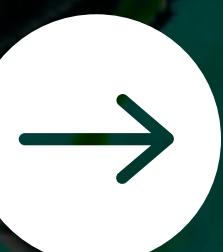


# Exciting times: extreme modelling of excitable tissue

EMIx

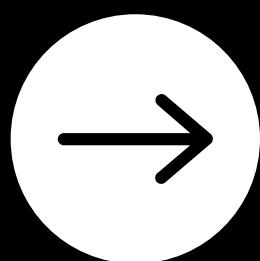


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Marie E. Rognes

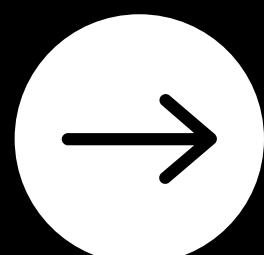
The EMIx project was established

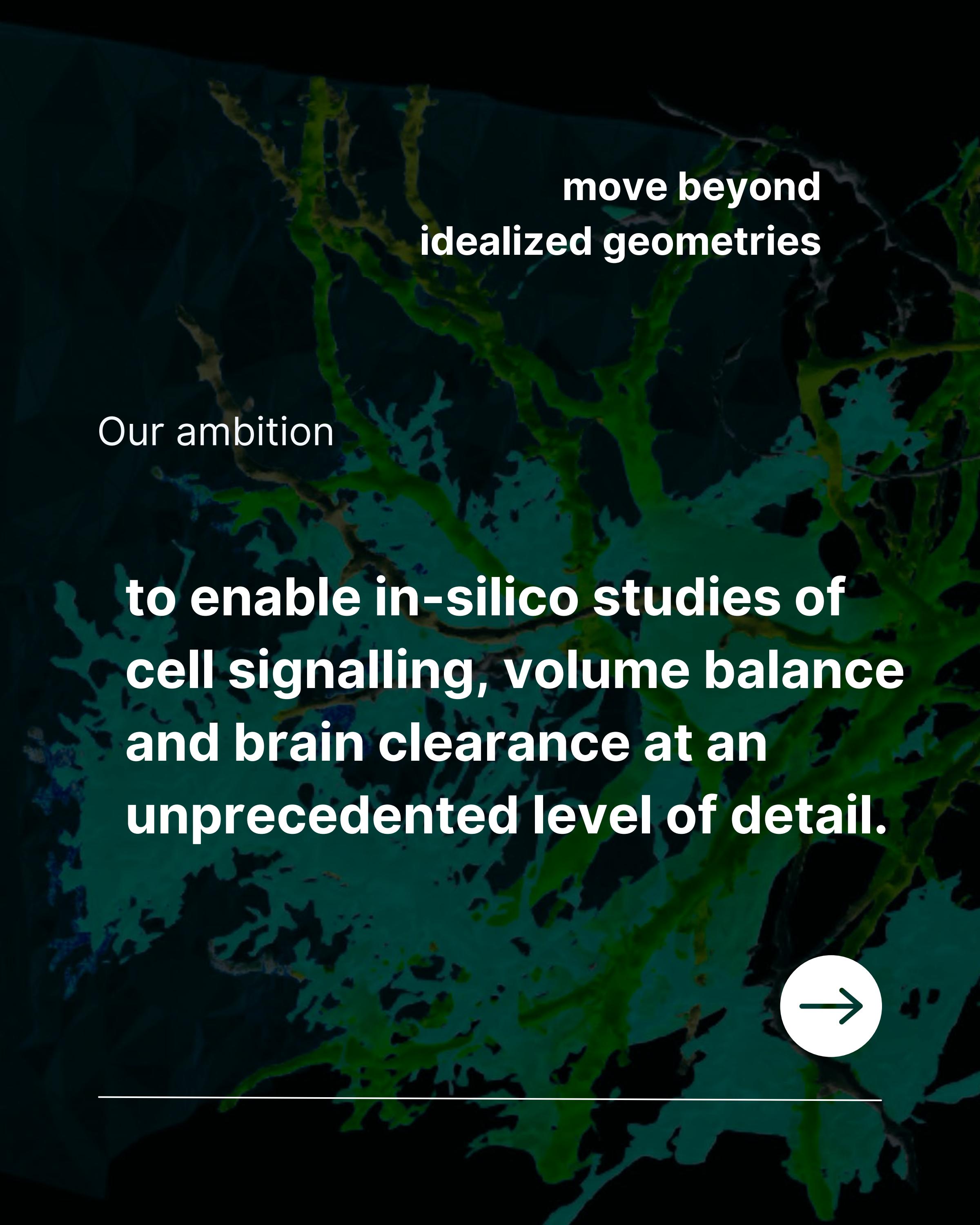
**to address a  
critical technology gap  
between the capabilities of  
imaging and simulation**



Our vision: to introduce

**next-generation  
computational mathematics  
for brain multiphysics**

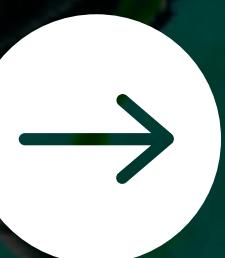




**move beyond  
idealized geometries**

Our ambition

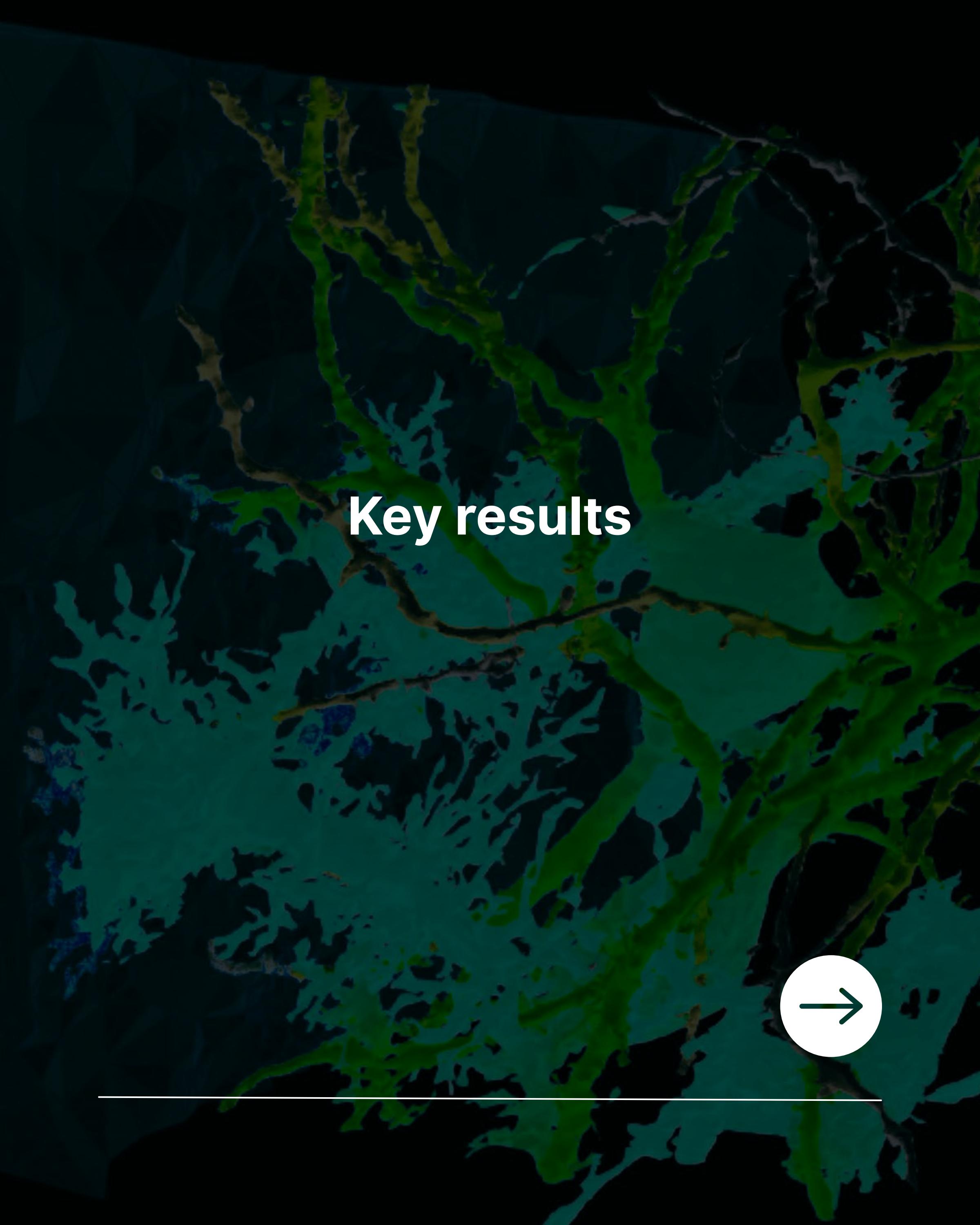
**to enable in-silico studies of  
cell signalling, volume balance  
and brain clearance at an  
unprecedented level of detail.**





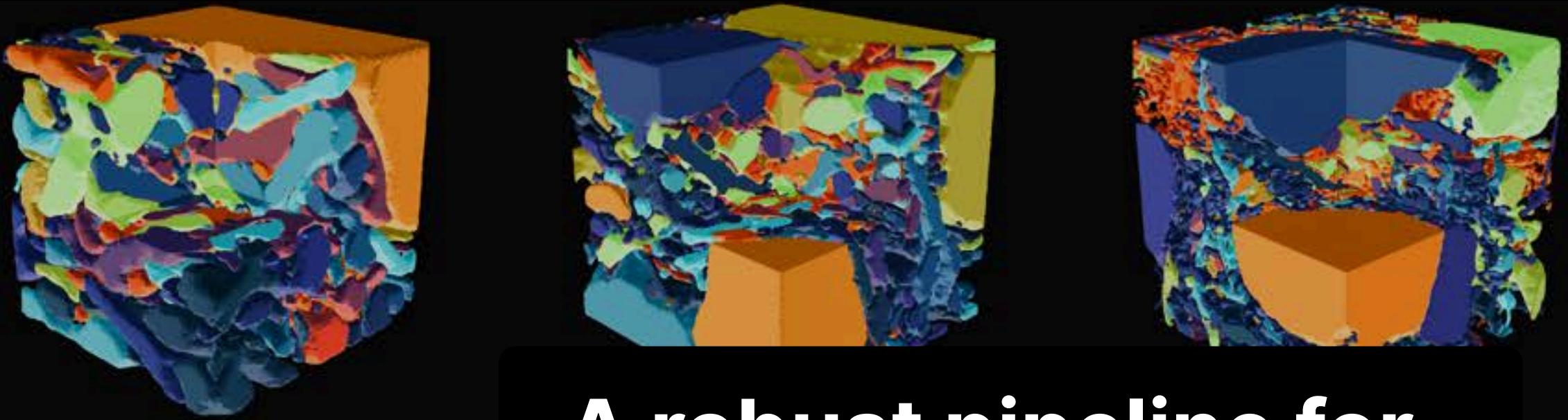
**Educating the next research generation**

*Ada J. Ellingsrud, Pietro Benedusi, Halvor Herlyng,  
Marte Julie Sætra, Marius Causemann*

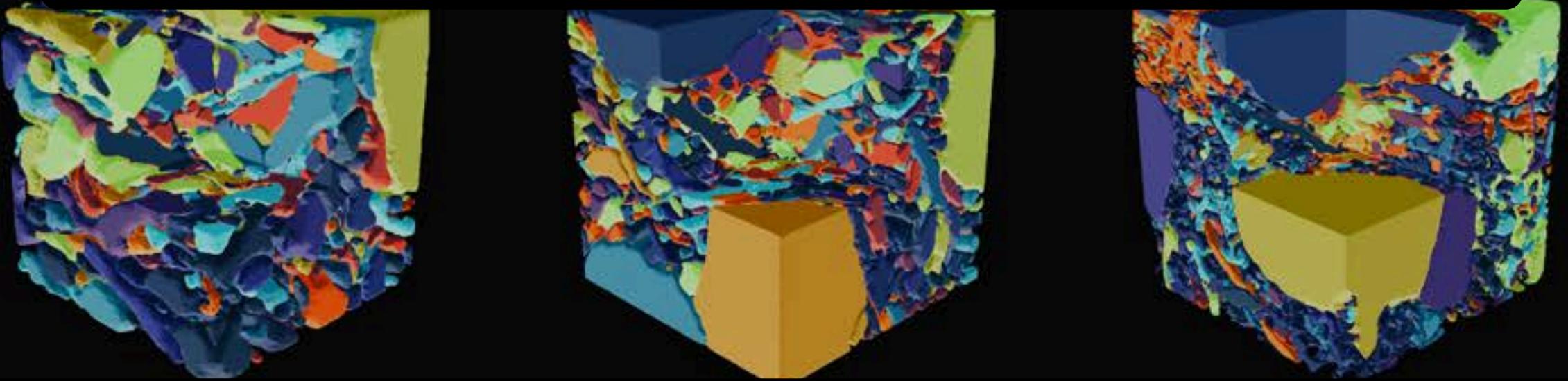


# Key results

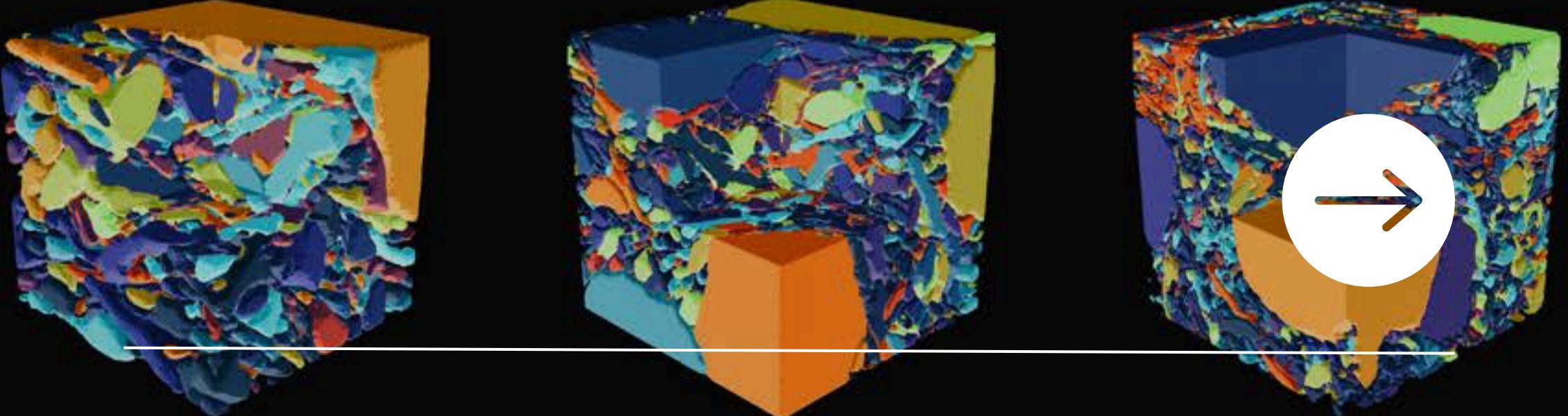




## A robust pipeline for digital representations of tissue



Mapping high-resolution images to  
computational geometries suitable for simulation



# **Hierarchies of models: from partial differential equations to network architectures**

describing the interplay between  
electrical activity, ion movement and  
fluid dynamics in excitable tissues

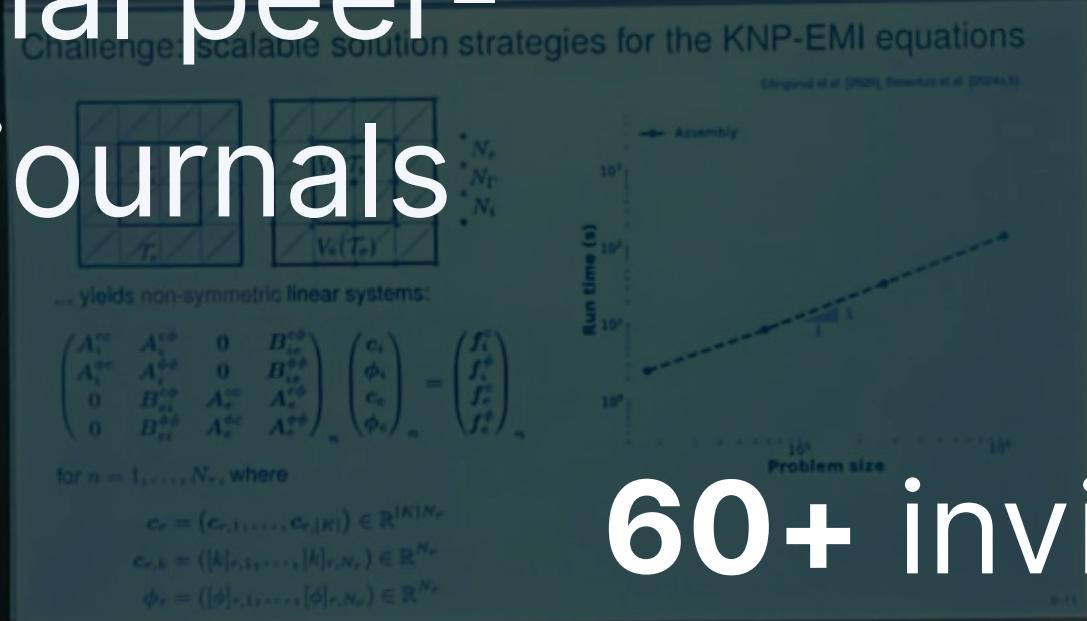


# Scalable finite element solvers

to accurately and efficiently  
simulate tissue multiphysics  
across time and space

In numbers

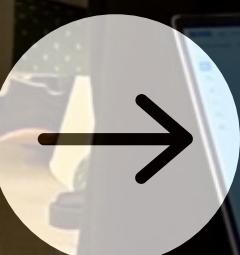
**25+** articles in  
international peer-  
reviewed journals

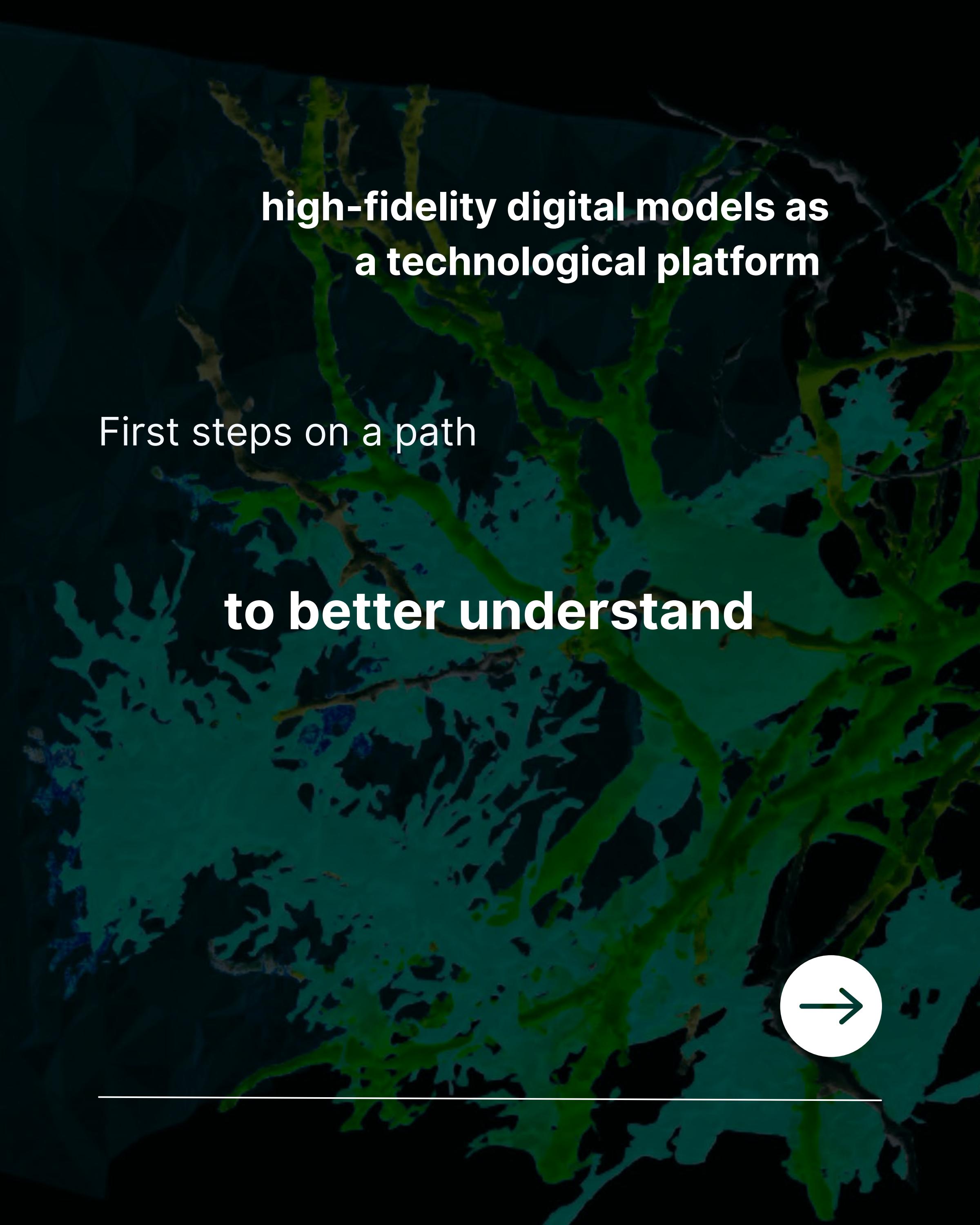


**60+** invited  
conference talks,  
seminars and lectures

**4+** data sets and  
software released into  
the public domain

Image credit: CIMNE

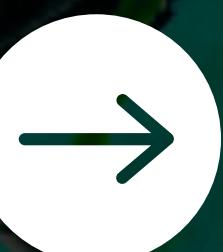




**high-fidelity digital models as  
a technological platform**

First steps on a path

**to better understand**



# Human physiology

Role of the enigmatic astrocytes  
The brain's ionic landscape



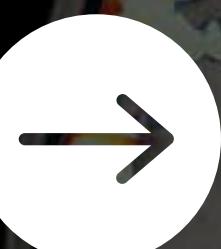
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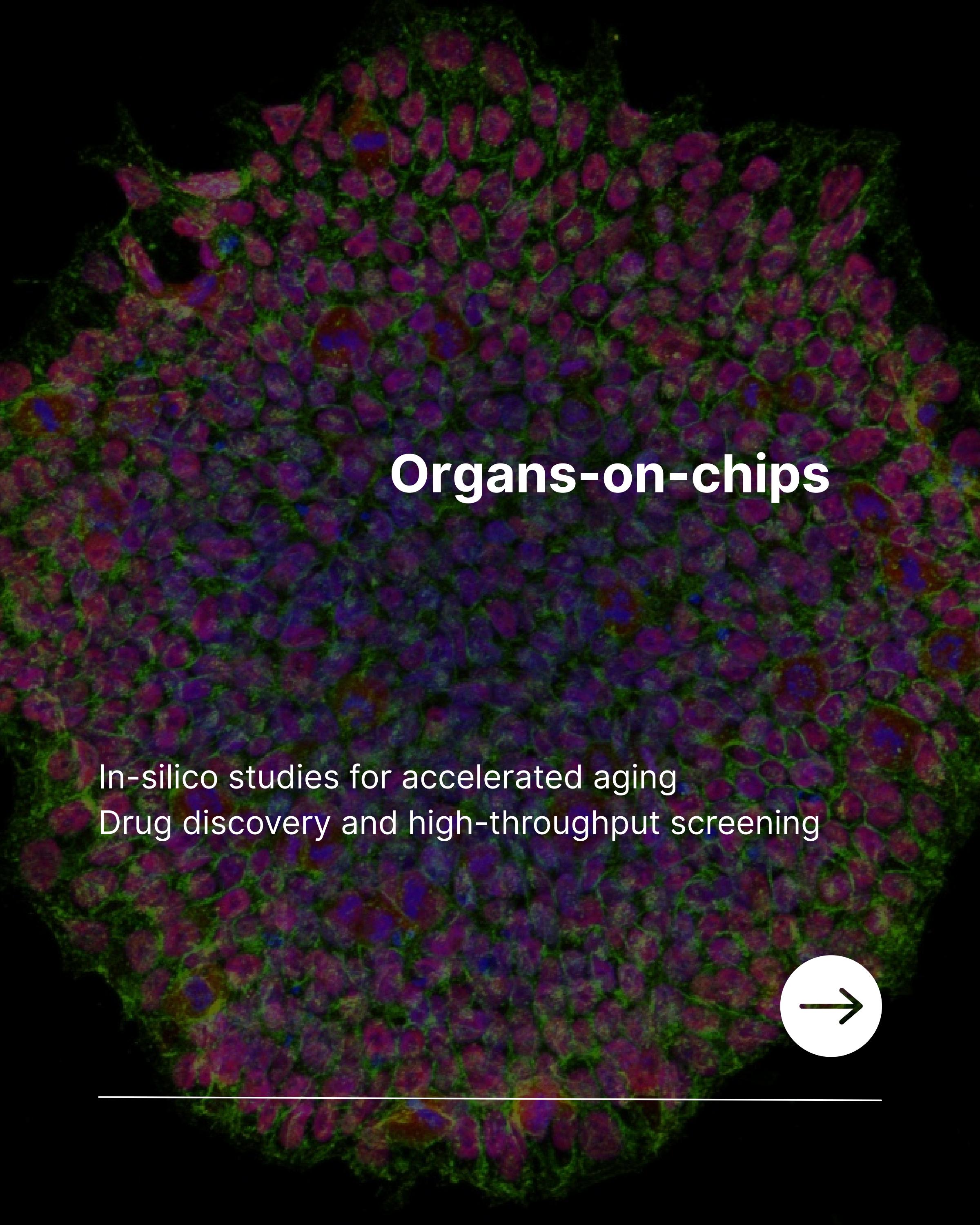
09:00 h

12:00

# Brain drug delivery

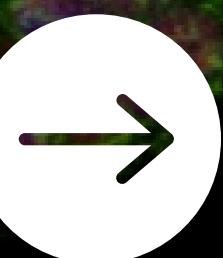
Chemotherapy to treat leukemia  
Gene therapy for neurological disorders

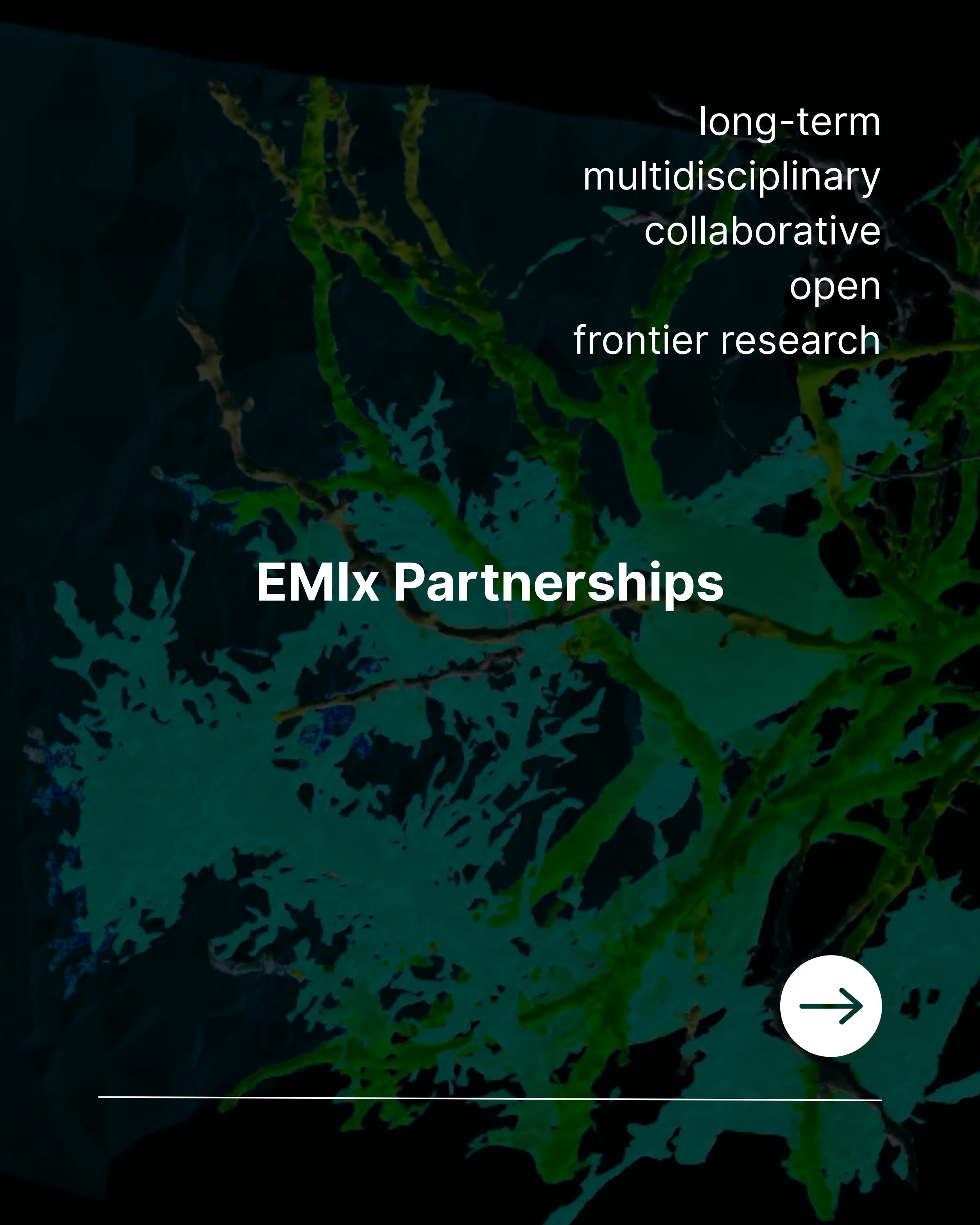


A circular microscopic image showing a dense layer of cells. The nuclei are stained purple, and the cytoplasmic membranes are stained green. The cells are arranged in a somewhat organized, layered pattern.

# Organs-on-chips

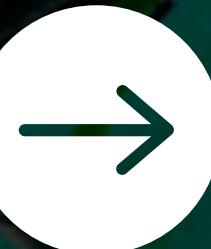
In-silico studies for accelerated aging  
Drug discovery and high-throughput screening





long-term  
multidisciplinary  
collaborative  
open  
frontier research

# EMIx Partnerships



# Simula Research Laboratory

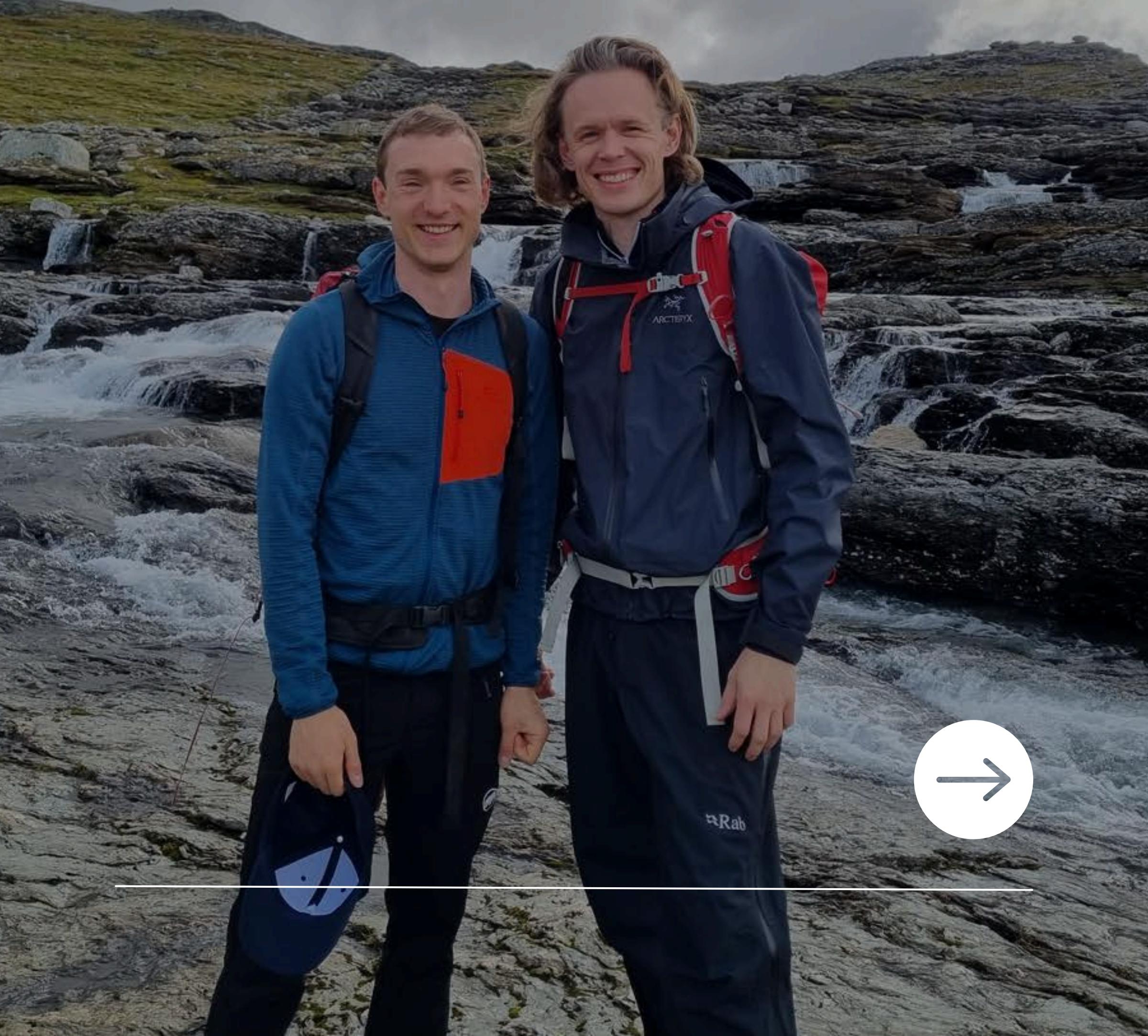
## Scientific Computing

Marie E. Rognes as  
project leader



# GliaLab, University of Oslo

led by Rune Enger



A woman with dark hair and a wide smile is wearing a large straw hat and a maroon zip-up hoodie. She is sitting at a white wooden table outdoors, surrounded by greenery and a yellow building in the background. A string of colorful triangular flags hangs above her. The scene suggests a sunny, social gathering.

# Computational Cellular Mechanobiology, UC San Diego

led by Padmini Rangamani



# Fyhn Lab, University of Oslo

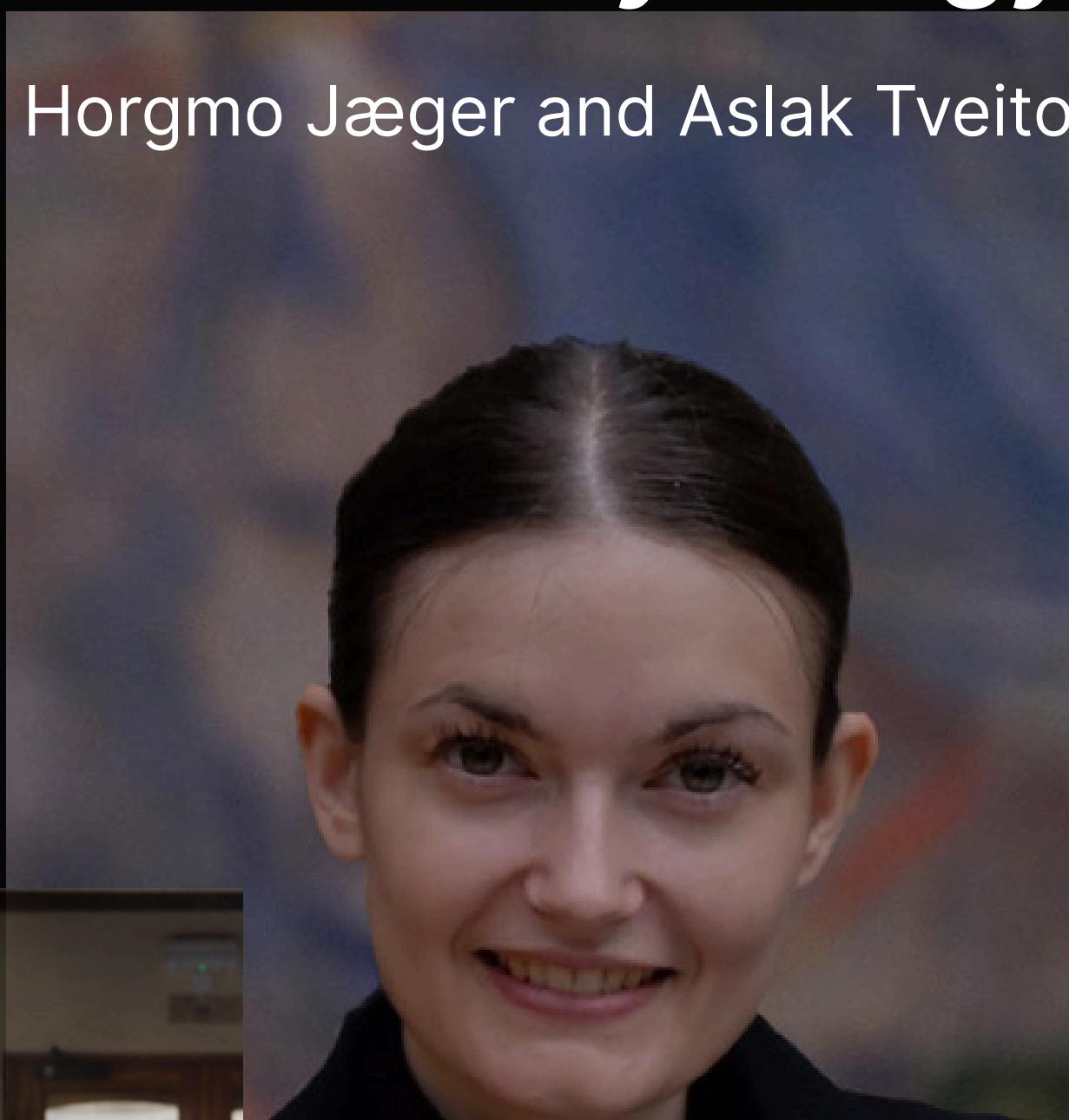
led by Marianne Fyhn

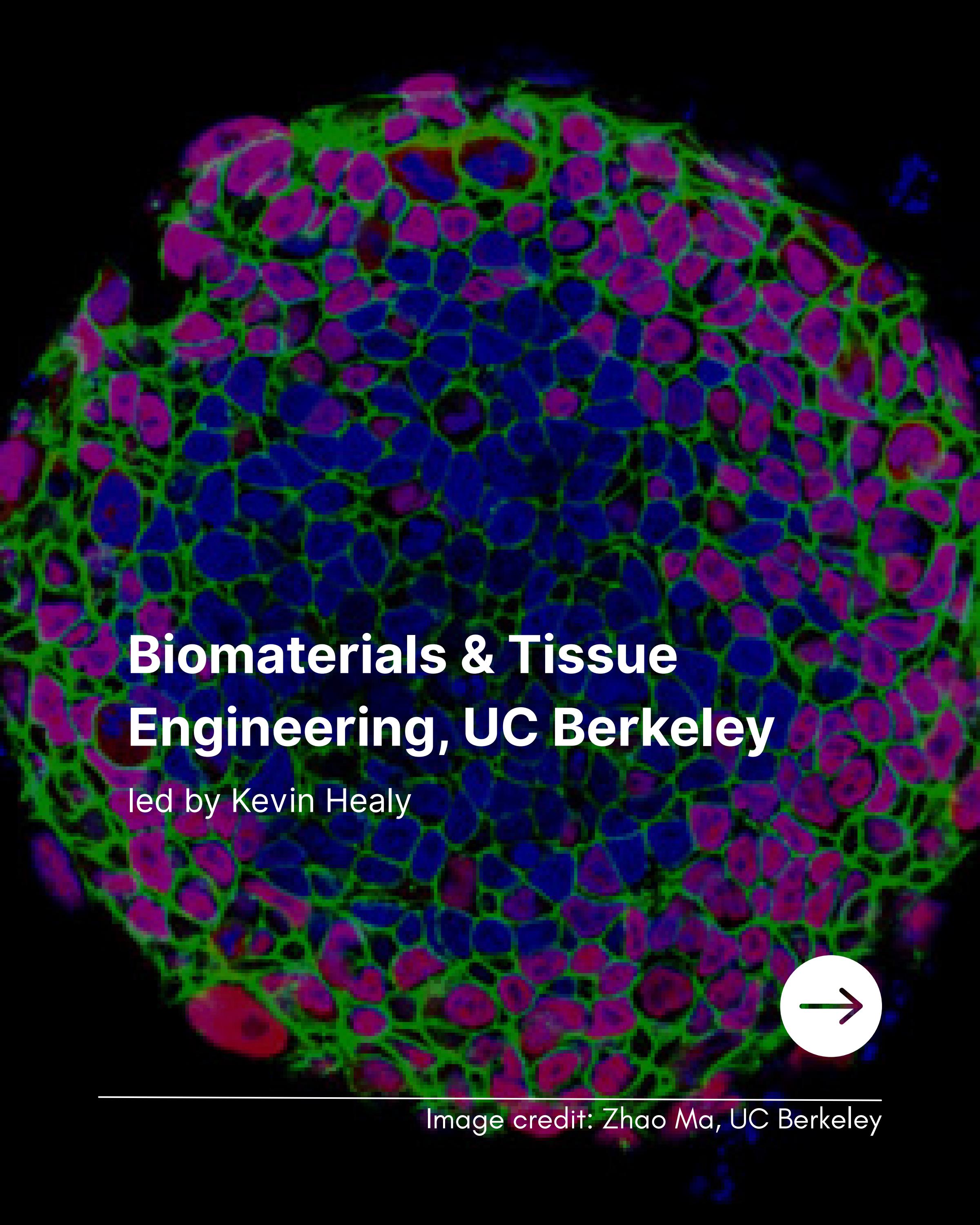


# Simula Research Laboratory

## Computational Physiology

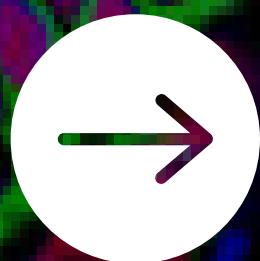
Karoline Horgmo Jæger and Aslak Tveito





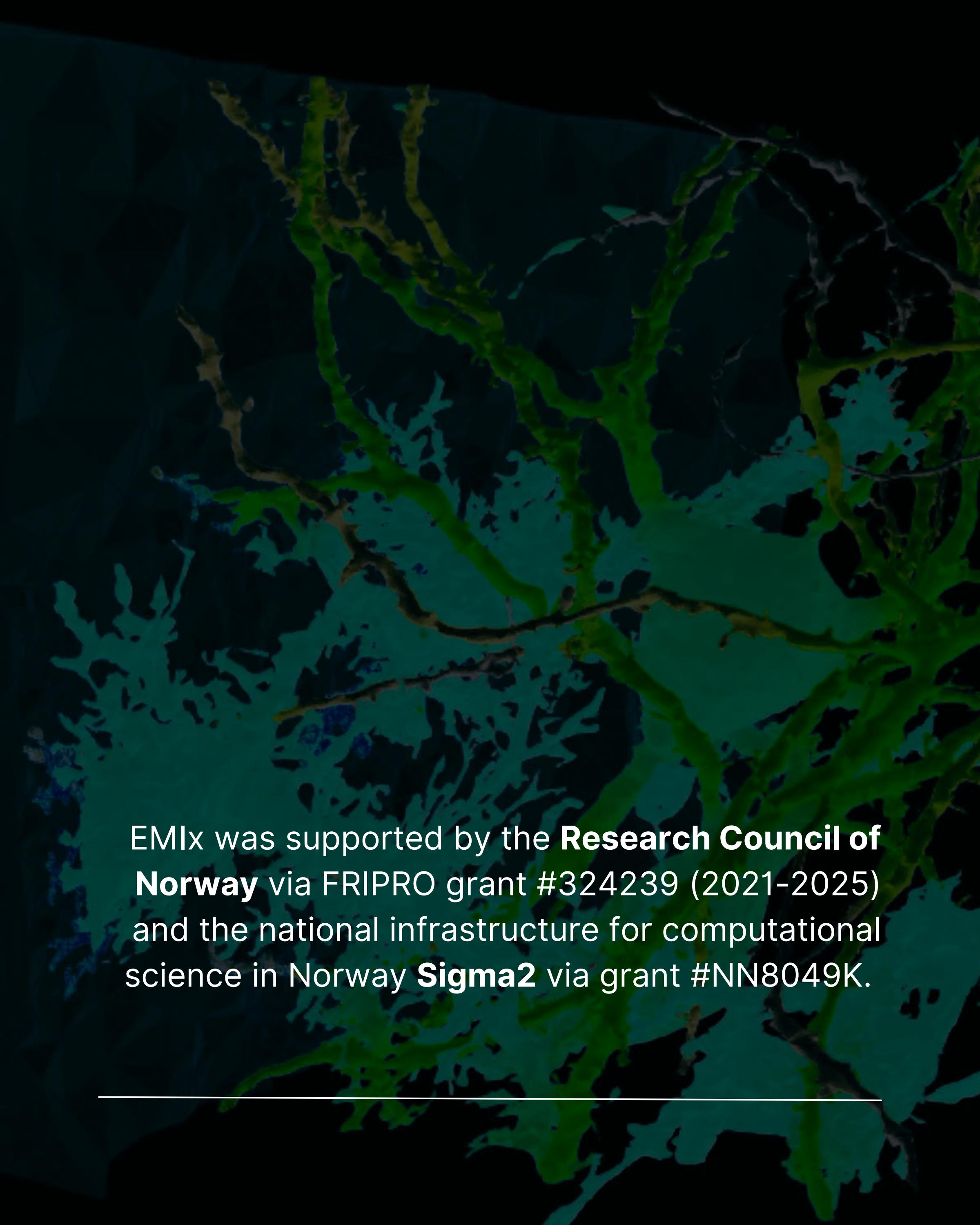
# Biomaterials & Tissue Engineering, UC Berkeley

led by Kevin Healy



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Image credit: Zhao Ma, UC Berkeley



EMIx was supported by the **Research Council of Norway** via FRIPRO grant #324239 (2021-2025) and the national infrastructure for computational science in Norway **Sigma2** via grant #NN8049K.

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## Image credits

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