ORGAN-ON-A-CHIP

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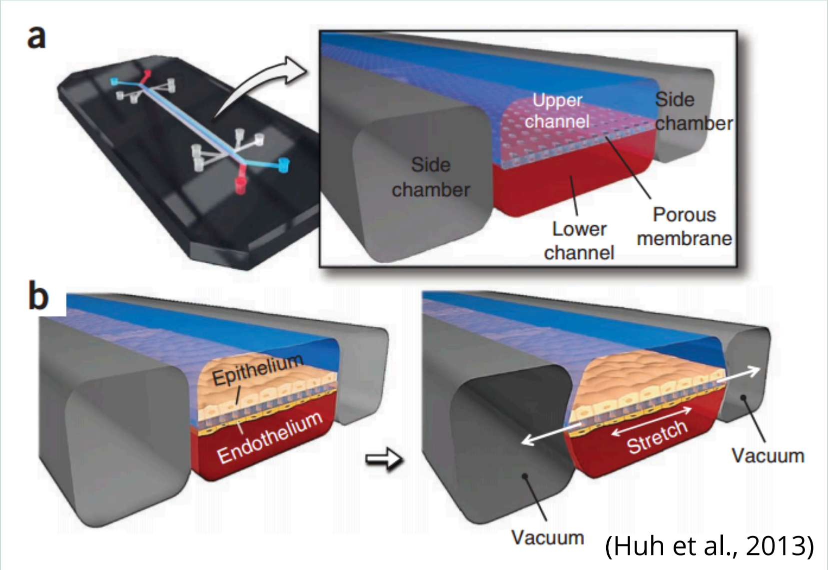
Example of the human lung-on-a-chip microsystem



(Huh et al., 2013)

STRUCTURE

a: This microfluidic device has upper (blue) and lower (red) cell culture microchannels separated by a microfabricated porous elastic membrane. The microdevice includes two full-height hollow microchambers beside the cell culture channels.

MECHANISM

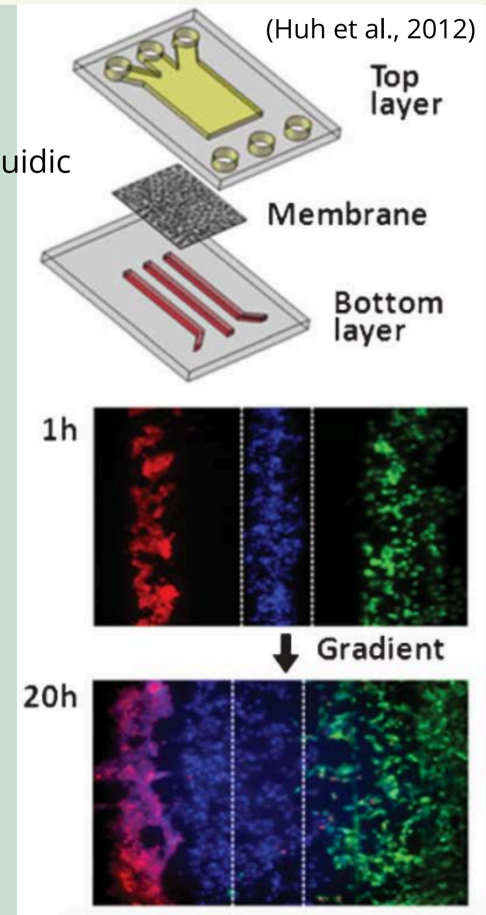
b: Vacuuming the side chambers mimics the physiological breathing motions of a living human lung. Actuation generates lateral extension of the elastic membrane, resulting in mechanical stretching of tissue layers in central channels.

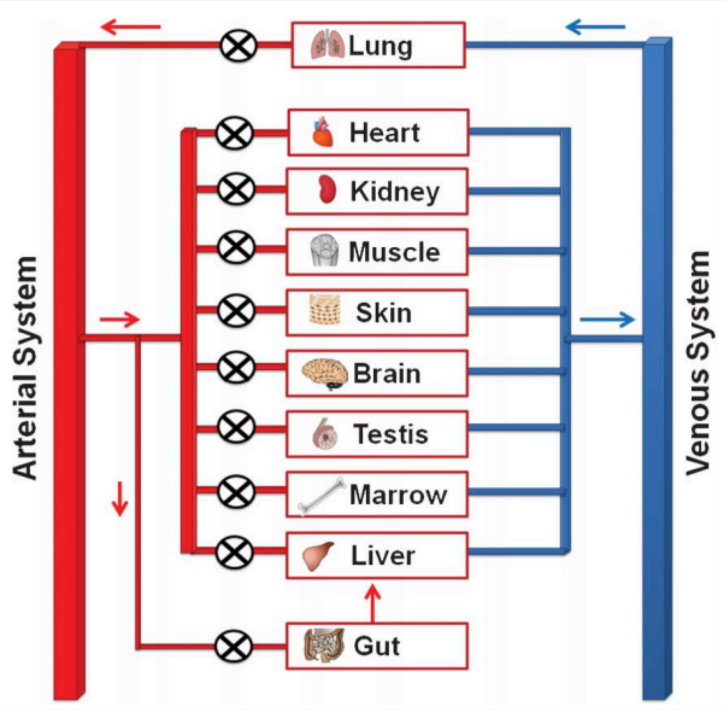
MAIN TECHNIQUE: MICROFLUIDIC SYSTEM

Chemotaxis of cancer cells during metastasis was modeled in a multilayered microfluidic device.

Example of a microfluidic system

(Huh et al., 2012)





Schematic of an integrated multi-organ systems instrument

(Huh et al., 2012)

FUTURE PERSPECTIVE

A single device can house ten separate organ chips linked to a microfluidic circulatory system. A blood substitute is perfused throughout the system, and in-line valves (white X-circles) may adjust flows and pressures to each organ, as well as couple flows between organ combinations.

The system requires environmental monitoring, pressure regulators, and pumps to maintain continuous flow and physiologically suitable conditions. Automated integration of several organ chips in a physiologically realistic manner can enhance the utility and effect of organ-on-chip technology.

Huh, D., Kim, H. J., Fraser, J. P., Shea, D. E., Khan, M., Bahinski, A., ... & Ingber, D. E. (2013). Microfabrication of human organs-on-chips. Nature protocols, 8(11), 2135-2157.

Huh, D., Torisawa, Y. S., Hamilton, G. A., Kim, H. J., & Ingber, D. E. (2012). Microengineered physiological biomimicry: organs-on-chips. Lab on a Chip, 12(12), 2156-2164.

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