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Technology Offer

Bioreactor for organ-on-a chip applications in tendon and ligament modelling

Tendon/Ligament-on-Chip | Microfluidics | Bioreactor |

In an increasingly active and aging population, the persistent morbidity of tendon and ligament diseases represents a growing unmet clinical need. However, research efforts are hampered by the lack of models to clarify basic cellular and molecular mechanisms and to test novel therapeutic treatments.

Background

Thus, our scientists developed devices and methods to recapitulate the structural and cellular biochemical as well as mechanobiological niche found in human ligaments (such as the cruciate ligament) and tendons (such as the Achilles tendon and the rotator cuff) to address this scientific and clinical requirement. Our Bioreactor combines a fully stretchable organ-on-a-chip with a mechanical rotational uniaxial bioreactor mechanism and primary tendon and ligament cells to model a biomimetic 3D environment that is capable of not only resemble the structure and cellular composition but also the mechanobiological niche comprising cyclic uniaxial stretching movements. With the incorporation of microfluidic technologies, the Bioreactor allows for fluid perfusion and the introduction of immune cells and therapeutic agents, enabling dynamic drug screening under lifelike mechanical stimulation.

Technology

Our innovative biomimetic biomechanical tendon/ligament-on-a-chip approach allows for the first time the dynamic manipulation of the cellular microenvironment with a high spatiotemporal resolution to emulate the pathogenesis of both extra- and intrasynovial tendon/ligament disorders by recapitulating in vivo-like mechanical cues (cyclic tensile and shear loading and overloading) and heterotypic cell crosstalk of disease-relevant cell populations in 3D microfluidic cultures.

Advantages

- scalable biomechanical system allows precise in situ formation and maturation of extra-synovial tendon/ligament organoids
- and intra-synovial microfluidic tendon/ligament-on-a-chip which allows the crosstalk of tendon and ligaments with synovia constructs under biomechanical strain loading
- our innovative approach stretches the entire tendon/ligament-onchip instead of stretching integrated components, which is much closer to the biophysical generation of fluidic shea

State of development

Proof of Concept

IPR

EP prio
Applicants:
Medical University of Vienna
University of Veterinary Medicine Vienna,
Vienna University of Technology.

Options

Cooperation /License agreement

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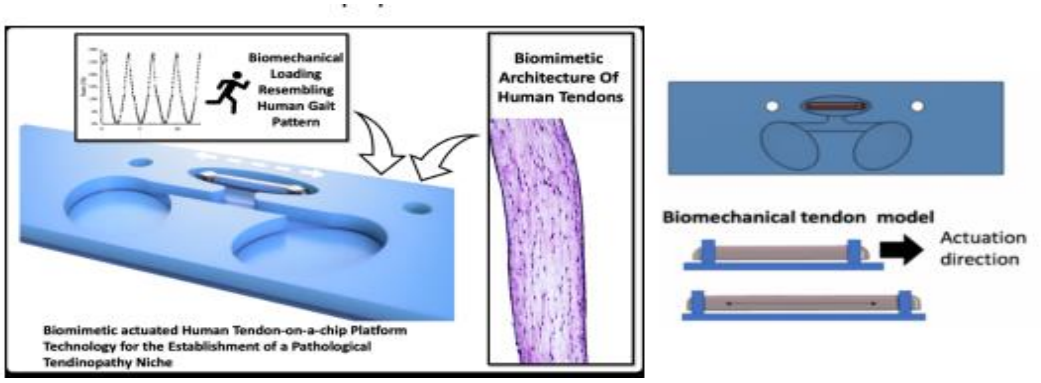
Reference

EM157

Application

research tool, screening tool



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