

# MATSUNAGA LAB.

## Healthcare starting from microvessel



Department of Mechanical and Biofunctional Systems

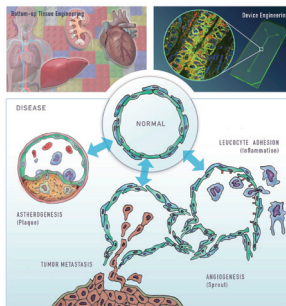
Tissue Engineering, Organ-on-a-chip, Vascular biology, Microfluidics

Department of Bioengineering, Graduate School of Engineering

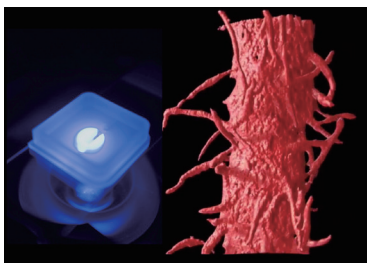
<http://www.matlab.iis.u-tokyo.ac.jp>

## 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.



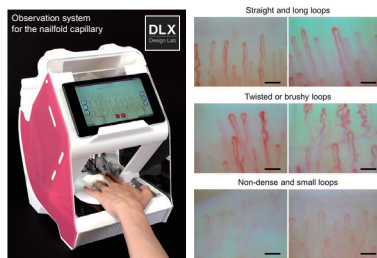
## 3D microvessel model



Pauty et al., *eBioMedicine*, 27 (2018).  
Sano et al., *Stem Cell Research & Therapy*, 13 (2022).

Organ-on-a-chip is an innovative platform which incorporates cells of human origin. It can be used to fill the gap between non-clinical studies and clinical studies in drug development. This platform enables recreation of the dynamic and complex microenvironment and the structure of the tissue and hence will be useful for understanding human responses. Our lab aims to visualize disease mechanisms using microvessel model. This model allows us to take control of the spatial arrangement of the cells and other physical and biochemical factors. Microvessels respond in the manner of sprout formation or alteration in the barrier function depending on the added biochemical factors. We combine creation and visualization of the tissue to elucidate what is happening in our bodies.

## Health × Design



Nakajima et al., *PLoS One*, 15, e0269561 (2022).

The goal is to establish a human capillary structure analysis method as a biomarker for disease, pre-symptomatic disease, and health maintenance and promotion.

- Development of a fingertip capillary image capturing system using a capillary detection model based on a convolutional neural network
- Development of image processing method for extracting various feature values of capillary structure and development of feature value extraction method using capillary detection model by convolutional neural network
- Development of methods for estimating attribute values related to lifestyle habits and disease risk from various feature values using Bayesian statistics and deep learning

We are developing "Attune system" that transforms the images of capillaries into a musical tune via collaboration with DLX Design Lab.

