

MATSUNAGA LAB.

[Healthcare starting from microvessel]



Department of Mechanical and Biofunctional Systems

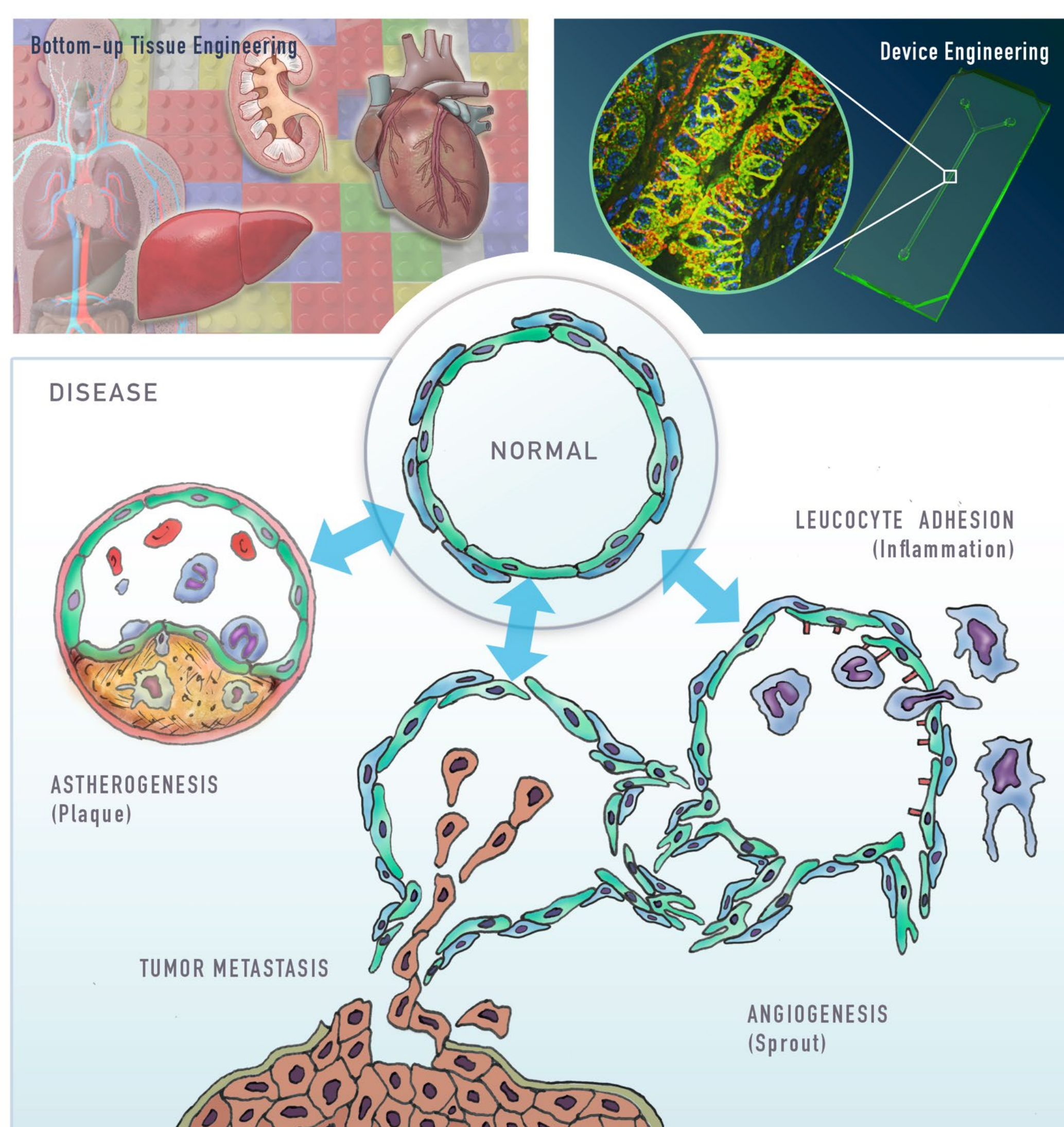
Tissue Engineering, Organ-on-a-chip, Vascular biology, Microfluidics

Department of Bioengineering

<http://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

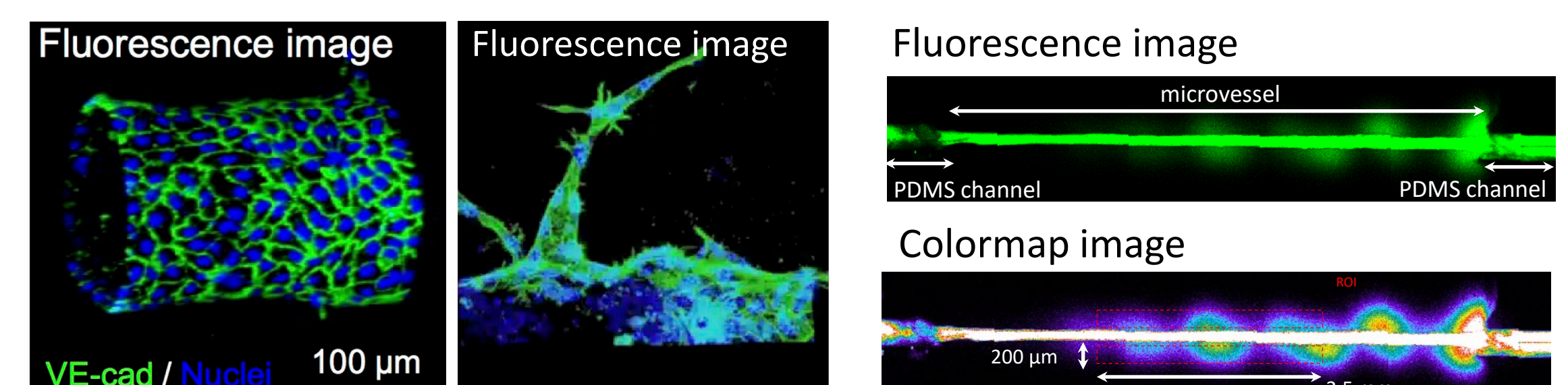
3D *in vitro* blood microvessel model is used to understand the physiological phenomena of the blood vessels at cellular and tissue levels. We have designed a collagen gel-based microchannel seeded with endothelial cells, developing an *in vitro* 3D microvessel model that allows: (i) rapid formation 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. Usaba *et al.*, *Nanotheranostics*, 1, 103-113 (2017).

R. Usaba *et al.*, *Biomaterials*, 197, 305-316 (2019).

Health X 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.

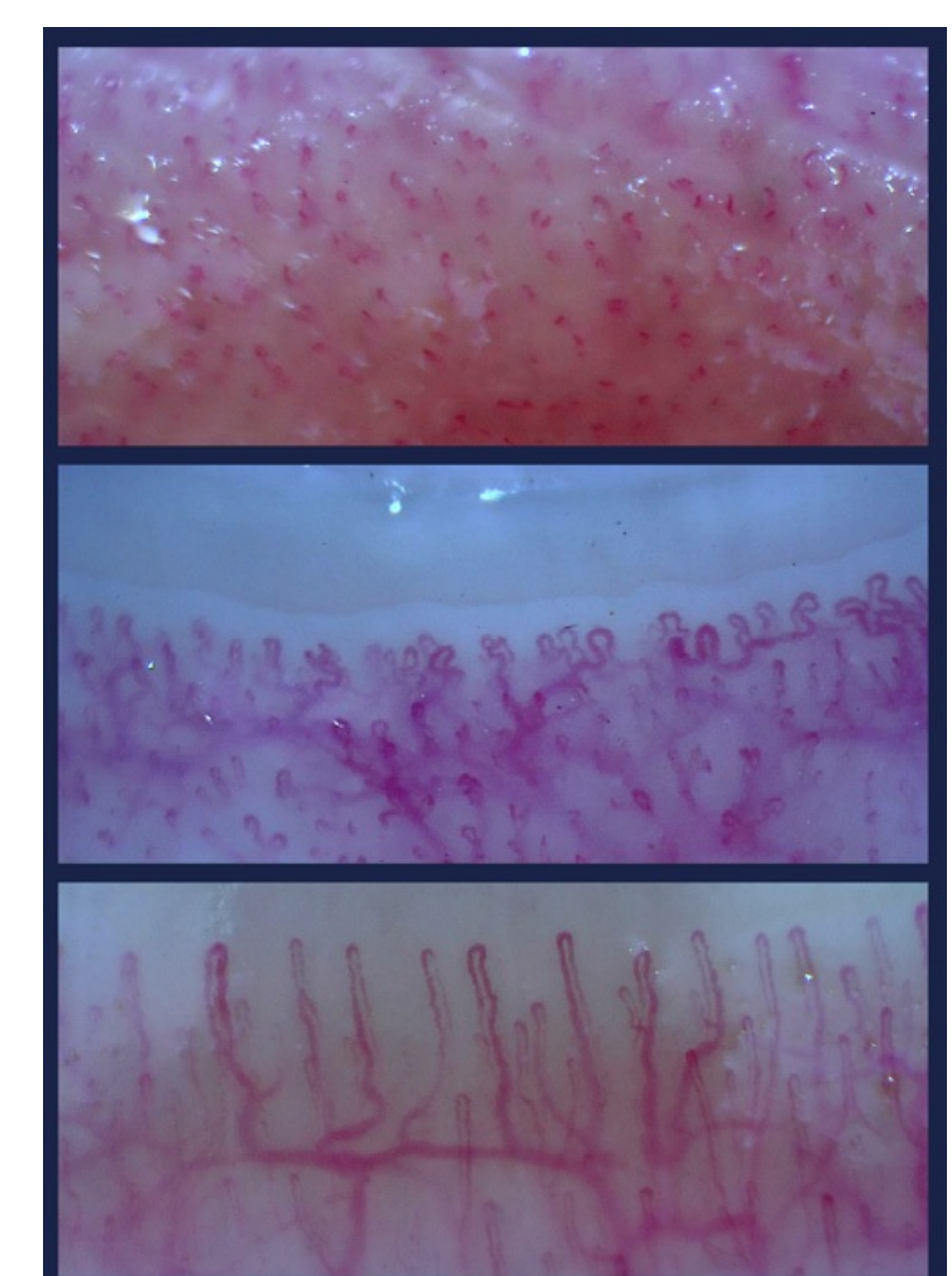
<https://www.designlab.ac/post/attune>

Microvessel → Healthcare

Tracking capillaries for health monitoring



Developed observation system for the nailfold capillary



Capillary images