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(71) Applicant: **THE BOARD OF TRUSTEES OF THE LE-**

LAND STANFORD JUNIOR UNIVERSITY [US/US];
Office of the General Counsel, Building 170, 3rd
Floor, Main Quad, P.O. Box 20386, Stanford, California
94305-2038 (US).

(72) Inventor: **LEE, Wonjae**; 1277 Clark Way, Palo Alto, Cal-
ifornia 94304 (US).

(74) Agent: **SHERWOOD, Pamela J.**; 201 Redwood Shores
Parkway, Suite 200, Redwood City, California 94065 (US).

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(54) Title: MICROFLUIDIC CHIPS AND MICROPHYSIOLOGICAL SYSTEMS USING THE SAME

(57) Abstract: Described herein is a microfluidic chip comprising a first channel in fluid communication with an adjacent second channel through an opening, wherein the height of the first channel and the second channel are chosen to generate sufficient surface tension at the opening such that a liquid injected into the first channel or the second channel is substantially confined within the first channel or the second channel, respectively, or that flow of the liquid therebetween is controlled, the surface tension producing a non-physical microfluidic barrier that limits or selectively controls passage of the liquid. Also described are *in vitro* microphysiological systems that use such microfluidic chips in modeling the structure and functions of human organs, such as a blood-brain barrier, and studying *in vivo*-like physiological responses of such organs to various investigative or therapeutic agents.



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