

Automated cell isolation from photodegradable hydrogel based on fluorescence image analysis

Shinji Sugiura¹, Shinya Yamahira¹, Masato Tamura¹, Kazumi Shin¹, Mayu Shibuta², Taku Satoh¹, Yui Matsuzawa³, Gen Fujii³, Fumiki Yanagawa¹, Michihiro Mutoh³, Masumi Yanagisawa⁴, Ryuji Kato², and Hirofumi Matsui⁵

¹Sangyo Gijutsu Sogo Kenkyujo Tsukuba Higashi

²Nagoya Daigaku Fuzoku Toshokan

³Kokuritsu Gan Kenkyu Center Gan Yobo Kenshin Kenkyu Center

⁴Engineering System Co Ltd 5652-83 Sasaga Matsumoto Nagano 399-0033 Japan

⁵Tsukuba Daigaku Igaku Iryokei

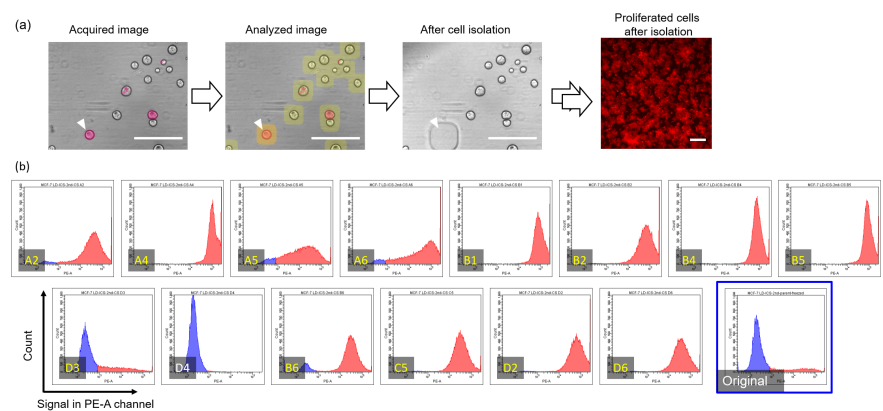
April 27, 2022

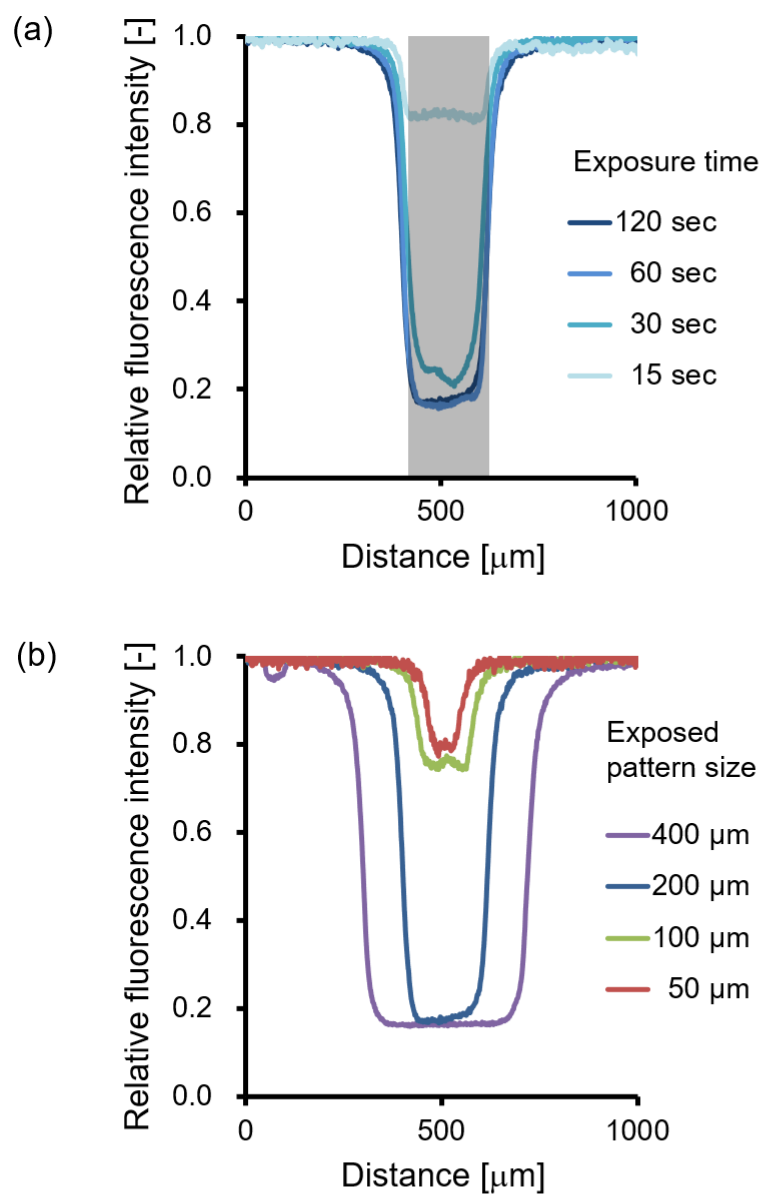
Abstract

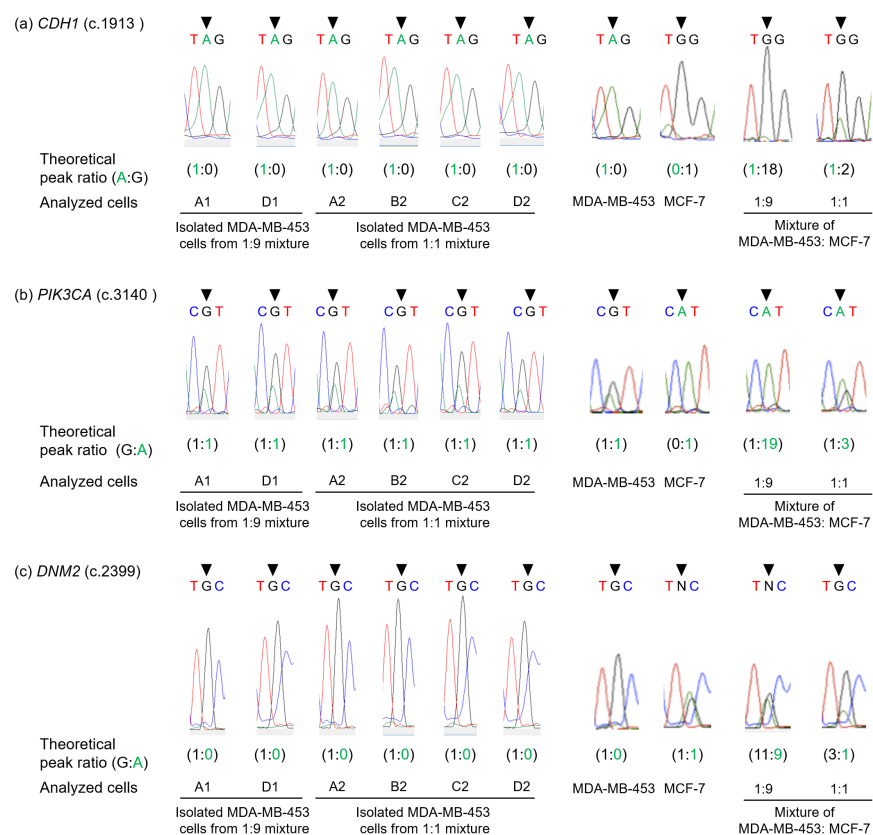
We report an automated cell-isolation system based on fluorescence image analysis of cell aggregates cultured in a photodegradable hydrogel. The system incorporates cell culture in a humidified atmosphere with controlled CO₂ concentration and temperature, image acquisition and analysis, micropatterned light exposure, and cell collection by pipetting. Cell aggregates were cultured on hydrogels, and target cells were selected by phase contrast and fluorescence image analysis. After degradation of the hydrogel by exposure to micropatterned ultraviolet light, cell aggregates were transferred to a collection vessel by robotic pipetting. We assessed the system for hydrogel degradation, recovery of target cells, and contamination by off-target cells. We demonstrated two practical applications of our method: (i) in cell aggregates from MCF-7-RFP strains in which 18.8% of cells produced red fluorescent protein (RFP), we successfully obtained 14 proliferative fluorescence-positive cell aggregates from 31 wells, and all of the isolated strains produced a higher proportion of RFP than the original populations; (ii) after fluorescent immunostaining of human epidermal growth factor receptor 2 (HER2) in cancer cells, we successfully isolated HER2-positive cells from a mixed population of HER2-positive and -negative cells, and gene sequence analysis confirmed that the isolated cells mainly contained the target cells.

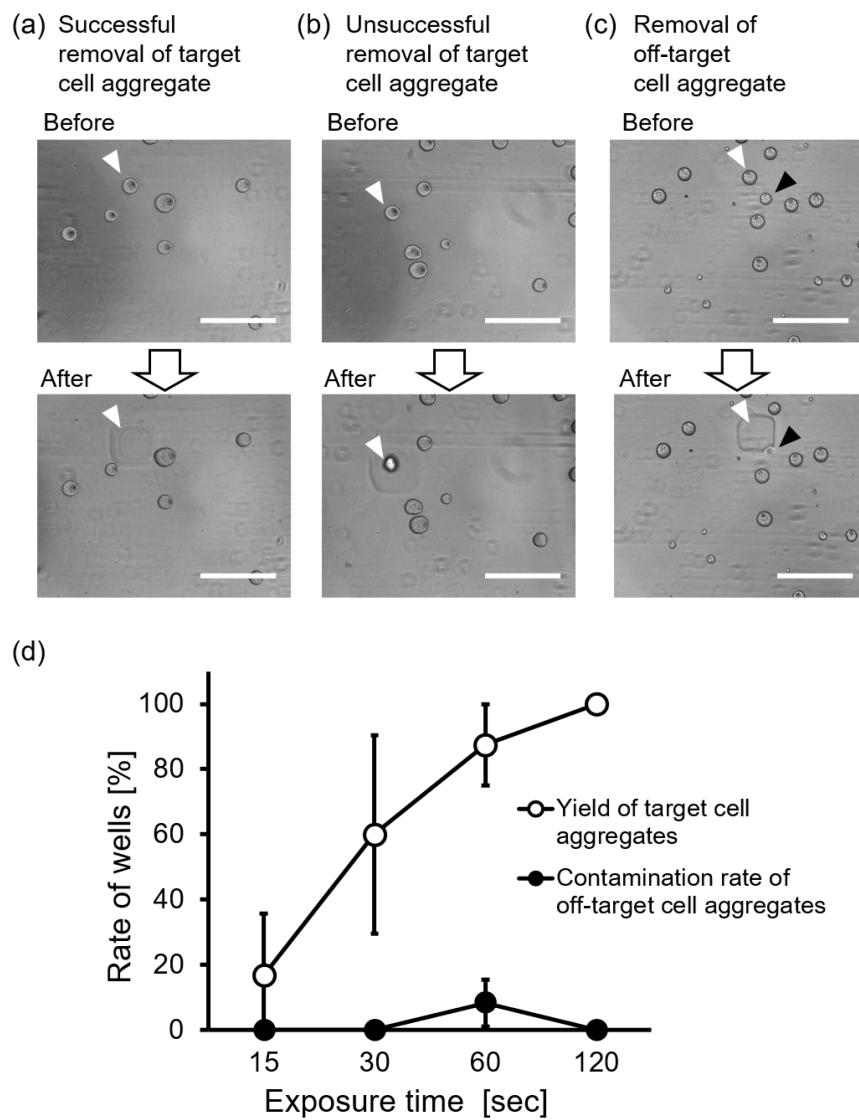
Hosted file

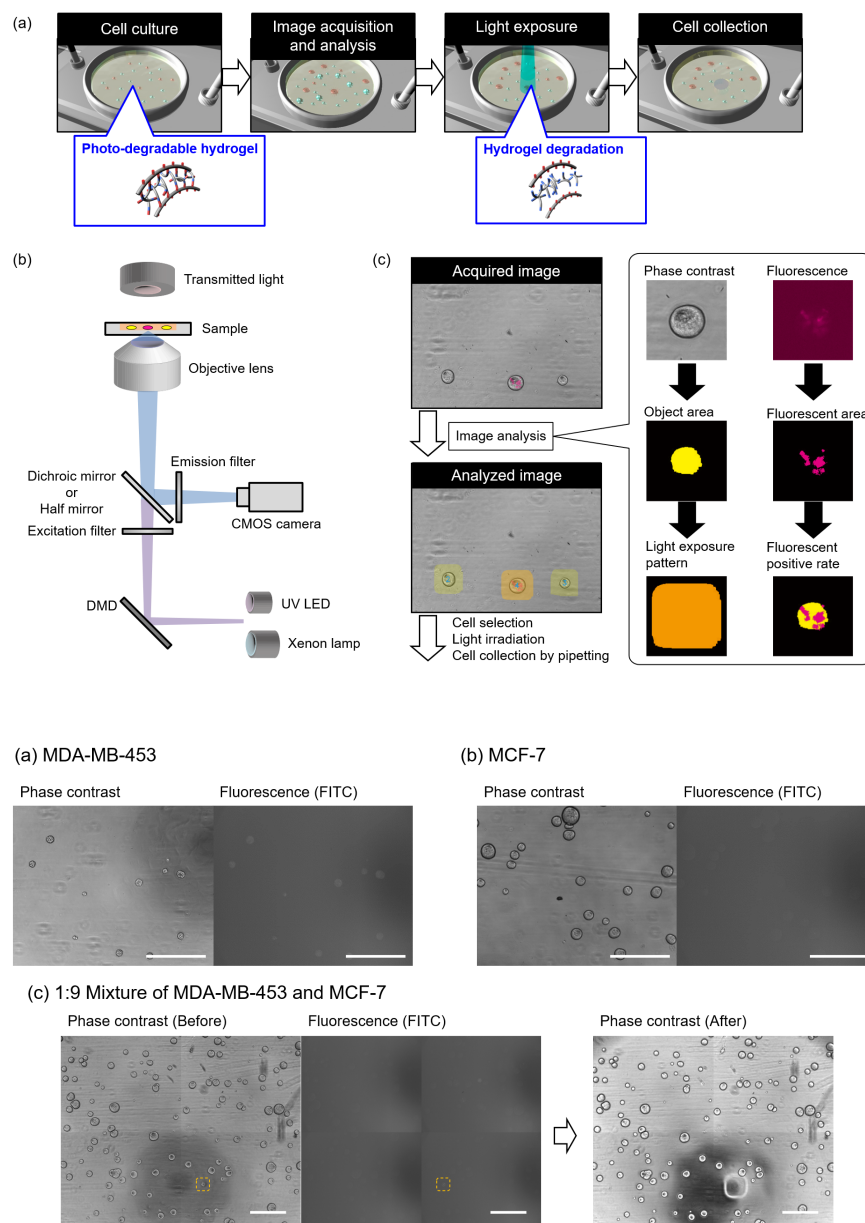
220425_MainText.docx available at <https://authorea.com/users/479039/articles/567012-automated-cell-isolation-from-photodegradable-hydrogel-based-on-fluorescence-image-analysis>











Hosted file

220425_MainTextwithFig.pdf available at <https://authorea.com/users/479039/articles/567012-automated-cell-isolation-from-photodegradable-hydrogel-based-on-fluorescence-image-analysis>