MATSUNAGA LAB.

[Healthcare starting from microvessel]

Department of Mechanical and Biofunctional Systems

Tissue Engineering, Organ-on-a-chip, Vascular biology, Microfluidics

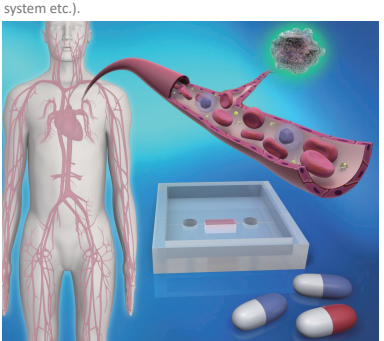
Department of Bioengineering http://www.matlab.iis.u-tokyo.ac.jp

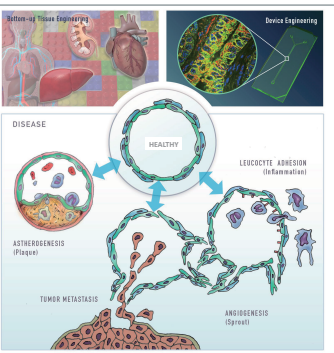
Overview

Matsunaga lab has been focusing on bottom-up tissue engineering using cells, proteins, and biopolymers as building blocks by unifying biomaterial synthesis, microfabrication and cell biology. Our goal is to develop controllable *in vitro* tissue models able to "visualize" the microenvironment of tissues from healthy to disease state at the cellular and tissue level. This approach serves as a powerful tool for mechanistic understanding of the disease and drug discovery.

3D microvessel model

3D in vitro blood microvessel model is used to understand the physiological phenomena of the blood vessels at cellular and tissue levels. We have designed a collagen gel-based microchannel seeded with endothelial cells, developing an in vitro 3D microvessel model that allows: (i) rapid formation of stable microvessels, (ii) simple and non-invasive observation, and (iii) scalability (i.e. co-culture with other cell types, flow system etc.).



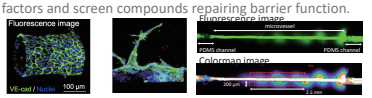


Angiogenesis

Angiogenesis is relevant in a number of physiological events and diseases, such as wound healing and cancer metastasis. We have developed an analysis system using physiological 3D *in vitro* microvessel for live-imaging.

Vascular Barrier Function

Dysfunction of vascular barrier induces several diseases. The barrier function is regulated by the endothelial cell-cell junction, and extracellular matrix and inflammation factors derived from vascular microenvironment (VME). We apply the 3D in vitro microvessel model to identifying factors and screen compounds repairing barrier function.



J. Pauty *et al.*, EBioMedicine, 27, 225-236 (2018). J. Pauty, R. Usuba *et al.*, Nanotheranostics, 1, 103-113 (2017). R. Usuba *et al.*, Biomaterials, 197, 305-316 (2019).

Microvessel → Healthcare

Health × Design

Human capillaries represent useful insights about our overall health and lifestyle habit. We are developing "Attune system" that transforms the images of capillaries into a musical tune via collaboration with DLX Design Lab. The music may help us change our behavior as the music changes to reflect our physical status. https://www.designlab.ac/attune