

Localised light delivery on melanoma cells using optical microneedles: supplement

XIAOBIN WU,^{1,2}  JONGHO PARK,¹ SIU YU A. CHOW,^{1,3} MARIA CARMELITA Z. KASUYA,¹ YOSHIHO IKEUCHI,¹  AND BEOMJOON KIM^{1,*}

¹*Institute of Industrial Science, The University of Tokyo, Tokyo, Japan*

²*Department of Precision Engineering, School of Engineering, The University of Tokyo, Japan*

³*Department of Chemistry and Biotechnology, School of Engineering, The University of Tokyo, Japan*

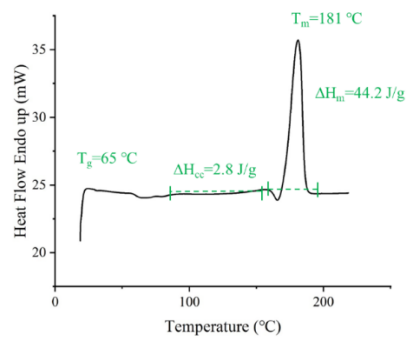
*bjoonkim@iis.u-tokyo.ac.jp

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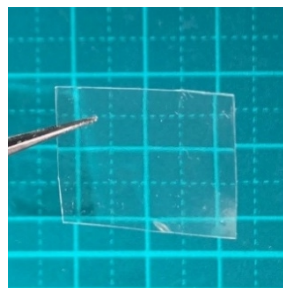
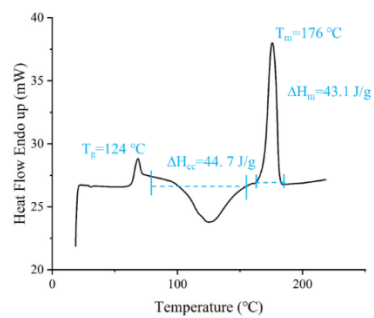
Supplement DOI: <https://doi.org/10.6084/m9.figshare.18858182>

Parent Article DOI: <https://doi.org/10.1364/BOE.450456>

Supplementary information



(a)



(b)

Fig. S1. (a) DSC analyses of PLA pellet before fabrication. (b) The crystallinity degree of PLA plate we fabricated is almost 0%. The PLA pellet samples are considered amorphous.

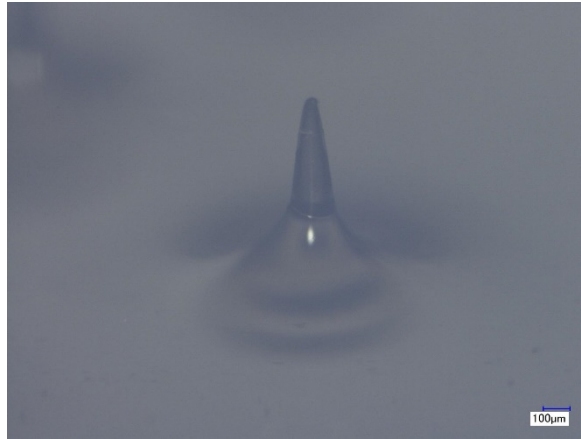


Fig. S2. The microneedles after penetrating the porcine skin.

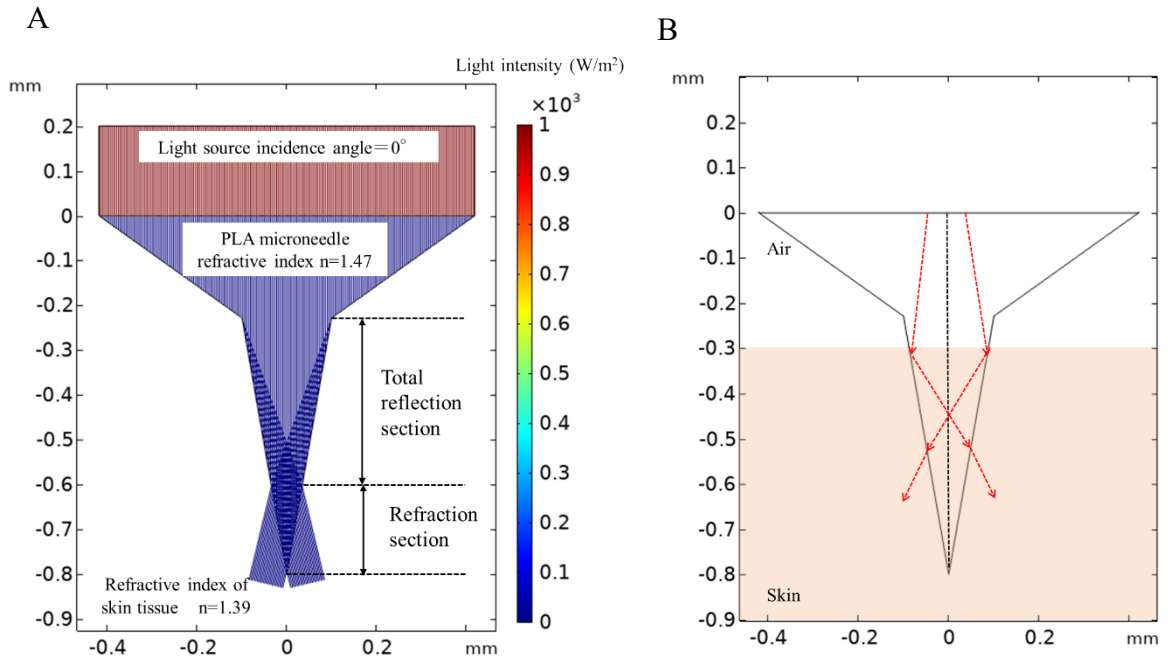


Fig. S3. (A) The simulation of ray tracing by COMSOL. (B) The schematic of light transmitted from the MNs to the skin.

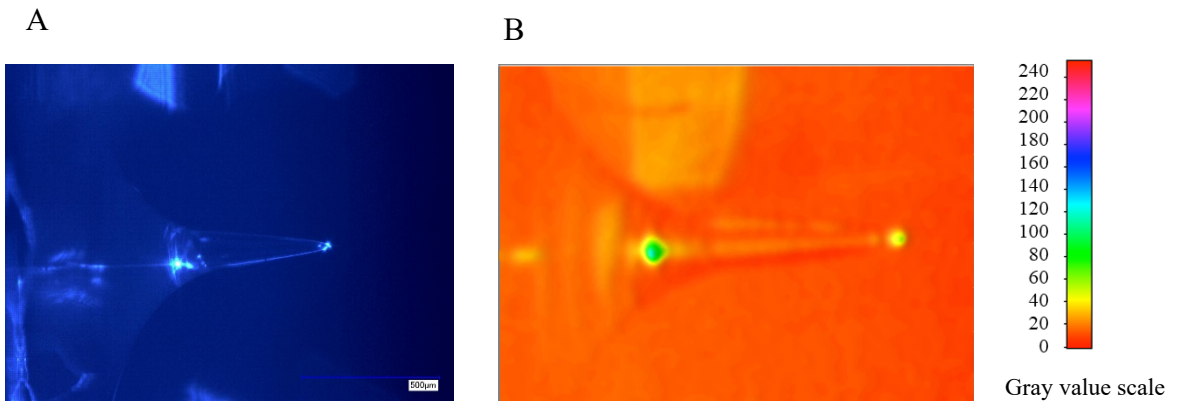


Fig. S4. (A) Blue light concentrated at the tip of the needle is shot out (in the air) (B) The grayscale was analyzed using Image J software and is brighter when the light is concentrated at the tip of the needle.

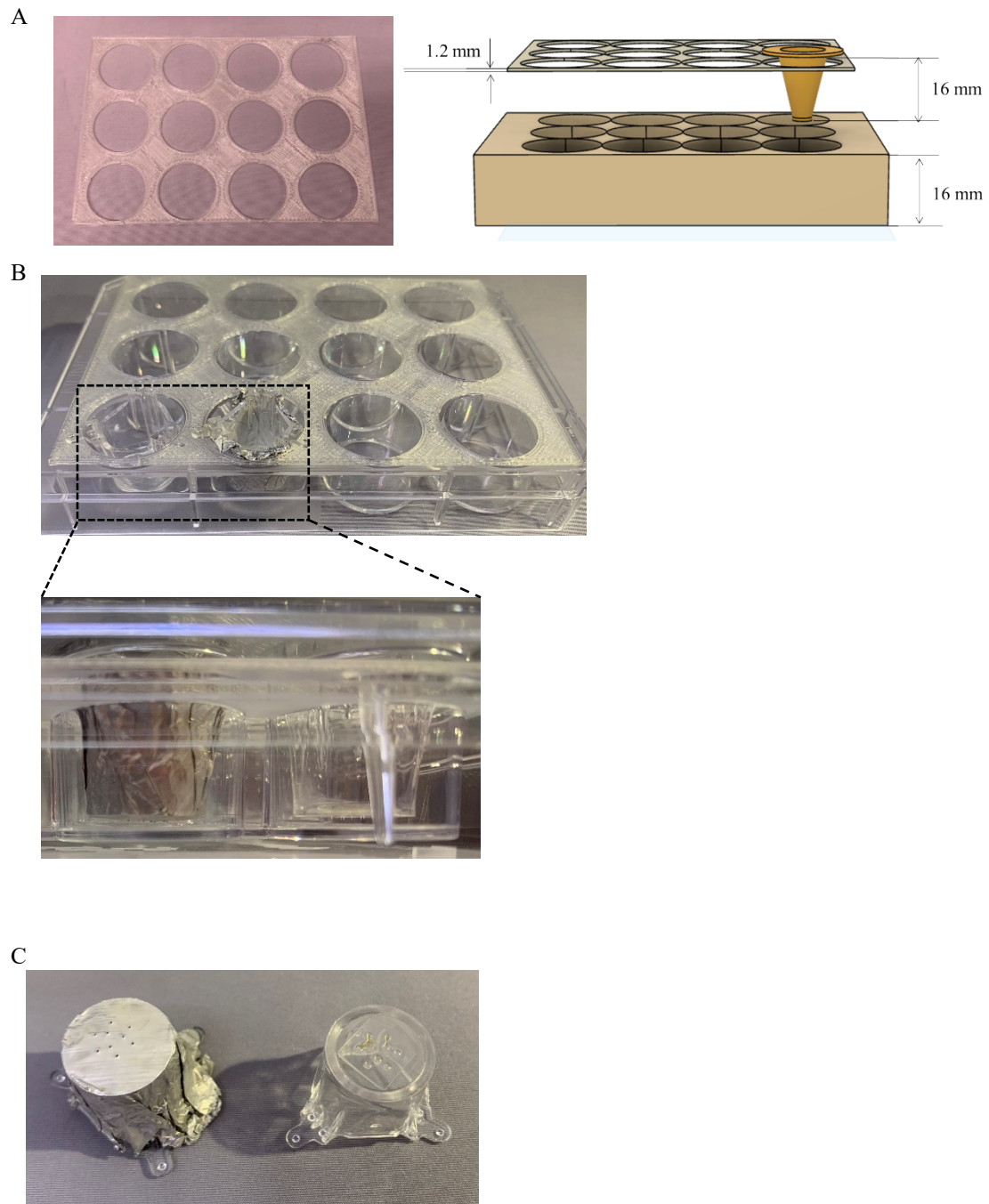
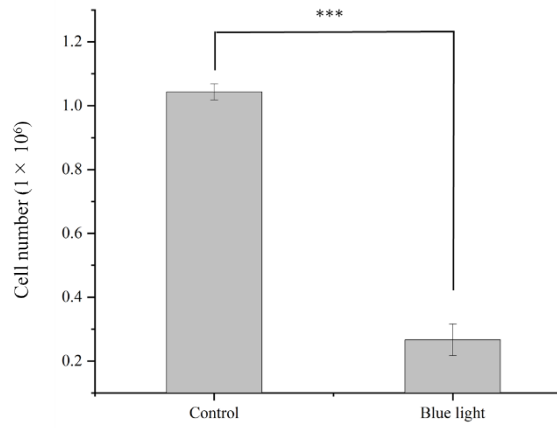


Fig. S5. LED setup of the *in vitro* cell irradiation system. (a) Schematic of 3D printer supporter for MNs insert. A 1.2 mm thickness of 3D printed board was put on the cell culture to provide a distance from MNs tip to cells. (b) Schematic diagram of PLA microneedles fixed on cell culture insert. (c) Left: microneedles punctured the membrane of the cell culture insert and be fixed on it.

A



B

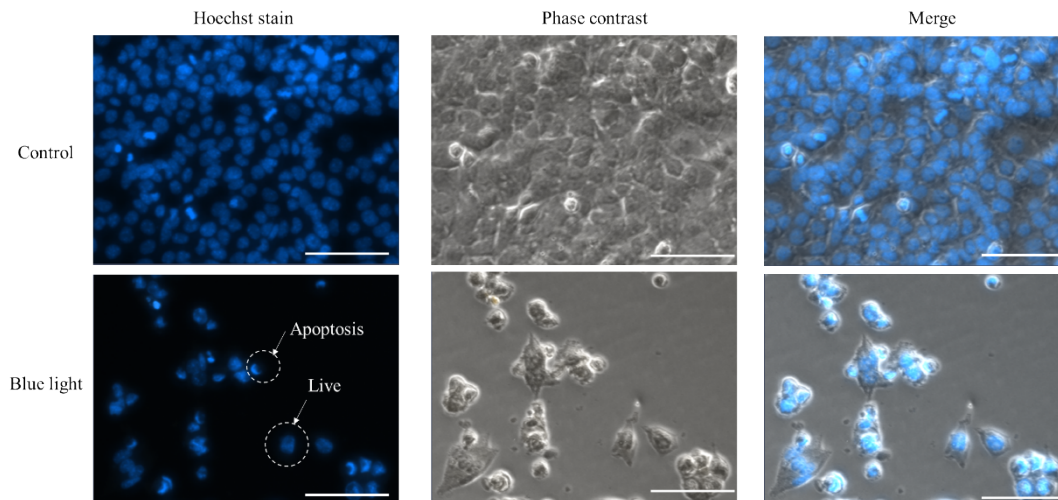


Fig. S6. (A) Cell growth for the control group and blue light irradiation group. The growth rate of B16F10 melanoma cells irradiated by 2 hours per day was significantly decreased, as compared with the growth rate of the control group cultured in a normal environment. Data are presented as the mean \pm standard deviation ($n=3$), Statistical significance was determined at $p<0.001$ (***) by Student's test. (B) Cellular apoptosis was observed with Hoechst staining. B16F10 melanoma cells were treated with blue light and the control group. White arrows indicate living cells and apoptotic bodies. Scale bar: 50 μ m.

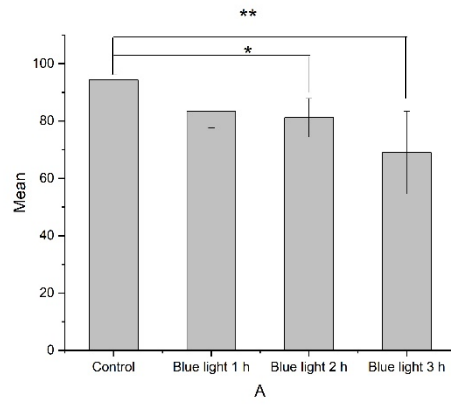


Fig. S7. The Blue light irradiation on B16F10 cells for 1 hours, 2 hours and 3 hours.

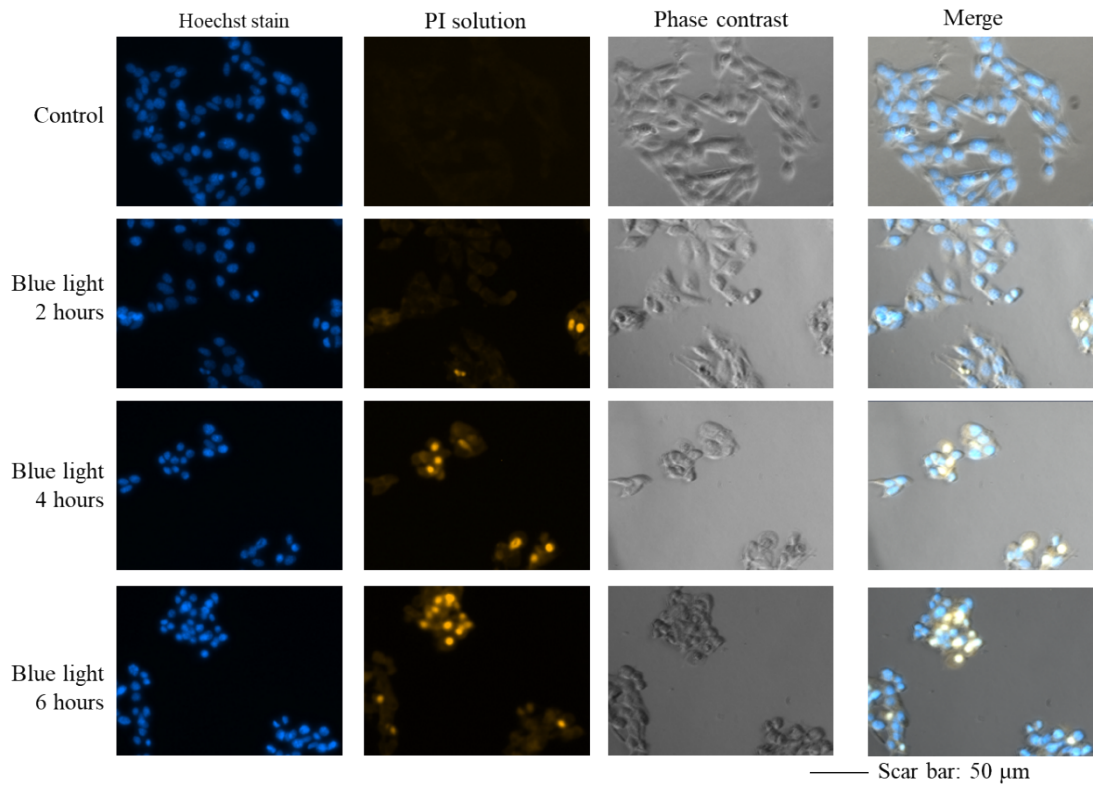


Fig. S8. Effect of exposure to blue LED by various exposure time. Fluorescent images of cells stained by Hoechst and PI solution.

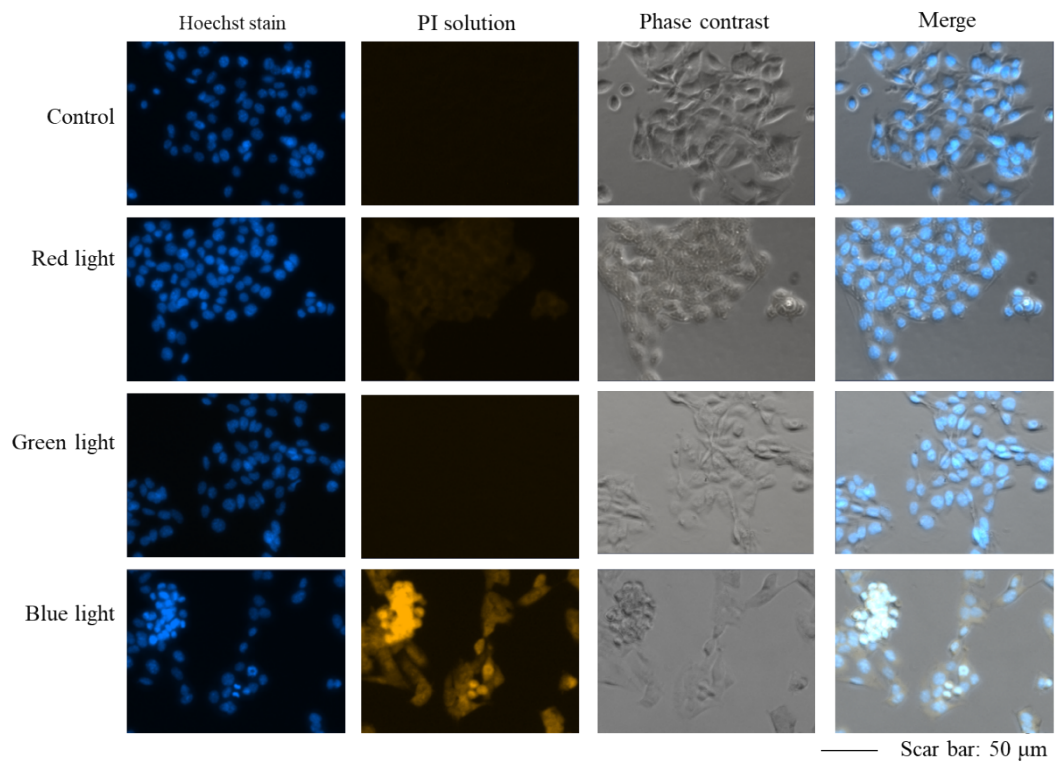


Fig. S9. Effect of exposure to LED by various wavelength. Fluorescent images of cells stained by Hoechst and PI solution.

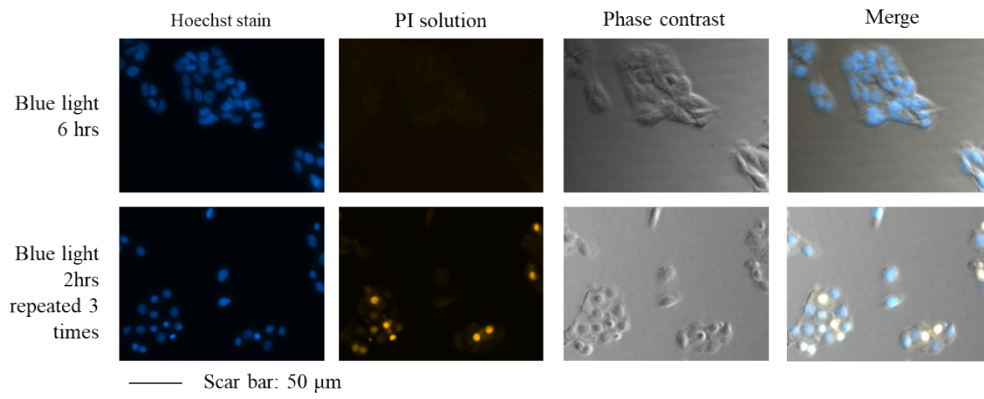


Fig. S10. Effect of exposure to blue LED after repeated 2 hours per day for 3 times and 6 hour on time. Fluorescent images of cells stained by Hoechst and PI solution.

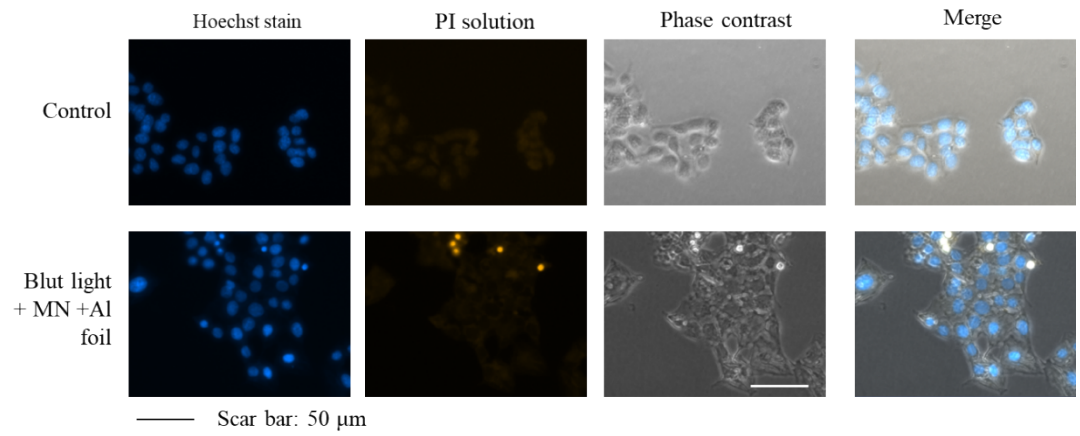


Fig. S11. Effect of exposure to blue LED by optical MNs. Fluorescent images of cells stained by Hoechst and PI solution.

Table S1 Parameters of LED arrays

Mode	Wavelength (nm)	Irradiance (mW/cm ²)	Time (h)	Light dose (J/cm ²)
Blue light	467	6.8 ±0.5	2	49.0
			4	97.9
			6	146.9
Green light	518	5.2 ±0.2	6	112.0
Red light	630	5.0 ±0.3	6	103.7

Dose (J/cm²) = Irradiance (mW/cm²) × Time of irradiation (s) /1000.