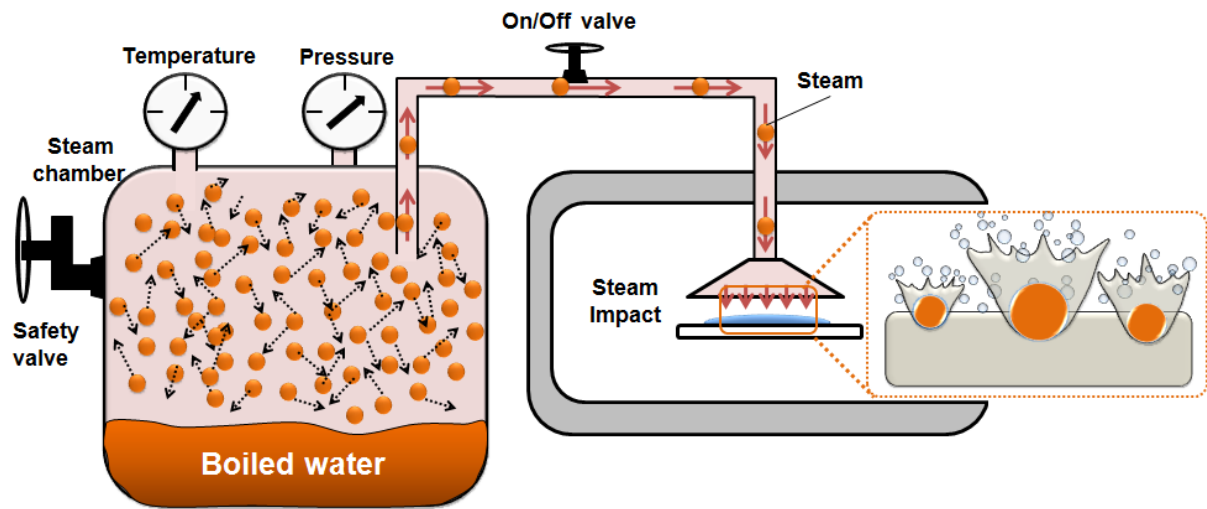
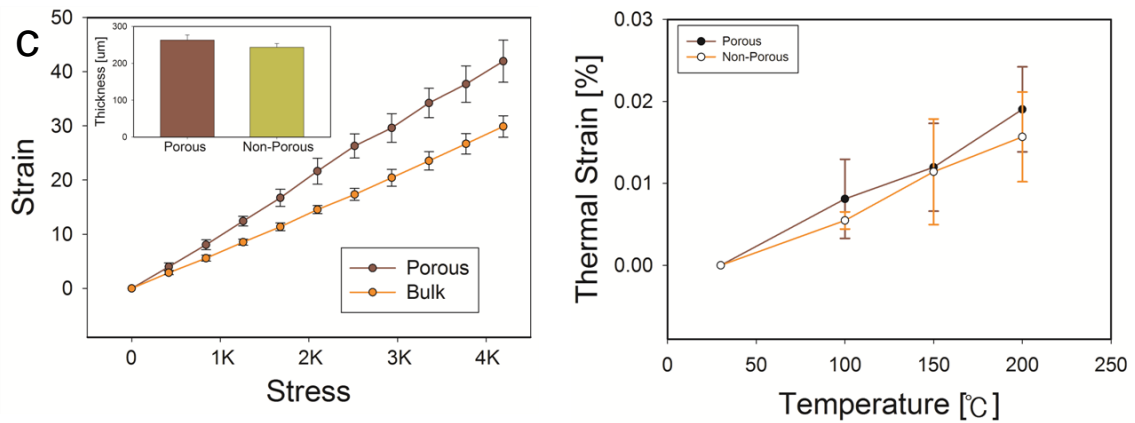
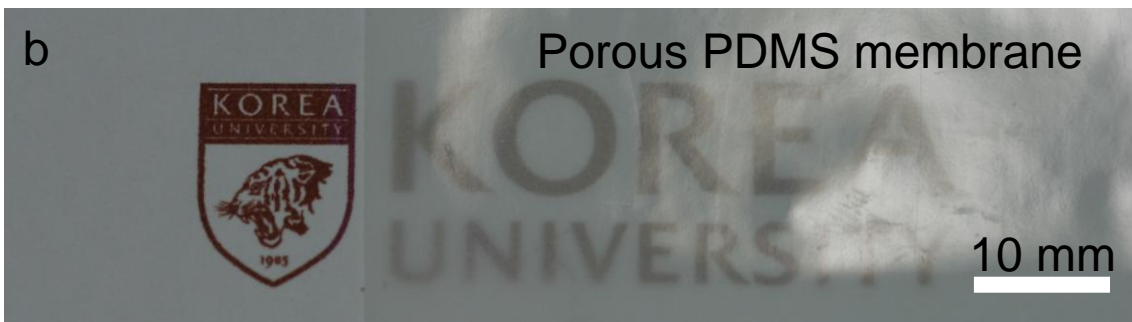
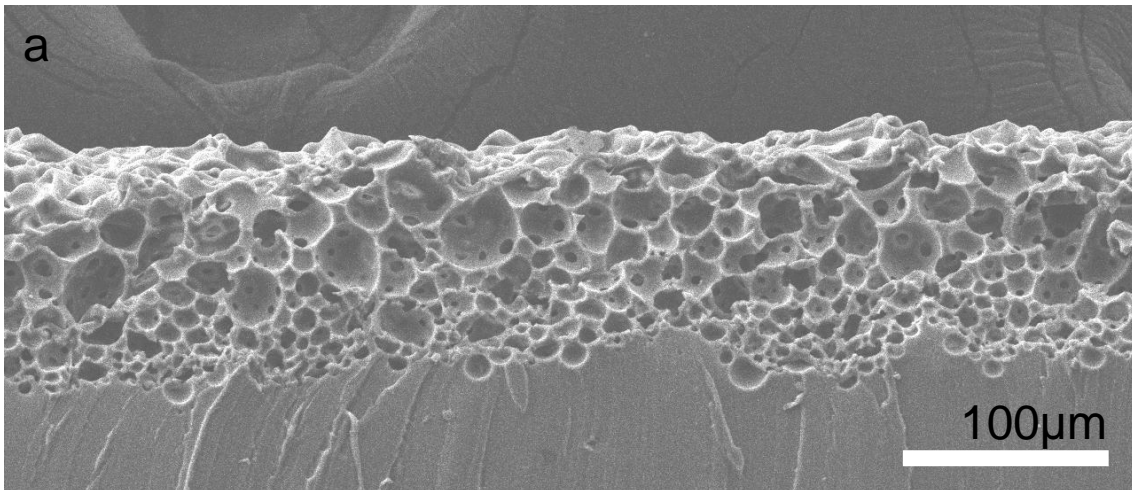


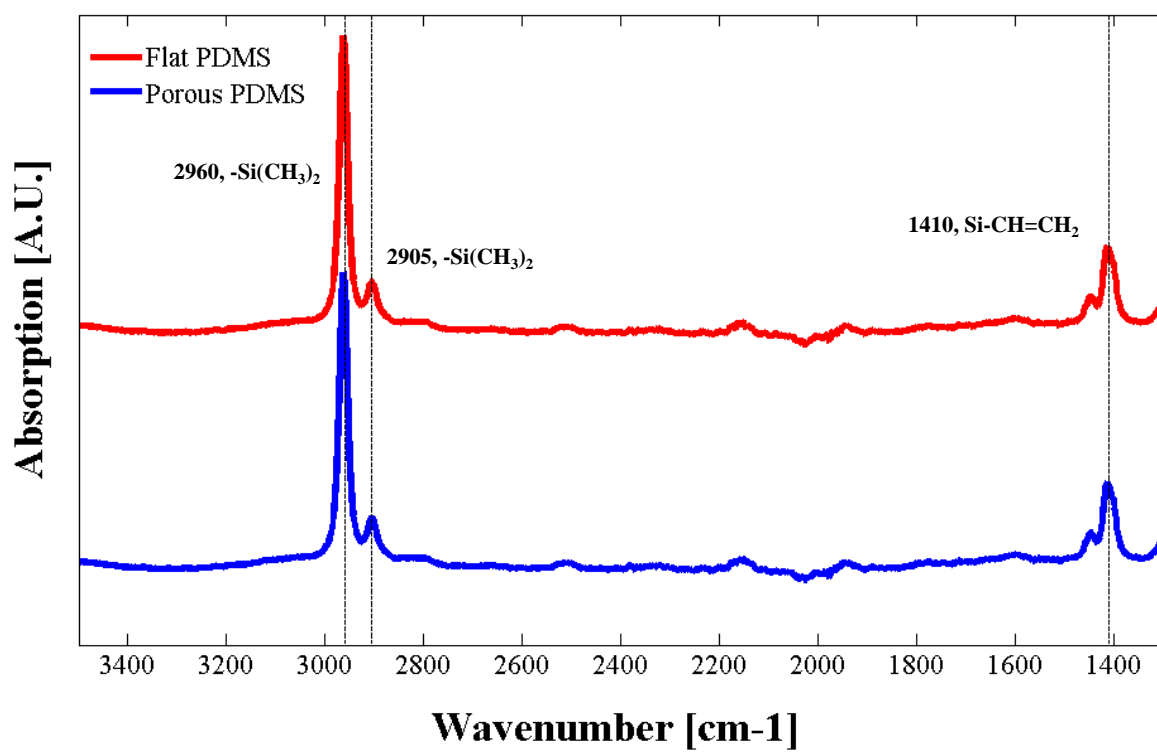
Supplementary Figures



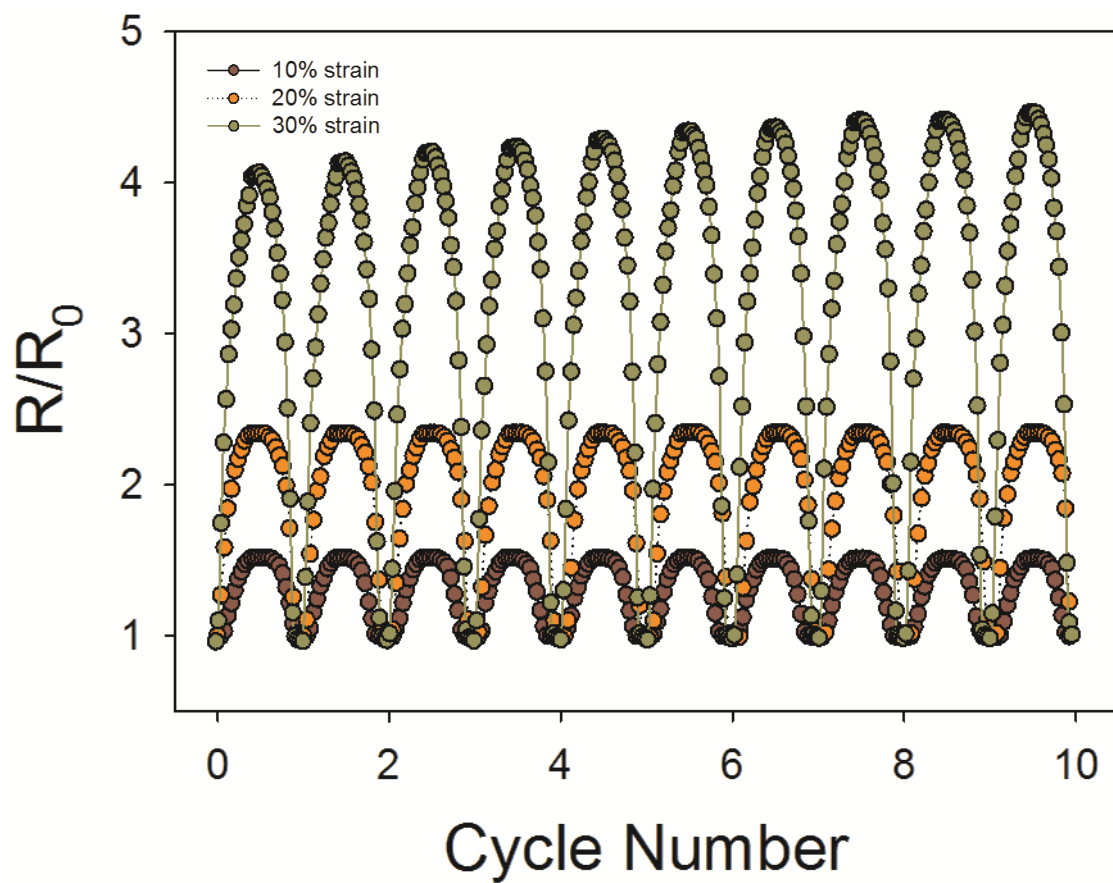
Supplementary Figure S1 **Steam etching process used to create porous structures.** Hot vapor was applied to the PDMS prepolymer surface, and the porous structures polymerized immediately under the hot vapor without the need for an extra thermal curing process.



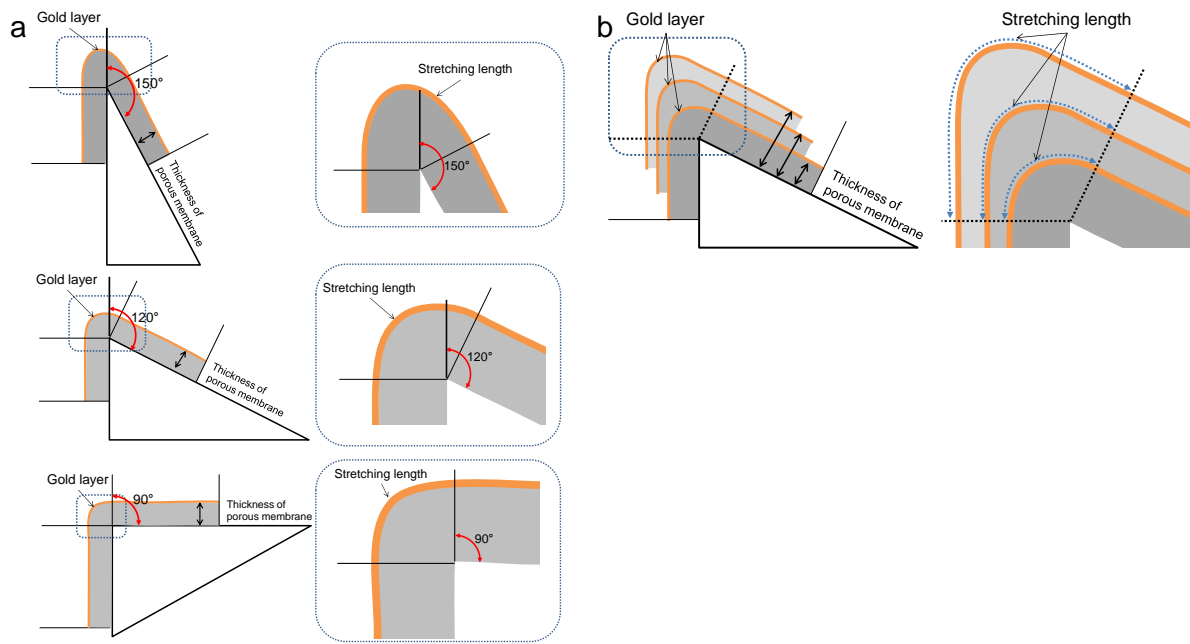
Supplementary Figure S2 **Characteristics of Porous PDMS thin membrane.** (a) Deep porous PDMS surface. The depth could be regulated by the steam pressure and changes in the viscoelastic properties of the prepolymer PDMS. (b) Semi-transparent characteristics of the porous structure. (c) Comparison of mechanical property of the porous and bulk PDMS (elongation and thermal expansion).



Supplementary Figure S3 FTIR spectrum of a normal PDMS sample (cured on a hot plate for 2 hours) and a steam-etched PDMS sample. No significant differences were observed.

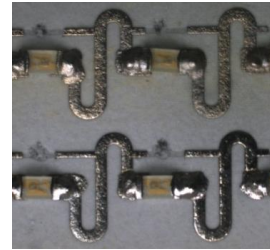
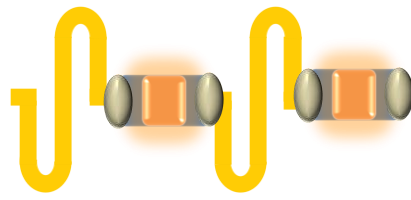


Supplementary Figure S4 **Resistance changes during the cycling tests.** The data supports the hysteresis measurements shown in Fig 2a.

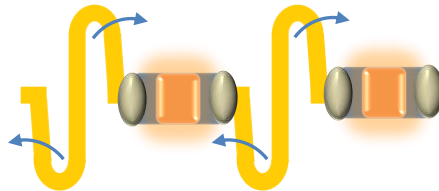


Supplementary Figure S5 **Bending motion of stretchable electrodes.** The higher stretching change based on (a) the angle and (b) thickness.

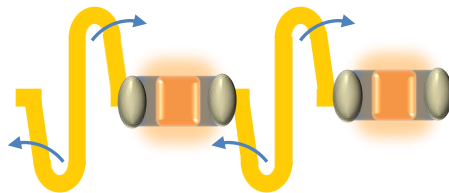
Initial



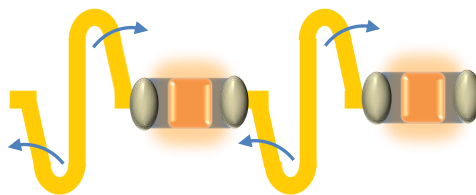
10% stretching



20% stretching



30% stretching



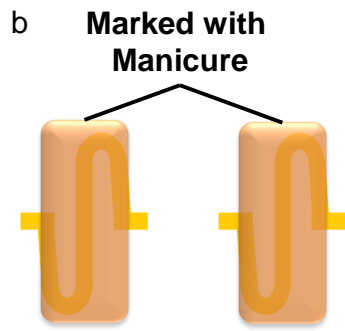
Supplementary Figure S6 **Schematic diagram and photograph of a deformed line pattern under stretching.**

Although the line and soldered regions deformed under stretching, the electronic circuit functioned well.

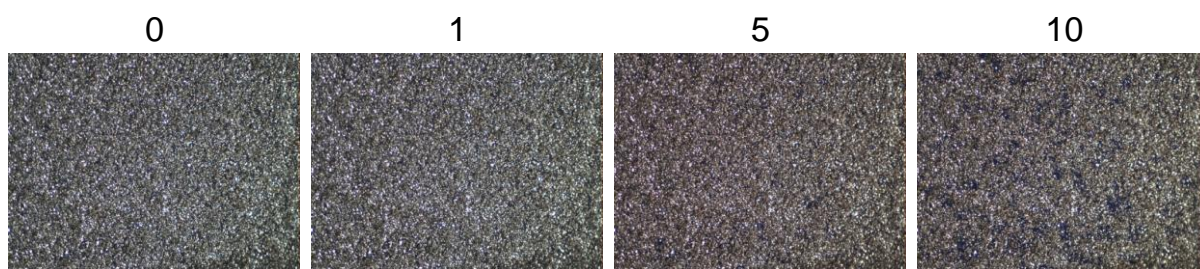
a



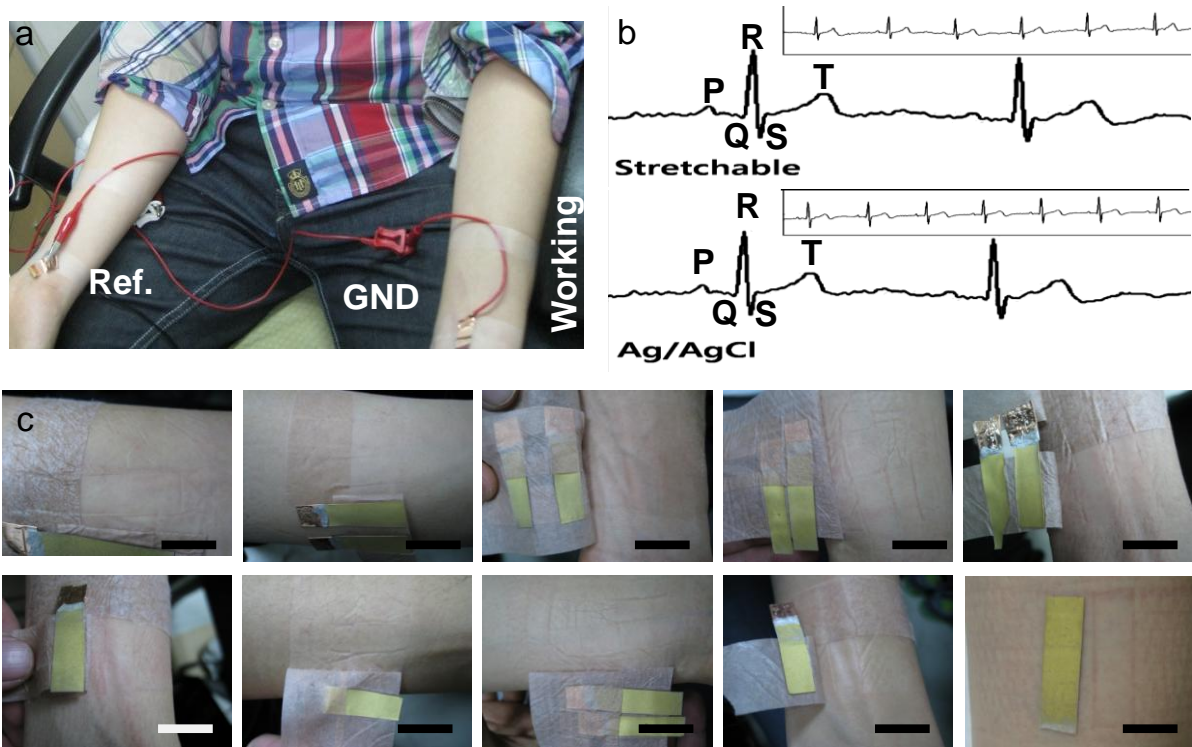
b



Supplementary Figure S7 **Selective electroplating.** (a) A picture of selectively electroplated circuit. (b) For selective electroplating, the meandering lines were partially marked with manicure.

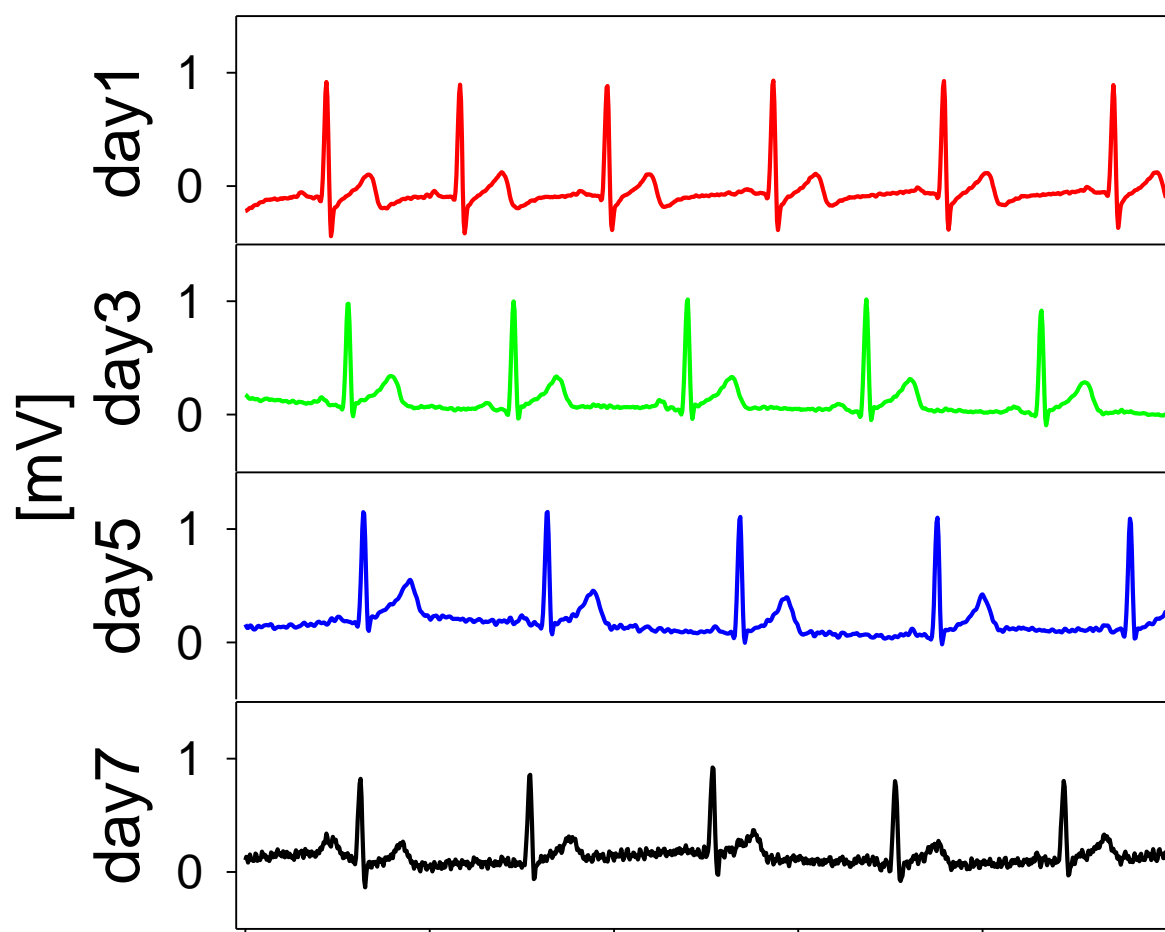


Supplementary Figure S8 **Tape test results from a Pt electroplated electrode.** The pictures were taken at 0, 1, 5, 10 tape test cycles. No significant changes in the sample surface were observed.

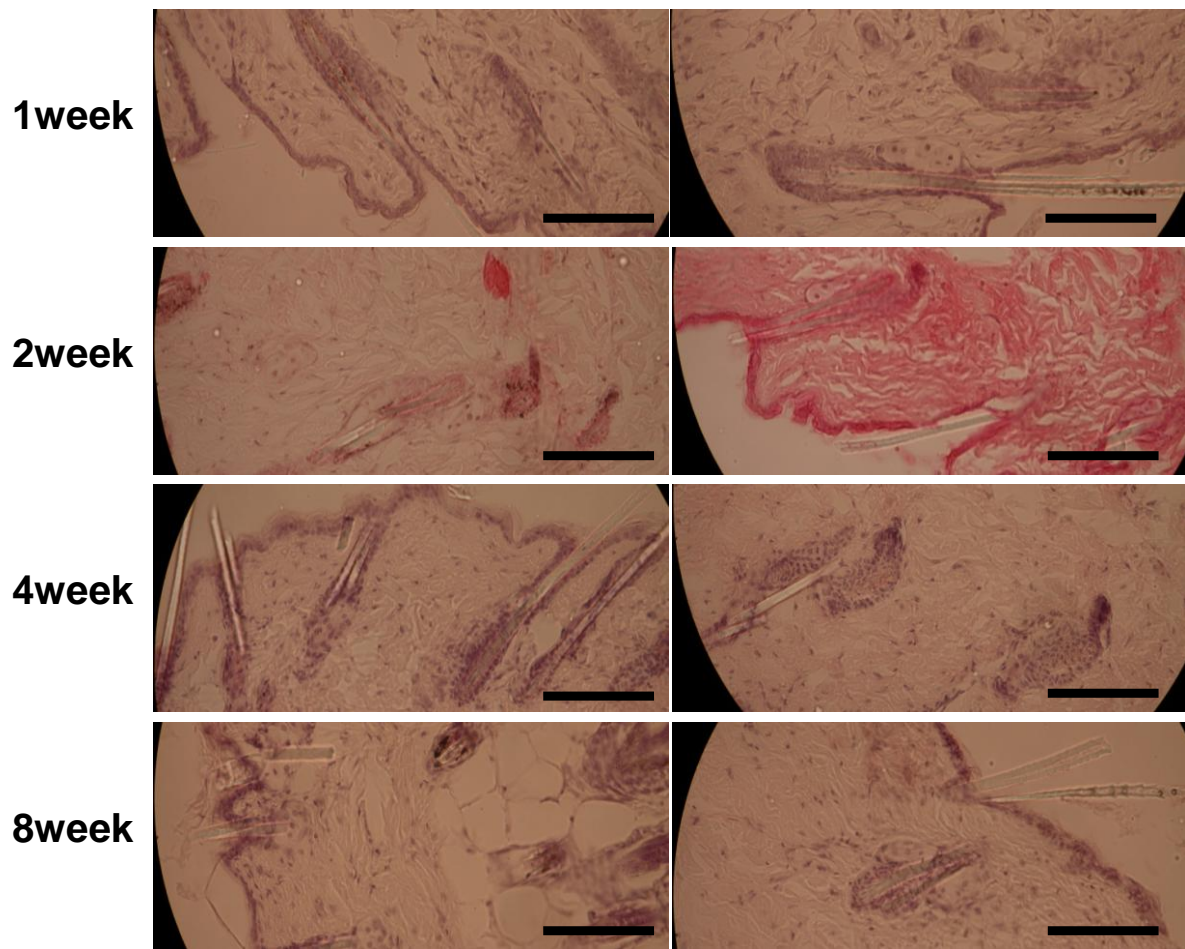


Supplementary Figure S9 **Biosignal monitoring**. (a) ECG recording experiments. The electrodes closely contacted the curvature of the skin. (b) A comparison of the ECG signals (PQRST) with those measured using a commercial Ag/AgCl electrode. The measured signals were similar. (c) After 1 week of continuous wearing, the electrode did not produce skin irritation or other problems for 10 recipients. Scale bar, 2 cm (c).

Porous (long term)



Supplementary Figure S10 ECG signals measured at days 1, 3, 5, and 7. No changes were observed during the first 5 days; however, at day 7, the baseline noise increased slightly and the amplitude of the R wave decreased by approximately 30%.



Supplementary Figure S11 **H&E stained tissue after long-term implantation of the porous PDMS in a mouse for 1, 2, 4 and 8 weeks.** Scale bar, 100 μ m.

Supplementary Tables

Supplementary Table S1. Elongation and thermal expansion

Test	Curing condition		Thickness (μm)	No. of Samples
Elongation	70°C for 6h	Porous	262.8 \pm 13.89	25
		Bulk	248.3 \pm 4.39	10
Thermal expansion	70°C for 6h	Porous	255.1 \pm 4.91	10

Supplementary Table S2. Resistance

Resistance	No. of Samples	Unit	Value
Line	N=20	R_0 (Ω/cm)	3.24 \pm 0.56
Sheet	N=20	R_0 (Ω/\square)	1.87 \pm 0.0.21

Supplementary Table S3. 8 LED array cycling reliability test

Strain (%)	Strain rate (%/s)	No. of cycles
5	5%/s	2,000 ~ 40,000
10	5%/s	~ 1,000
20	5%/s	~ 300
30	5%/s	~ 100

Supplementary Table S4. ECG test

	SEX	Age	Period	Skin reaction
Volunteer #1	F	22	7 days	X
Volunteer #2	F	21	7 days	X
Volunteer #3	M	26	7 days	X
Volunteer #4	M	23	7 days	X
Volunteer #5	M	22	7 days	X

Volunteer #6	M	28	7 days	X
Volunteer #7	M	25	7 days	X
Volunteer #8	M	21	7 days	X
Volunteer #9	M	20	7 days	X
Volunteer #10	M	25	7 days	X
Mean		23.3 ± 2.45		

Supplementary Table S5. Strain test

Strain test	Strain rate	Figure
10 %	5%/s	Fig. 2 a & b
20%	5%/s	Fig. 2 a & b
30%	5%/s	Fig. 2 a & b
80%	Manually	Fig.2 c

Supplementary Table S6. Bending test

Test	Thickness (μm)	No. of Samples
Bending test	236.5±4.8	8
	349.8±15.31	8
	412.18±14.72	8

Supplementary Table S7. Elongation and thermal expansion

Test	Curing condition		Thickness (μm)	No. of Samples
Elongation	70°C for 6h	Porous	262.8±13.89	25
		Bulk	248.3±4.39	10
Thermal expansion	70°C for 6h	Porous	255.1±4.91	10

Supplementary Table S8. Resistance comparison

Ref.	Material	R_0
R. Carta ³¹	Cu foil meandering	0.94~2.23 (Ω/cm)
F. Axisa ¹⁶	Cu foil meandering	0.8~1.3 (Ω/cm)
S. Rosset ³⁶	Au(sputtering),	17 (Ω/\square)
	Au (implant)	34~398 (Ω/\square)
L. Hu ³⁷	SWNT	≤ 1.0 (Ω/\square)
S. Lacour ³⁸	Au (wavy line)	35~320 (Ω/cm)
M. Urdaneta ²⁵	Pt salt mixture	2.2(Ω/\square)
Our study	Ti-Au (evaporation)	3.24 \pm 0.56 (Ω/cm)
		1.87 \pm 0.21 (Ω/\square)