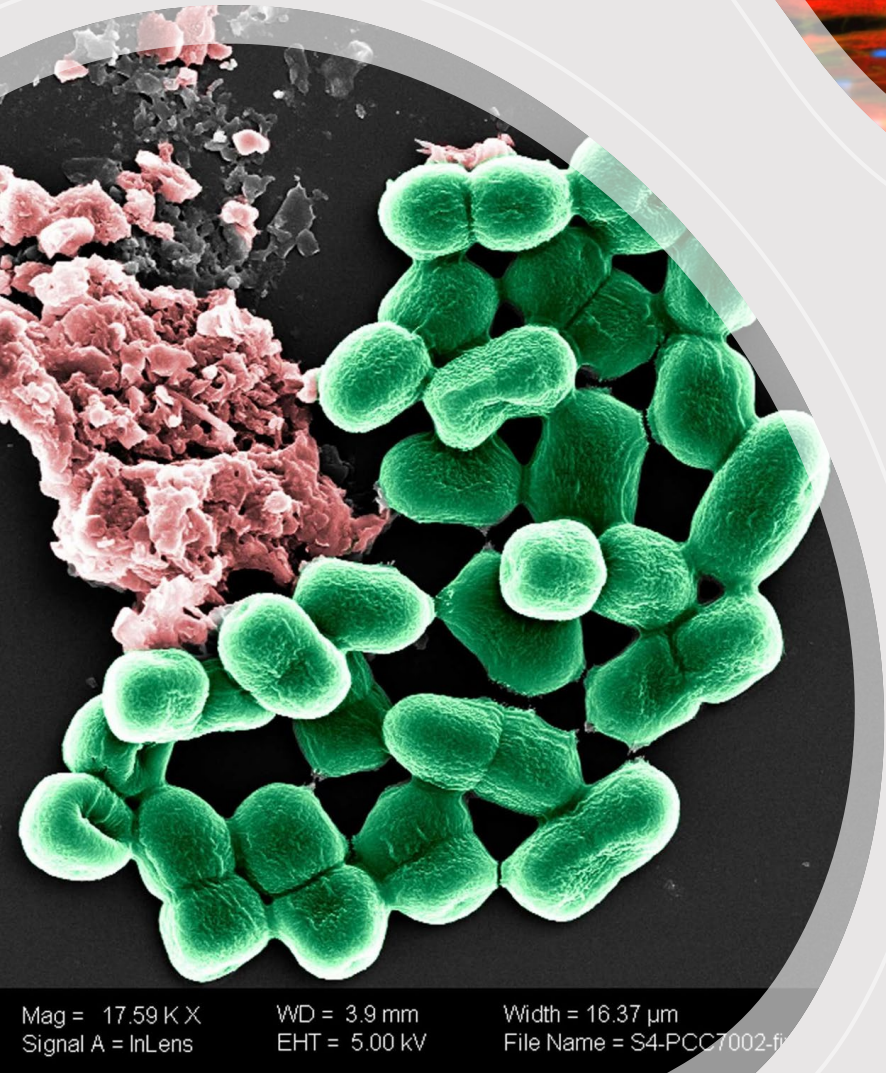
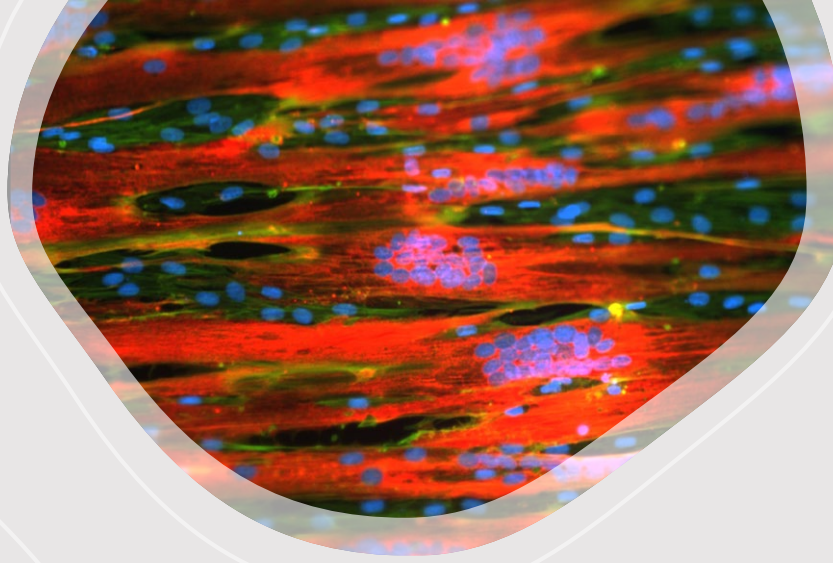


ALIVE SFA-AM Update

Eleni Chatzi, Miriam Filippi, Mark Tibbitt, Robert Katzschmann, Ralph Müller, Xiao-Hua Qin, Ueli Angst

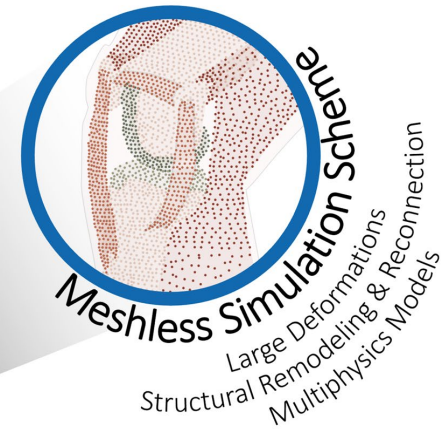
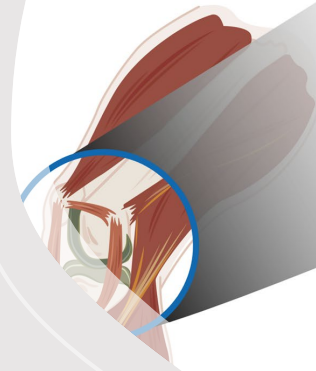
February 2024

BHR
Multiscale
Biohybrid Tissues
for Robotics



Mag = 17.59 K X WD = 3.9 mm Width = 16.37 µm
Signal A = InLens EHT = 5.00 kV File Name = S4-PCC7002.tif

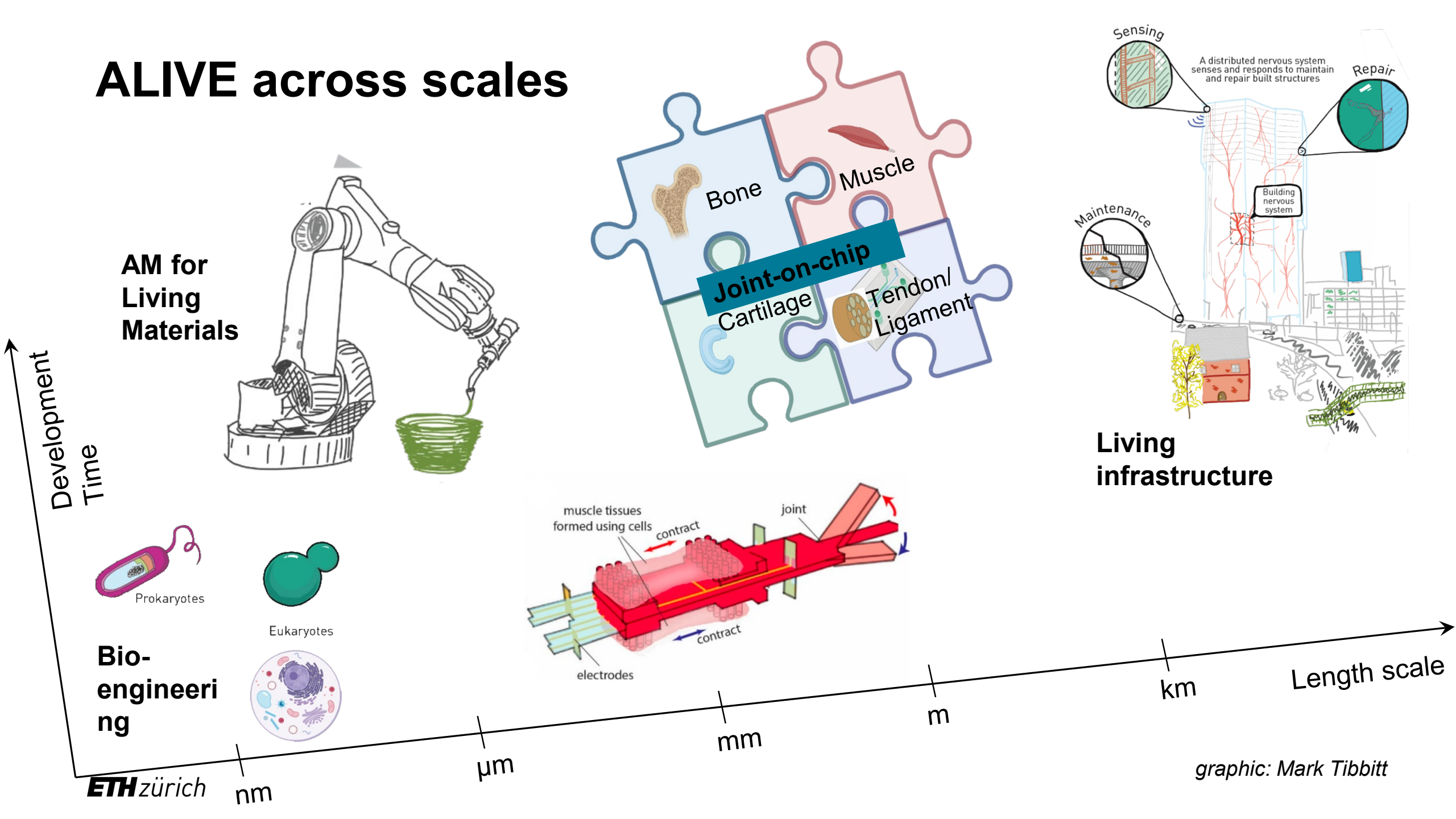
Zurich Joint
Human Joint Organoid
on Chip



We realise engineered systems that are sustainable, resilient & intelligent.

CLiMa
carbon-capturing in
self-aware
infrastructure

ALIVE across scales



ALIVE | stream: Living systems for carbon-capturing in self-aware infrastructure (CLiMa)

Eleni Chatzi, Ueli Angst
February 2024

Vision & expected outcome

Key idea

Harness the abilities of bacteria, mycelia & other living systems to...

...render infrastructure **carbon negative**

- Lower emissions in new construction
- Turn existing structures into CO₂ sinks

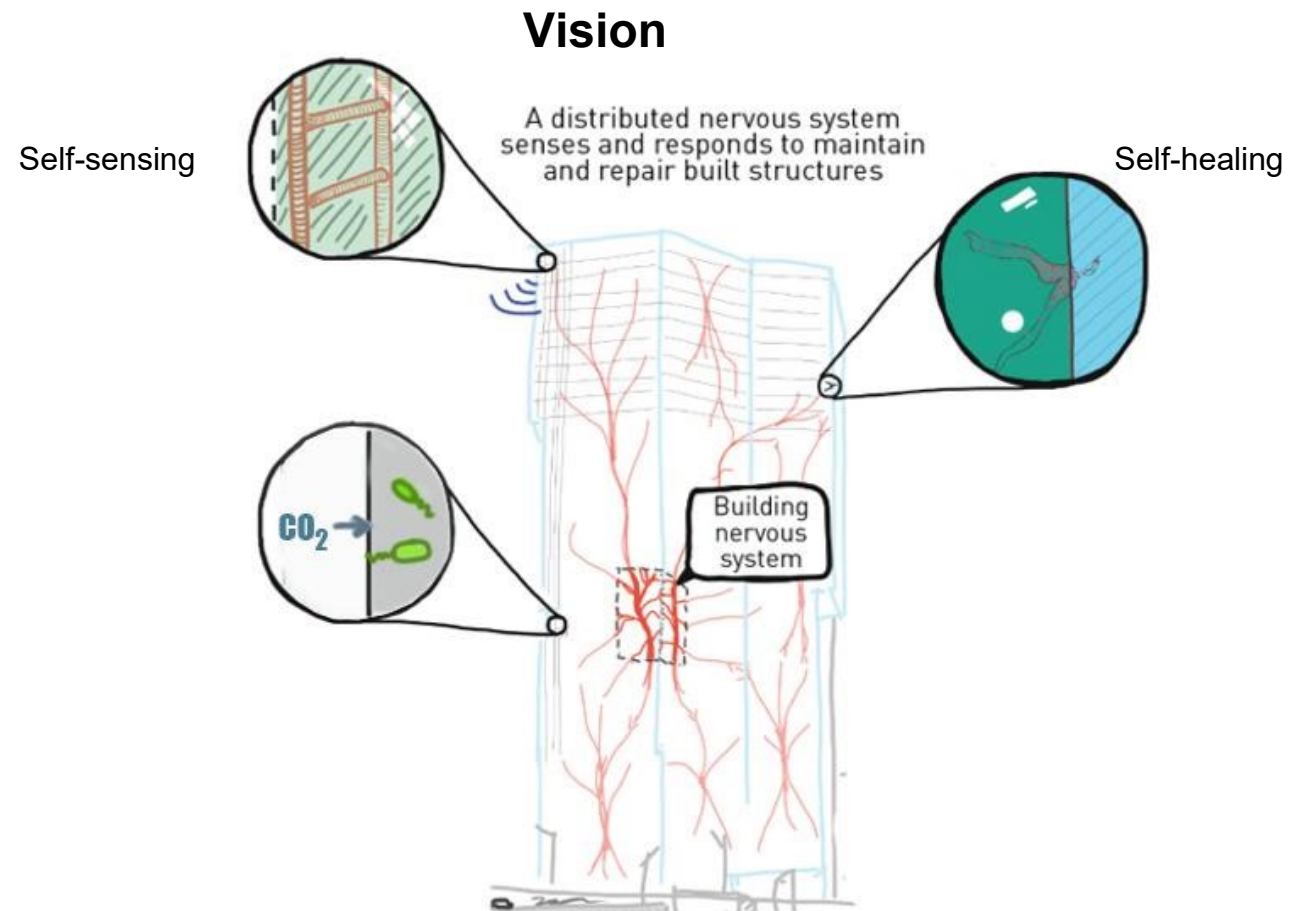
...render infrastructure **self-aware** to tackle potential durability challenges

- Self-healing
- Self-sensing

8 PhD students

9 PIs / Co-PIs

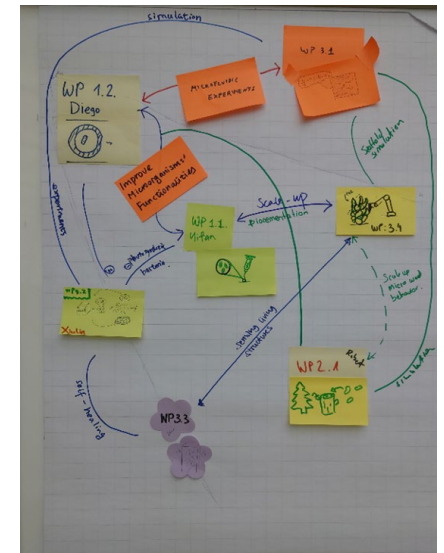
5 departments



Highlights



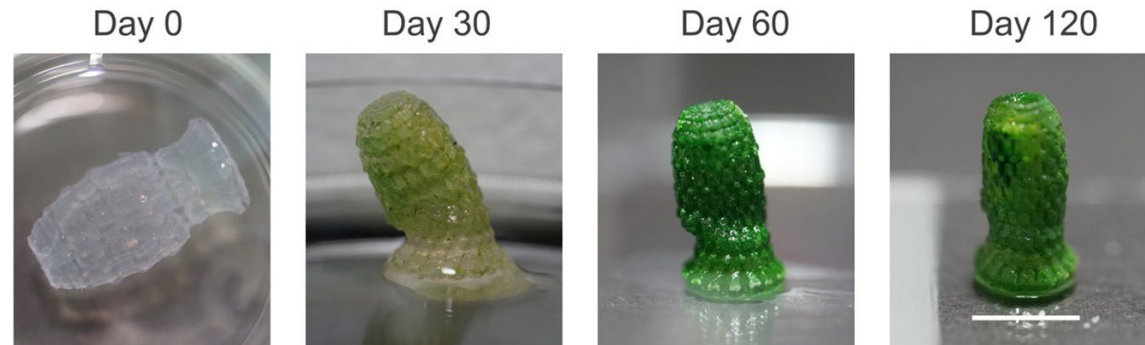
4 full day workshops with the entire team of the stream held:
September 2023, February 2023, September 2023, January 2024



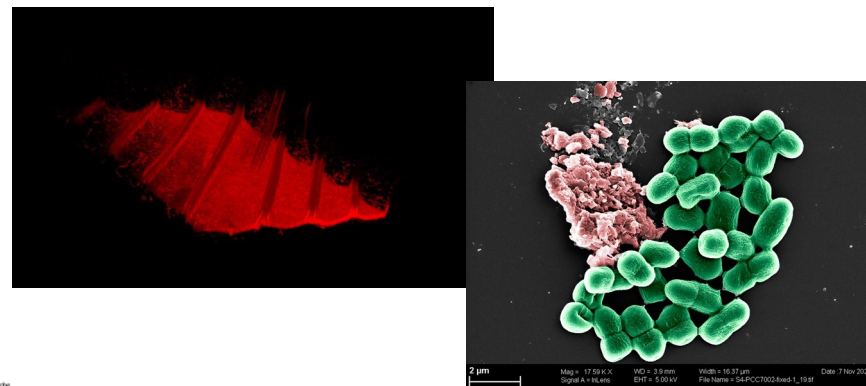
Two joint laboratories established: Mycelia lab & Bacteria lab



Design of Microbe-laden Materials for 3D Printing



Engineering Living Wood Materials



Microorganisms for carbon capture in buildings

ALIVE | stream:
Zurich Joint -
An Actuated Human Joint Organoid on Chip

Ralph Müller, Xiao-Hua Qin
February 2024

Vision & expected outcome

Key idea

Create an *in vitro* organoid model of human joint that...

...comprises connected joint tissues on chip

- bone
- cartilage
- tendon/ligament

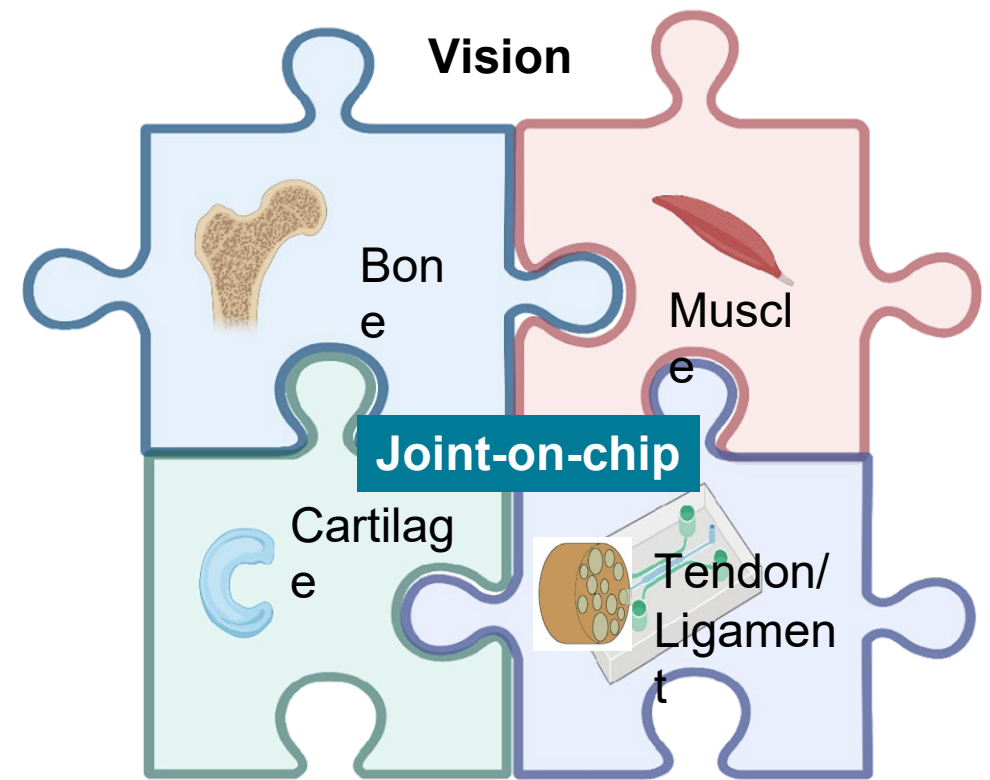
... can be assembled and tested modularly

- using user-dictated **muscle actuation**

4 PhD students

5 PIs

2 departments

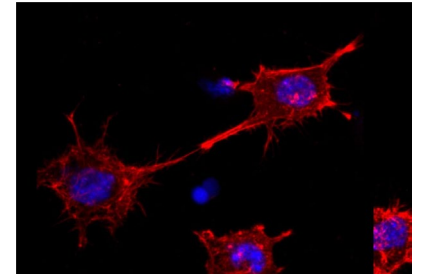


Highlights

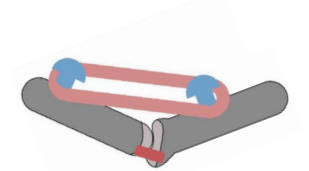
ALIVE Mammalian Lab in GLC



Margherita Bernero published a paper in **Biomaterials Science** 2024
Title: "IPN hydrogels for studying the role of matrix viscoelasticity in 3D osteocyte morphogenesis"



Ali Kerem Kalkan has successfully generated optogenetically-controlled muscle tissue!

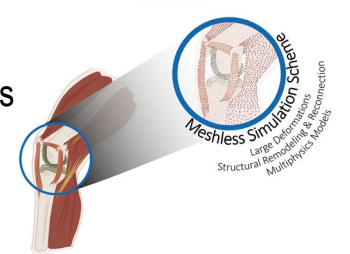


Hao Liu won the Best Oral Presentation Award at TERMIS-AP Conference 2023, Hongkong.

Title: "Filamented Light (FLight) Biofabrication of Centimeter-scale Muscle Tissue Constructs Using Pax7-nGFP Primary Myoblasts"



Rodrigo Castillo Acuna has developed a meshless framework to simulate large deformations in soft materials and tissues. Congratulations!



ALIVE | stream:
BHR - Multiscale Biohybrid Tissues for
Robotics Driven by Applications in Health

Miriam Filippi, Lucio Isa, Robert Katzschmann, Edo Mazza, Simone Schürle, Jess
Snedeker
February 2024

ALIVE BHR Project

Biohybrid Robotics

Robert Katzschmann

Biomechanics

Edoardo Mazza

Cell Sensing + Control

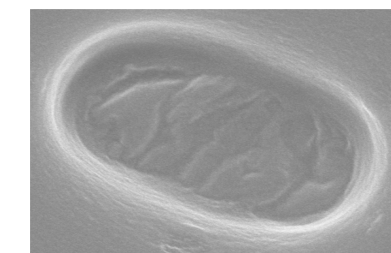
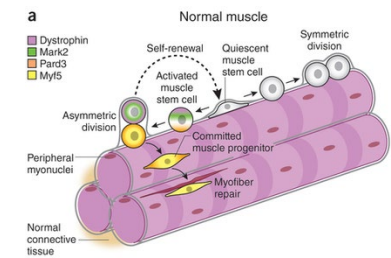
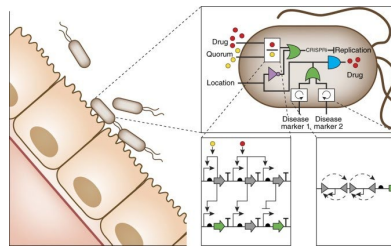
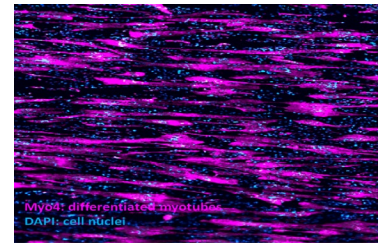
Simone Schürle

Musculoskeletal system

Jess Snedeker

Soft Materials & Interfaces

Lucio Isa



Bio-hybrid Robots:

- Biomimicry
- Augmented functions

Goals for BHR:

Large

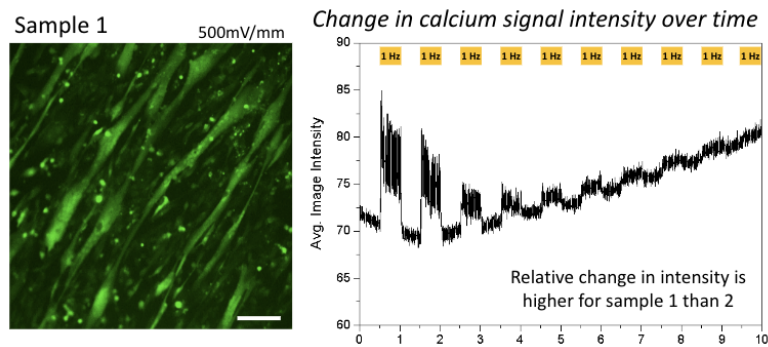
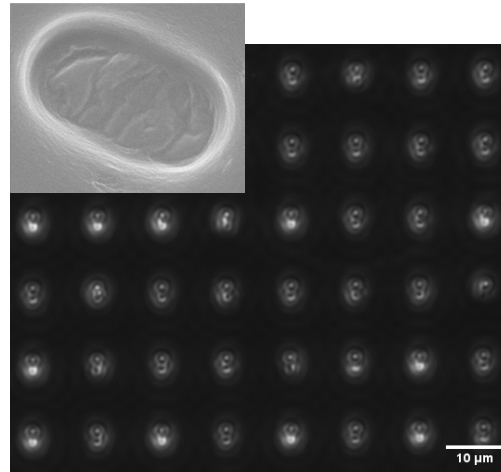
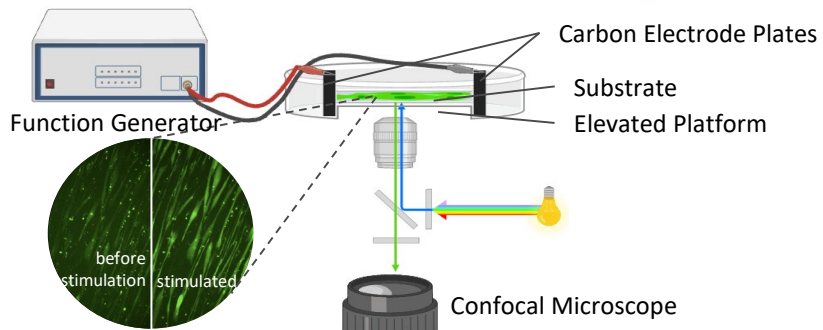
Biomimetic

Predictable

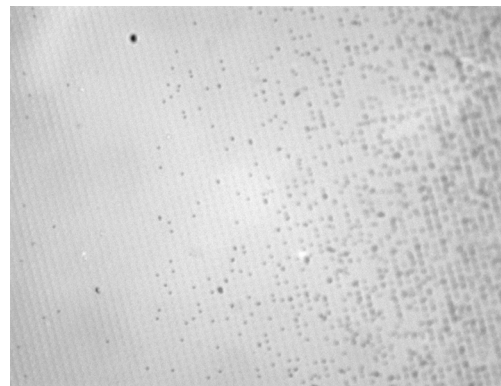
Repaired

Protected

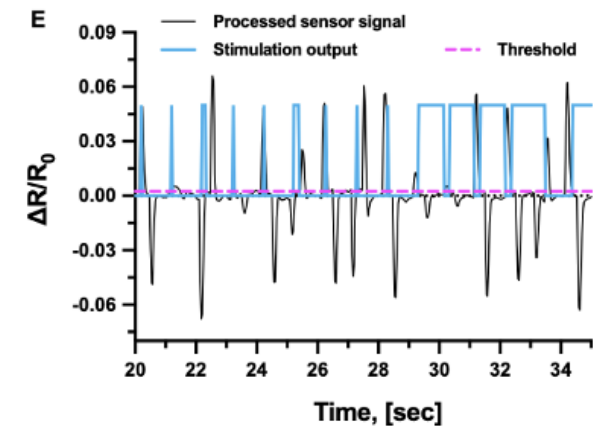
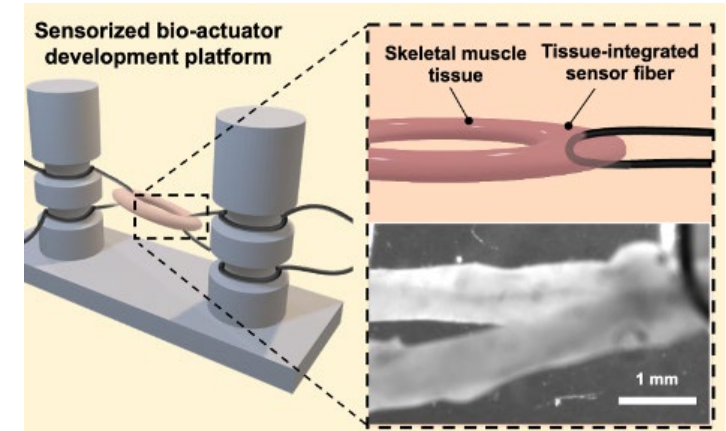
Highlights



Tuba Majid built an electrical stimulation setup to study muscle cell contraction via Ca^{2+} imaging



Isabelle Feller achieved capillary-assisted bacteria deposition and particle deposition on hydrogels.



Aiste Balciunaite realized a sensorized muscle tissue that acts as a close loop system.

ALIVE |
Labs & Equipment

Infrastructure

Mammalian Lab



Bacteria Lab



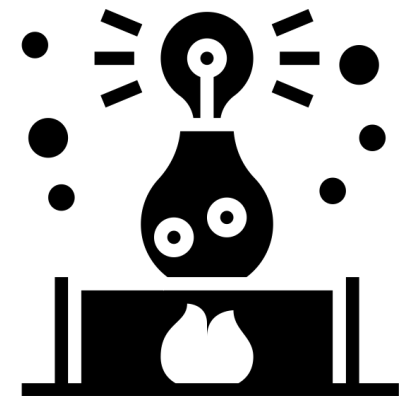
Biofabrication Lab



Infrastructure Platforms & Access

- The ALIVE labs are financed by the SFA AM contribution with co-financing from the ALIVE core members.
- The newly established infrastructures are openly listed on our [webpage](#) and are made available for access and collaboration to further researchers and members of the ETH Domain.
- The initiative actively looks for and initiates collaborations across institutions of the ETH Domain, as well as beyond. To this end, we have established the function of Associated members in our ALIVE Charter document.

Associate membership can be applied for by faculty of ETH Zurich who share an interest in Engineering with Living Materials and are eager to leverage their expertise in the context of ALIVE. Associate Members receive all ALIVE-related general communication, unless classified exclusive for Core Members, and access to ALIVE resources.



ALIVE |
Outreach & Dissemination

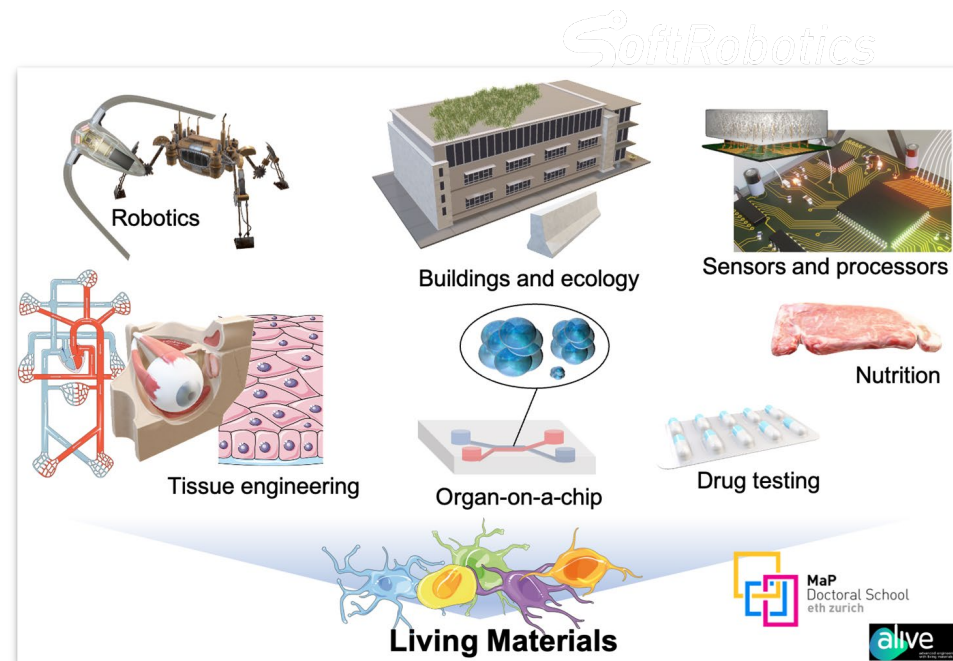
Outreach

Past Activities

- 23.01.2024 ALIVE CLiMa Symposium
- 30.10.2023 ALIVE ZJ Progress meeting
- 12.09.2023 ALIVE [CLiMa](#) Symposium
- 19.06.2023 [ALIVE Open Science Day](#), June 2023

Upcoming Activities

- 14.02.2024 ALIVE ZJ Progress meeting
- 19.02.-29.04.2024 [MaP Distinguished Lecture Series: Engineering with Living Materials](#)
- 26.03.2024 ALIVE Open Science Day
- 12.&13.09.2024 ALIVE Symposium 2024



ALIVE | Advanced Engineering with Living Materials | www.map.ethz.ch/research/alive



ALIVE Allocation and Spendings, status 2023-11-30*

	Original budget [kCHF]	Allocated status 2023-11-30* [kCHF]	Spent status 2023-11-30* [kCHF]	Comments
Fellows	2'000	1'800	~1'060	A cohort of 18 ALIVE doctoral students have been hired. Each of the 18 PIs involved received a share to hire a fellow with matched own funds.
Khammash fellow (100k) <input type="checkbox"/> Xolo bioprinter		100		Status January 2024: The Xolo bioprinter has been purchased; to be setup and taken into operation.
Bambach fellow (100k) <input type="checkbox"/> Equipment under discussion		pending		The 100k will be used for equipment. Different equipment options best serving the community and ETH are under discussion.
Mammalian lab	400	400	400	
Bacteria lab / BFL + Koordination (activities, symposia, meetings, partial salary of MaP Ex.Office people)	500 (300+200)	500 (300+200)	~247 (195+52)	- Equipment orders pending; all funds will be spent. - In 2024 the initiative will organise a larger symposium.
Total	2'900	2'800	~1'707	

*Date of reported numbers to SFA-AM.

The three labs (Mammalian lab, Bacteria lab and Biofabrication lab (BFL)), have been setup and are operable (funded by SFA-AM with additional matching funds by the PIs). Current purchased and available equipment in the ALIVE labs is published on the ALIVE website www.map.ethz.ch/research/alive/labs.html.