University of Basel

Department of
Biomedical Engineering

University of Basel, department of Biomedical Engineering, Hegenheimermattweg 167c, 4123 Allschwil

Master of Science – Biomedical Engineering
Thesis Proposal:

Cartilage-on-Chip model to compare mechanically induced and cytokine-driven inflammation

Osteoarthritis is a degenerative disease which results from the interaction of mechanical stress and inflammatory signalling, yet most in vitro models focus on only one factor at a time. Organ-on-chip platforms can be used to mimic osteoarthritis by controlling compression of chondrocytes under microfluidic perfusion, allowing the study of mechanobiology in a highly controlled environment. While IL-1β stimulation is widely used to induce inflammation through biochemical means. Directly comparing these two modes of OA induction can clarify whether mechanically triggered inflammatory responses match those induced by cytokines, and how donor-to-donor variability affects these pathways.

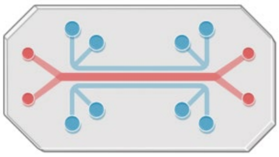

Figure 1. A compartmentalized organ-on-chip device with a deformable membrane and posts enabling controlled compression and perfusion of 3D chondrocyte constructs.

The objective of this thesis is to culture primary human chondrocytes from multiple human donors on the chip platform and evaluate their response to mechanical compression versus IL-1β stimulation. The aims include **(1)** producing and seeding the organ-on-chip devices with primary cells, **(2)** applying defined mechanical loading or IL-1β treatment, and **(3)** analysing inflammatory, morphological and matrix-related outputs across different donors. The multi-donor design will allow the student to assess biological variability and identify trends in how mechanical and cytokine-driven inflammation differ or overlap.

Nature of thesis
Experimental: 80%
Documentation: 20%

Specific requirements
Experience with cell culture and imaging is helpful but not required. Interest in mechanobiology and organ-on-chip technology is beneficial.

Group leader
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