Electronic Supplementary Material (ESI) for Lab on a Chip.

A hydrostatic pressure-driven passive micropump enhanced with siphon-based autofill function

Xiaolin Wang‡[abc], Da Zhao‡[d], Duc T.T. Phan[e], Jingquan Liu[abc], Xiang Chen[abc], Bin Yang[abc], Christopher C.W. Hughes[de], Weijia Zhang*[fg], Abraham P. Lee*[dh]

[a] Department of Micro/Nano Electronics, School of Electronic Information and Electrical Engineering, Shanghai Jiao Tong University, Shanghai 200240, P. R. China
[b] National Key Laboratory of Science and Technology on Micro/Nano Fabrication, Department of Micro/Nano Electronics, School of Electronic Information and Electrical Engineering, Shanghai Jiao Tong University, Shanghai 200240, P. R. China
[c] Key Laboratory for Thin Film and Microfabrication Technology (Ministry of Education), Department of Micro/Nano Electronics, School of Electronic Information and Electrical Engineering, Shanghai Jiao Tong University, Shanghai 200240, P. R. China
[d] Department of Biomedical Engineering, University of California, Irvine, CA 92697, USA. E-mail: aplee@uci.edu; Fax: +1 (949) 824 1727 ; Tel: +1 (949) 824 9691
[e] Department of Molecular Biology & Biochemistry, University of California, Irvine, CA 92697, USA
[f] The Fifth People's Hospital of Shanghai and Institutes of Biomedical Sciences, Shanghai Medical College, Fudan University, Shanghai 200032, China. E-mail : weijiazhang@fudan.edu.cn; Tel: +86 (021) 5423 7385
[g] State Key Laboratory of Molecular Engineering of Polymers, Fudan University, Shanghai 200433, China
[h] Department of Mechanical and Aerospace Engineering, University of California, Irvine, CA 92697, USA
‡ These authors contributed equally to this work
* These authors contributed equally as senior authors and correspondents to this work

Corresponding authors:

Weijia Zhang
Email: weijiazhang@fudan.edu.cn; Tel: +86 (021) 5423-7385.

Abraham P. Lee
Email: aplee@uci.edu; Fax: +1 (949) 824-1727; Tel: +1 (949) 824-9691.

Supplemental Movie S1: Simple platform setup, easy assembly process, and operation principle of enhanced micropump

Supplemental Movie S2: Effectiveness of liquid barrier connector (LBC) on the sensitivity of siphon-based autofill function

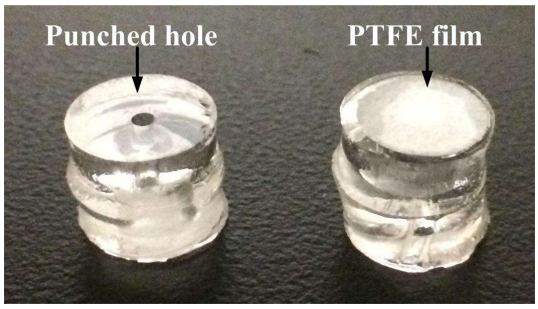
Supplemental Movie S3: Comparison experiment of enhanced micropump with siphon-based autofill function and conventional micropump without autofill function

Supplemental Movie S4: Intermittent and continuous refilling modes of siphon-based autofill function depending on the relative flow rate between inlet and outlet.

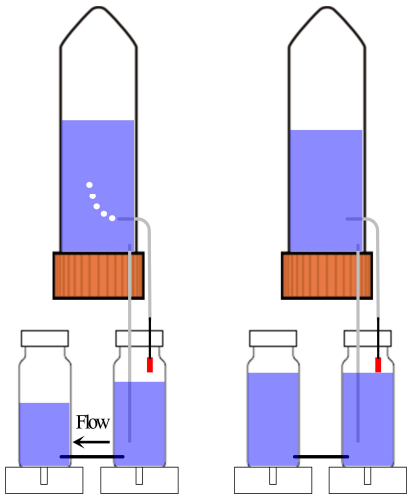
Supplemental Movie S5: Multiplexed micropump with stopcock for selective liquid perfusion with high controllability.

Supplemental Movie S6: Assembly of actual prototype and the fabrication of PDMS LBC

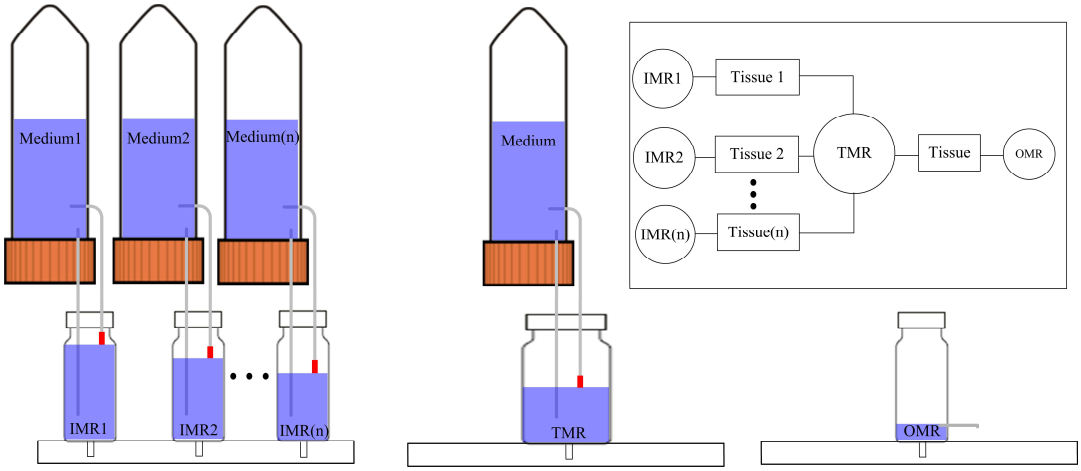
Supplemental Movie S7: Application on vasculogenesis with enhanced micropump inside incubator, and its experimental results on microvascular network formation inside tissue chambers throughout 21 days.



Supplemental Figure S1: Prototype of the liquid barrier connector fabricated from PDMS with punched holes and gas permeable/liquid impermeable PTFE film.



Supplemental Figure S2: Schematic diagram showing parallel micropump with the same liquid level inside multiple IMRs driven by only one MSC.



Supplemental Figure S3: Schematic diagram showing multi-tissue co-culture on a single microfluidic device by using multiple enhanced micropump modules with either different medium types or different hydrostatic pressure drops to maintain the optimal culture condition.