Generation of oxygen gradients in microfluidic devices for cell culture using spatially confined chemical reactions

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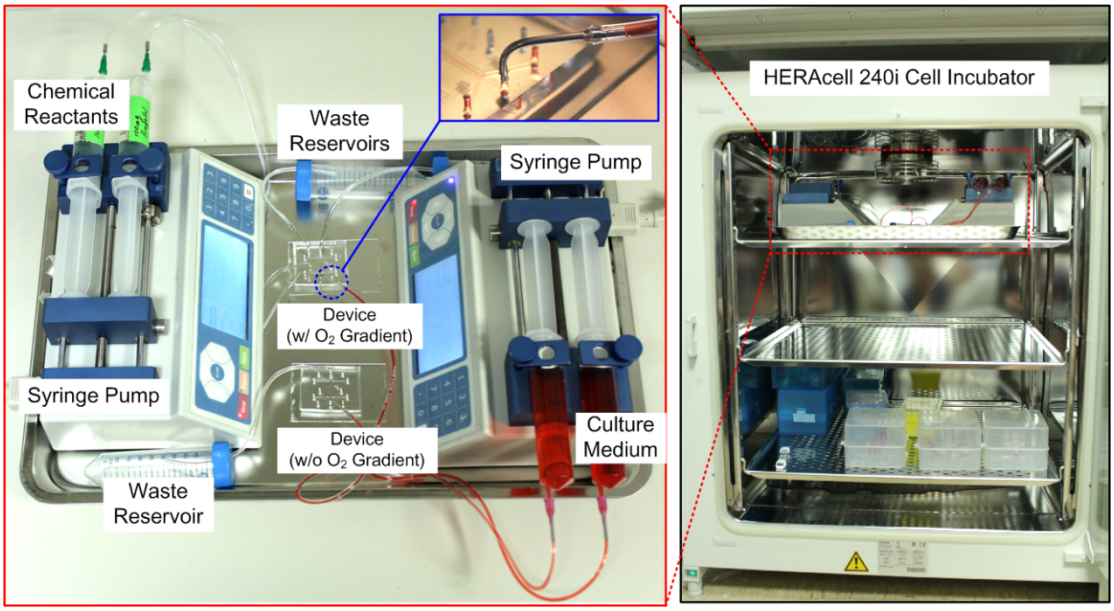
Supplementary Information

Figure S-1. Photos of the microfluidic cell culture experimental setup. Two double-syringe syringe pumps (Fusion 200, Chemyx Inc., Stafford, TX) were utilized for a set of cell culture experiments, including one device without oxygen gradients for control, and another device with oxygen gradients. One pump is for growth medium perfusion, and another one is for oxygen generation or scavenging chemical reactants. The interconnections between syringes and the microfluidic device were made with Tygon tubings (Saint-Gobain Performance Plastics, Akron, OH), and gauge 16 blunt needles (Jensen Global, Santa Barbara, CA). The entire setup, including syringe pumps, was placed inside the incubator (HERAcell 240i, Thermo Scientific, Waltham, MA) for cell culture experiments.

Figure S-2. The bright field and fluorescence microscopic images of the A549 cells seeded and cultured for overnight inside the cell culture channel. After the overnight culture, the A549 can attach well on the channel bottom surface. The fluorescence image (live/dead stain) shows that most of the cells are live (> 99.0%) after the seeding process.

Figure S-3. Bright field phase images of the A549 cell cultured under various medium and oxygen gradients. (a) A549 cells cultured under 6-hour normal growth medium perfusion with a hyperoxic gradient. (b) A549 cells cultured under 48-hour anti-cancer drug (1 mM TPZ) perfusion without and with hypoxic oxygen gradients.

Figure S-4. The live cell ratios calculated from the microscopic images for the A459 cells cultured under normal growth medium with a hyperoxic gradient for 6 hours, and anti-cancer (1 mM TPZ) drug with a hypoxic oxygen gradient for 48 hours in the flow direction. Statistical analysis was performed by ANOVA followed by Holm-Sidak tests (n=6). The analysis results show there are no statistical differences among the live cell ratios calculated within the upstream, midstream, and downstream regions of the cell culture channel ($p>0.26$). Data are expressed as the mean±SD.



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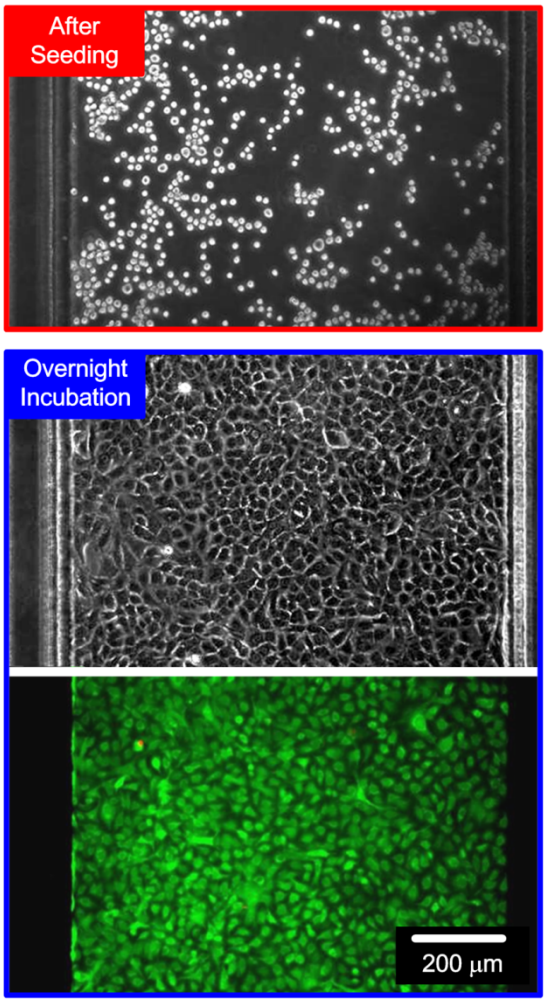

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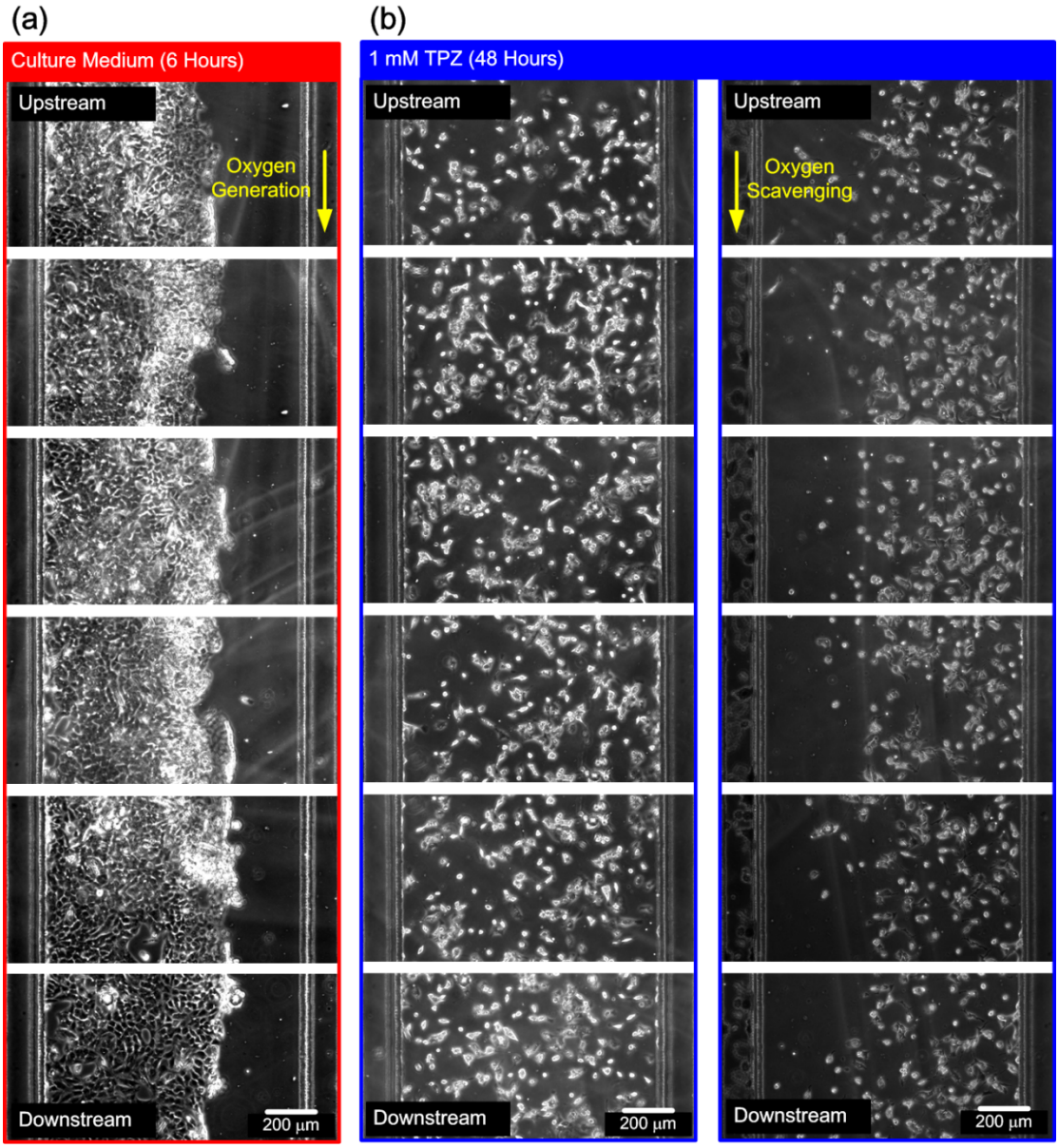

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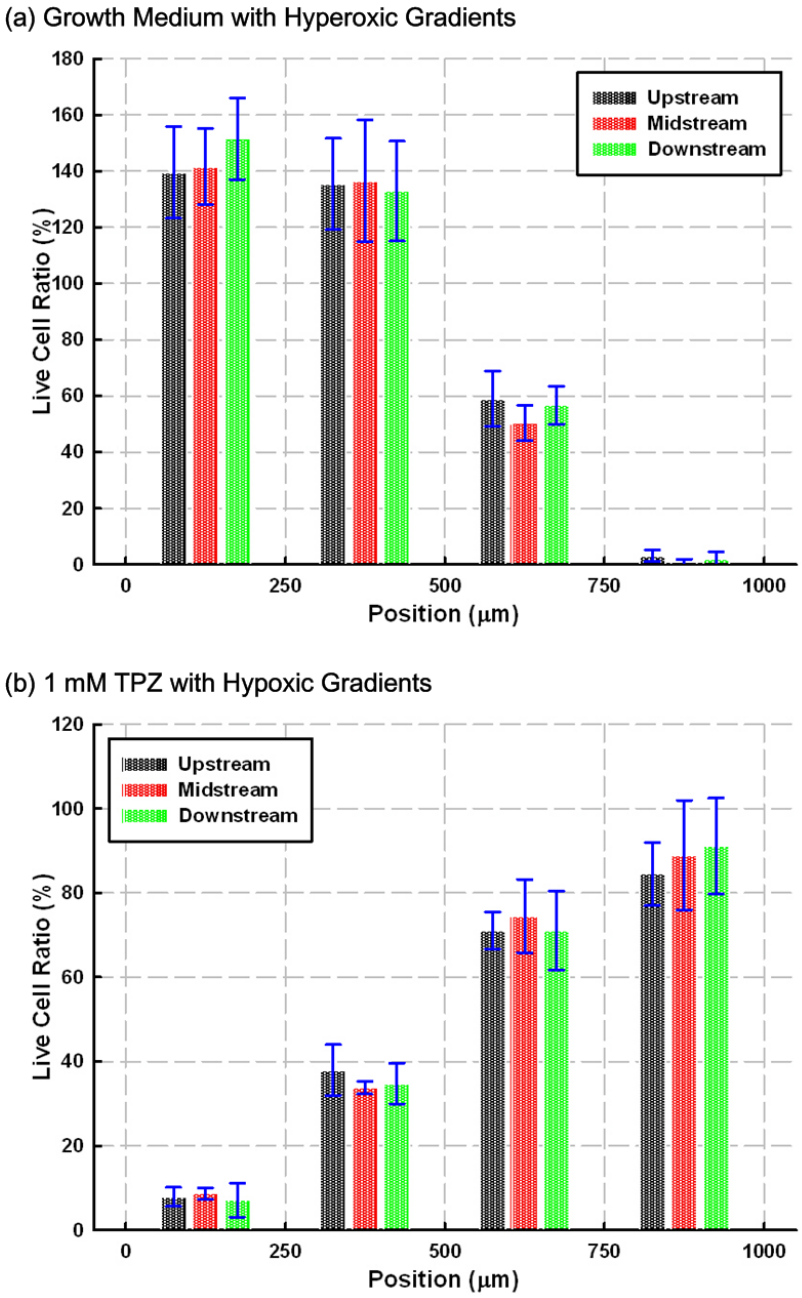

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