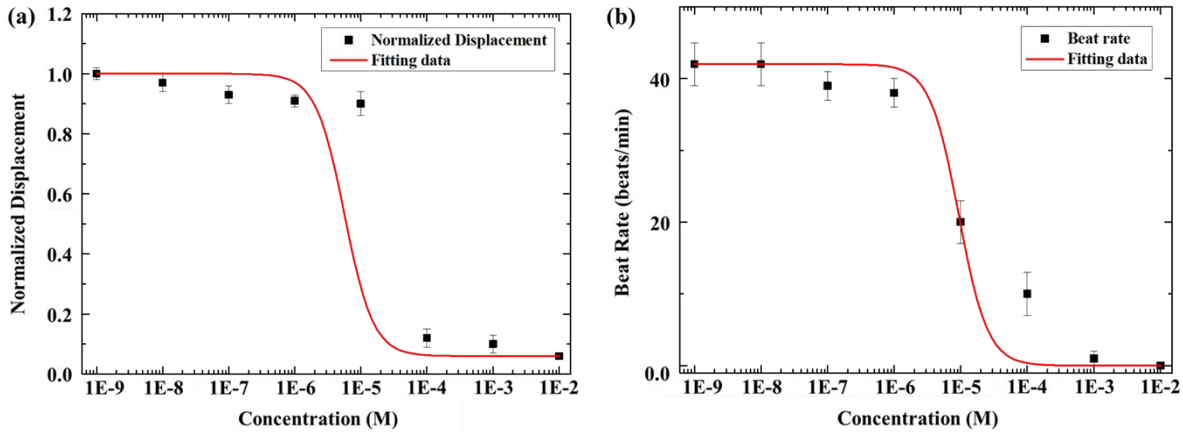

Fig. S13. Quinidine drug-dose response curve. (a) Inotropic and (b) chronotropic effect of cardiomyocytes cultured on bare SU-8 cantilever. The bars and error bars indicate the mean ± s.d., (n = 10).

Table S1. Various parameters that has been used to optimize the cantilever design or achieving maximum displacement.

S. No	Length (μm)	Width (μm)	Thickness (μm)	Ratio	Displacement (μm)	Spring Constant (mN/m)	Factors
1	6000	2000	5	1:3	79	1.15	Roll-off
2	6000	2000	10	1:3	53	9.25	Roll-off
3	6000	2000	15	1:3	44	31.25	Optimized
4	6000	2000	20	1:3	35	74.07	High spring constant
5	6000	500	15	1:12	82	7.81	Self-bending
6	6000	1000	15	1:6	61	15.62	Self-bending
7	6000	2000	15	1:3	44	31.25	Optimized
8	6000	4000	15	1:1.5	31	62.50	High spring constant
9	2000	2000	15	1:1	37	843.75	High spring constant
10	4000	2000	15	1:2	40	105.46	High spring constant
11	6000	2000	15	1:3	44	31.25	Optimized
12	8000	2000	15	1:4	51	13.18	High cell consumption

Table S2. Contraction properties of cardiomyocytes on day 21 (maximum displacement date).

Parameters	Without Au	With Au
Displacement (μm)	14.2	17.6
Rise time (ms)	270 ± 13	272 ± 12
Decay time (ms)	1234 ± 18	1797 ± 17
Duration (ms)	1504 ± 20	2069 ± 16
Heart rate (Hz)	0.66 ± 0.01	0.48 ± 0.01