ETH zürich
INDUSTRY DAY

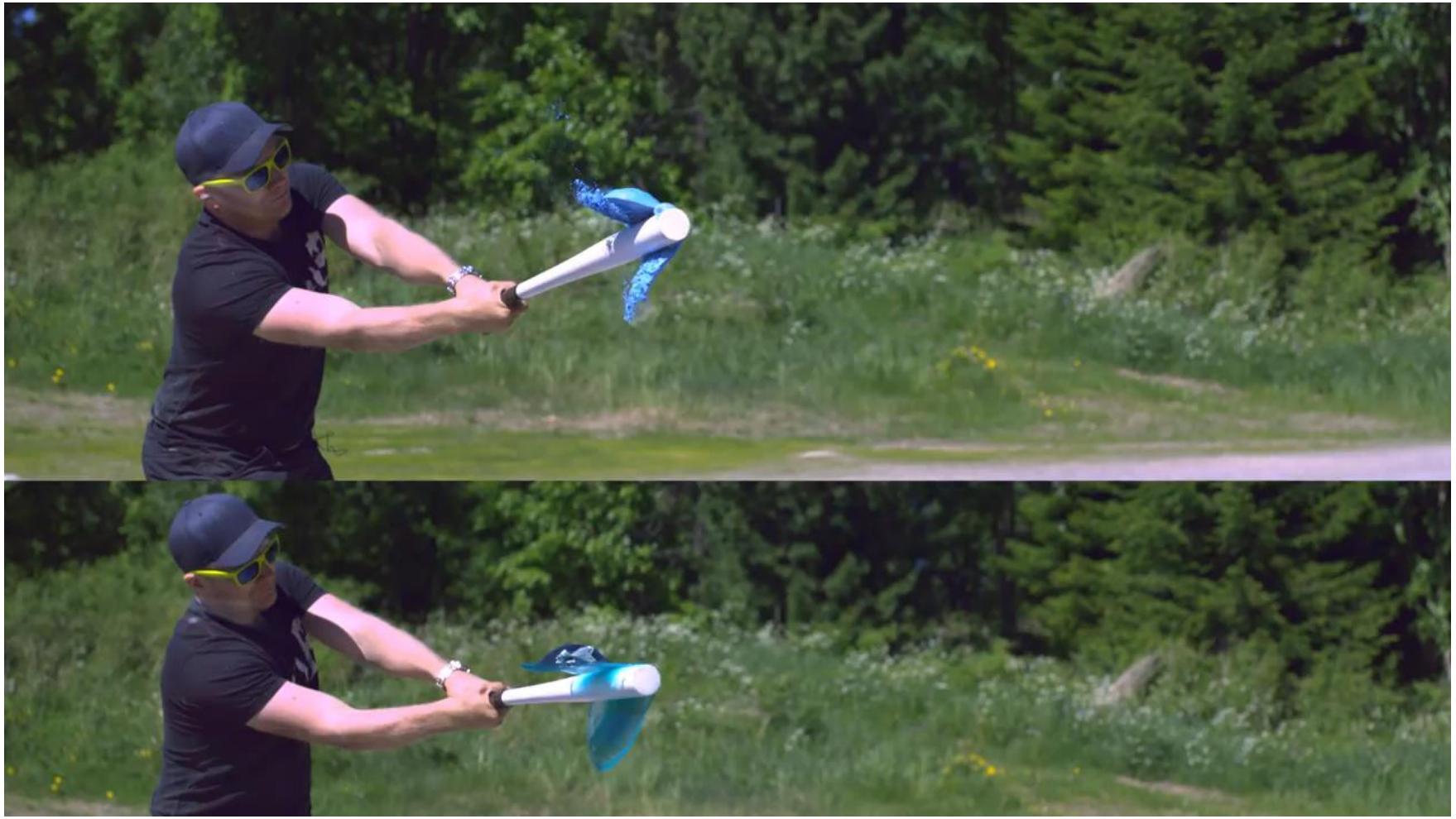
Laboratory for Soft Materials and Interfaces, D-MATL

To flow or not to flow: that is the question

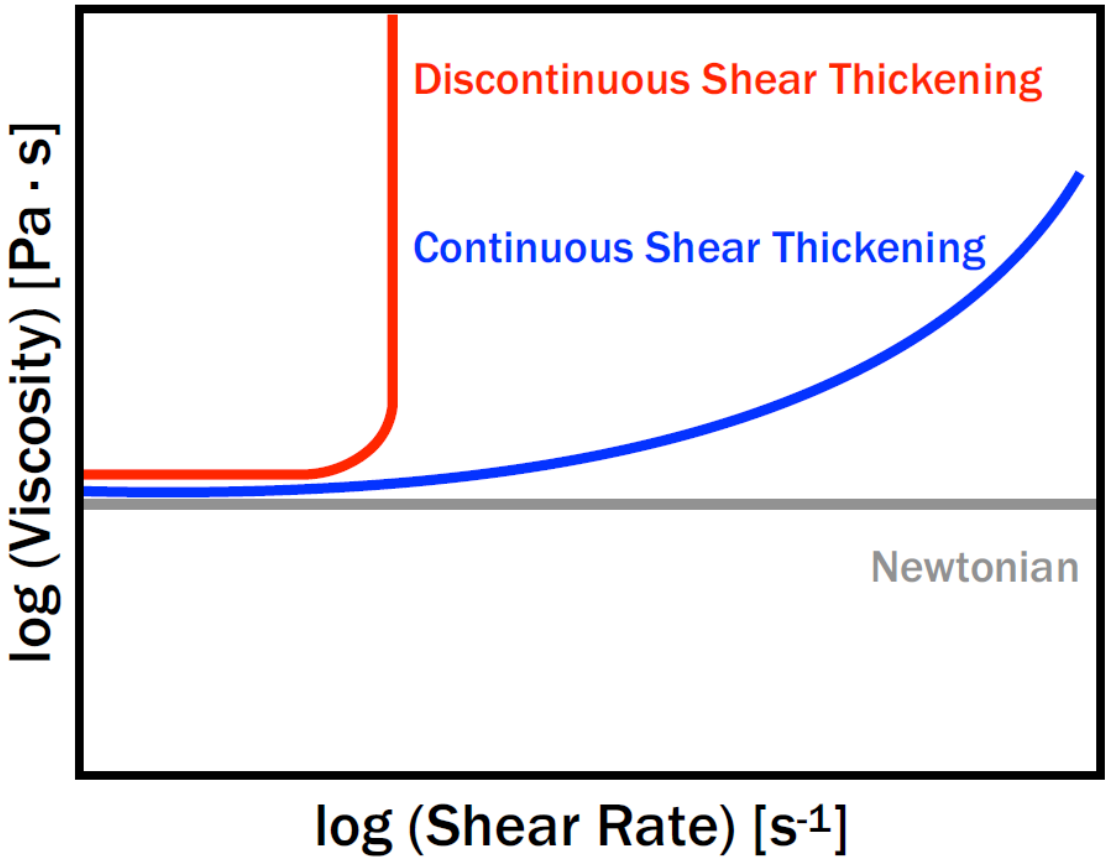
(for the processing of concentrated pastes!)

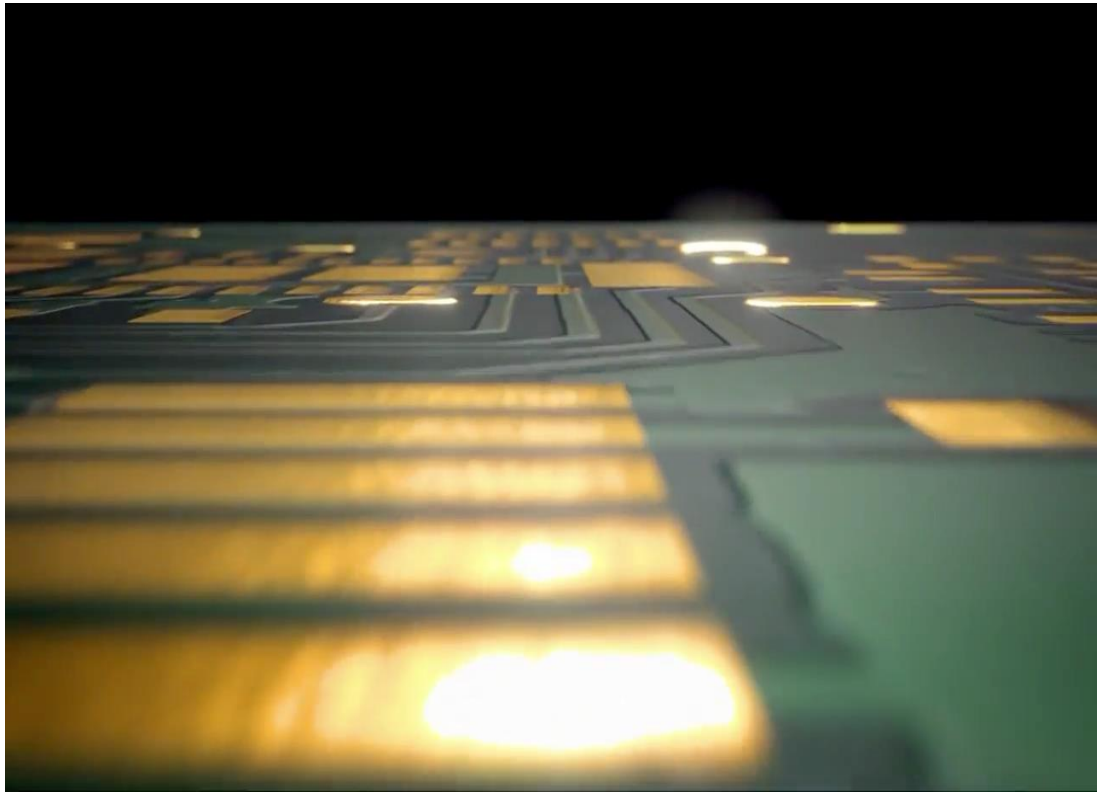
Prof. Dr. Lucio Isa
Department of Materials,
Laboratory for Soft Materials and Interfaces

Shear-thickening fluids: when liquids become solid



When shear thickening becomes a problem for industry

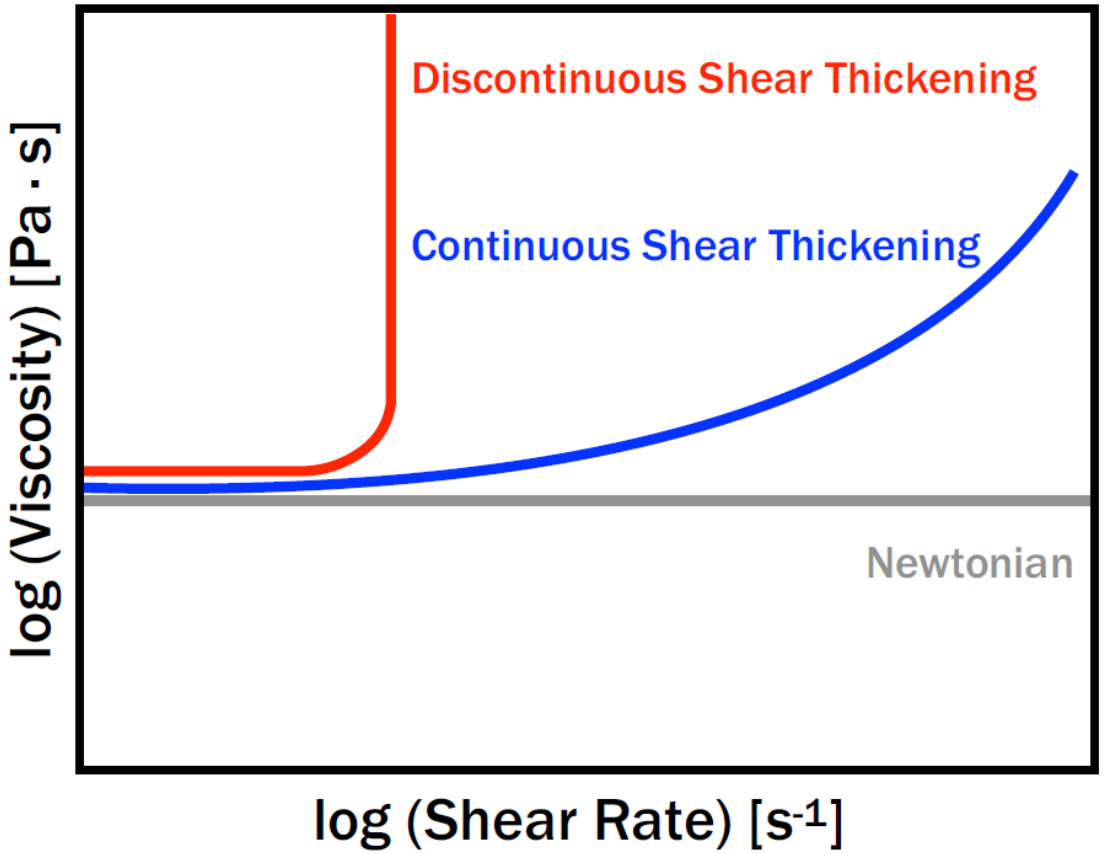




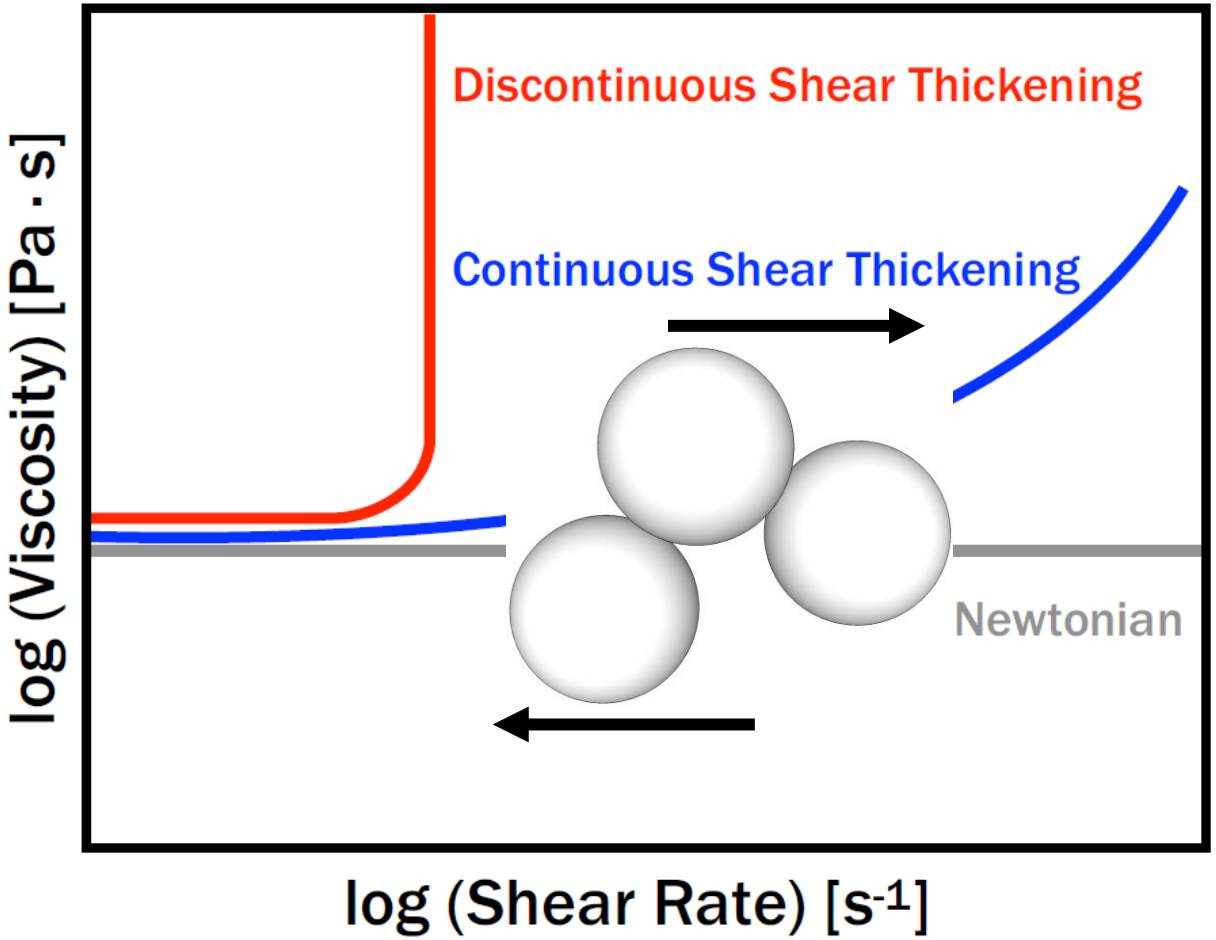
https://www.youtube.com/watch?v=OLSxOJEs1N8

When shear thickening becomes a problem for industry

https://www.concrete2you.com

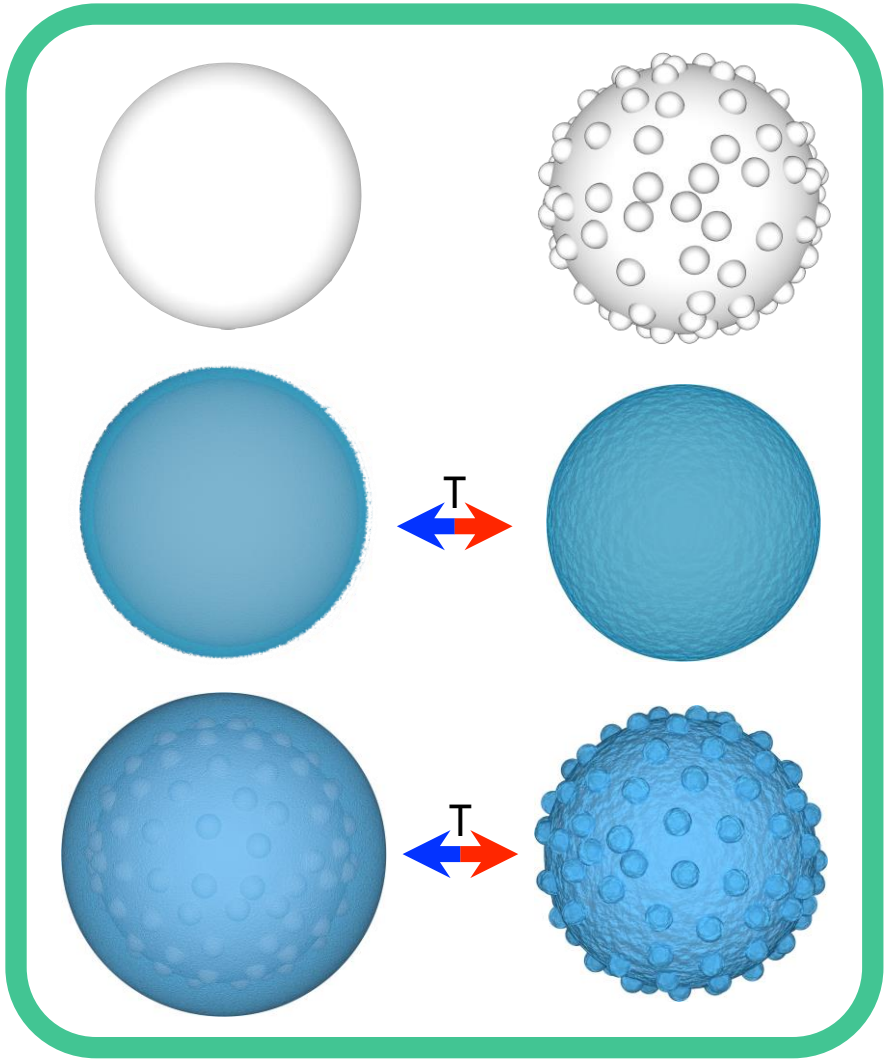


When shear thickening becomes a problem for industry

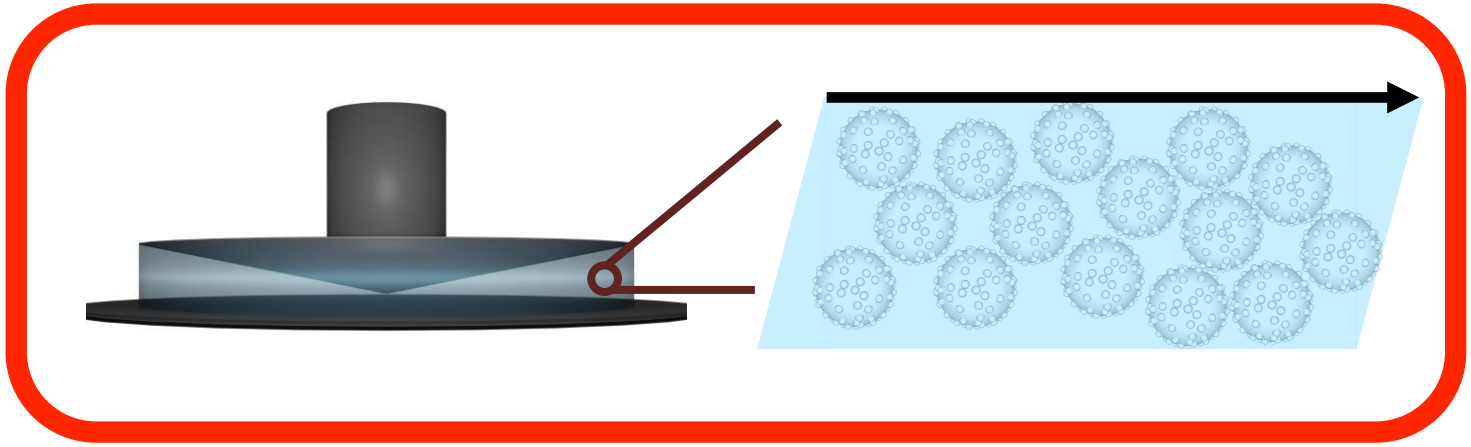


Our research: from nanoscale contacts to macroscopic flows

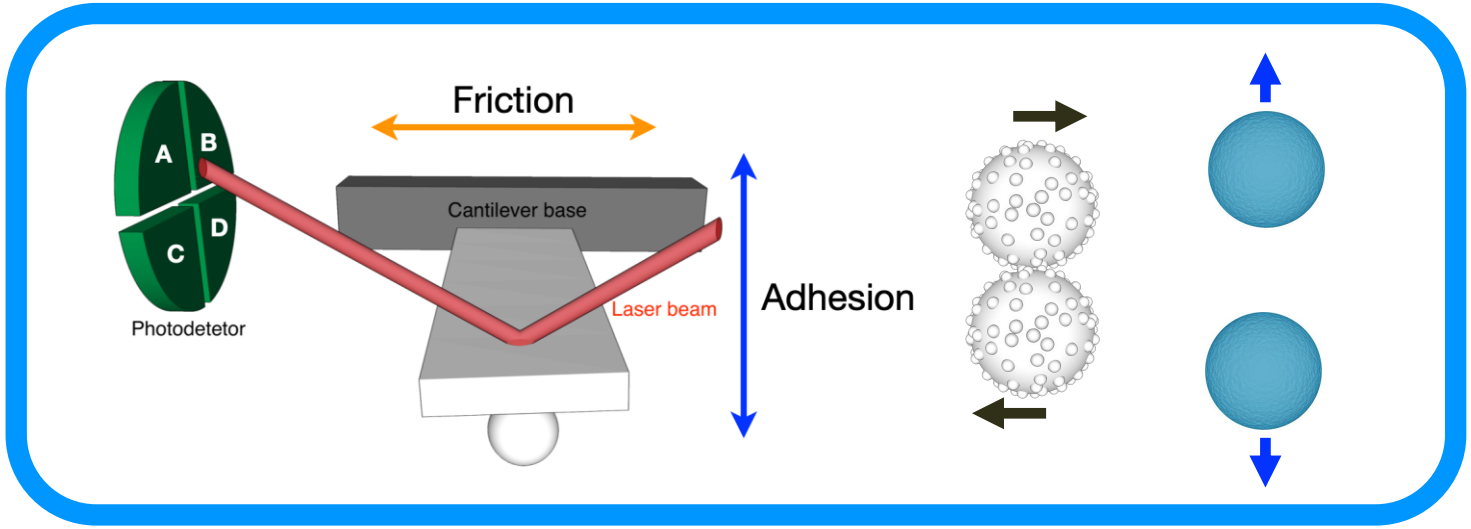
Colloidal Model Systems



Macroscopic Rheology



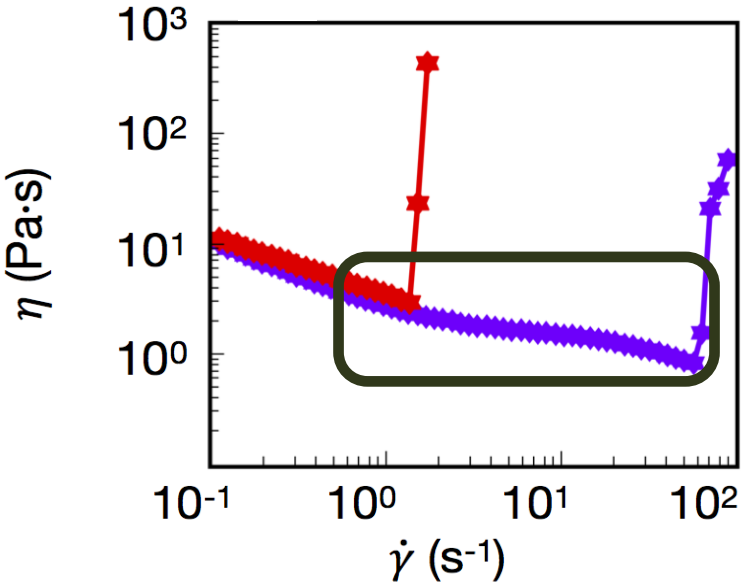
Nanotribological Contacts

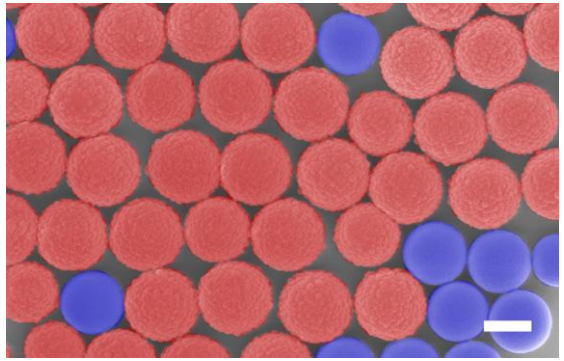


Particle engineering-based solutions

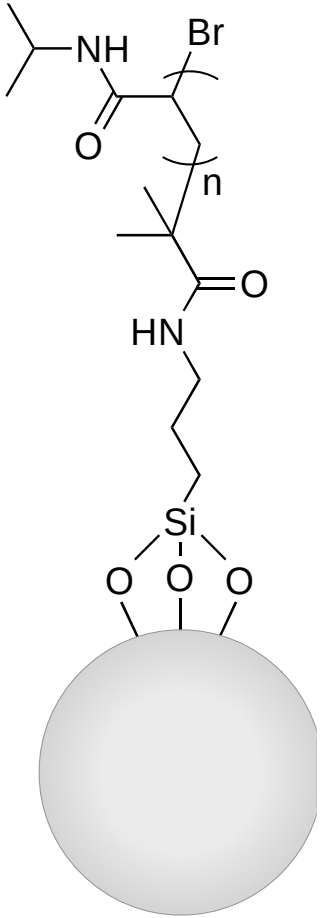
New characterization methods

Particle-based additives





Functional coatings for frcition reduction



ETH zürich
INDUSTRY DAY

Thank you for your attention!

Professor Lucio Isa
Lucio.isa@mat.ethz.ch

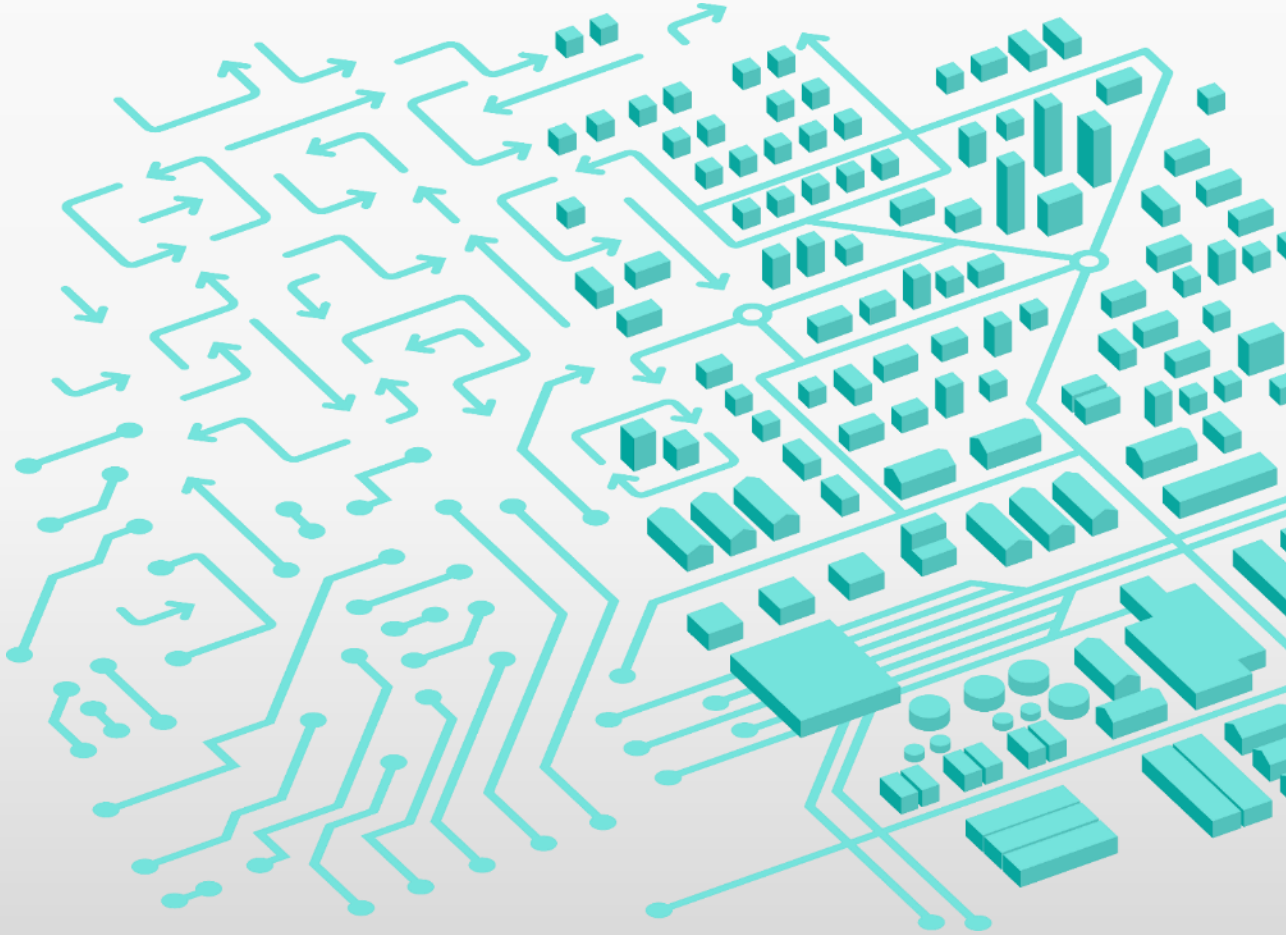
ETH Zurich
Laboratory for Soft Materials and Interfaces
HCI H 525
Vladimir-Prelog-Weg 1-5/10
8093 Zurich, Switzerland

Swiss National Science Foundation

NCCR Automation

Automation

The answer to all buzzwords.



Dr. Claudia Fischer

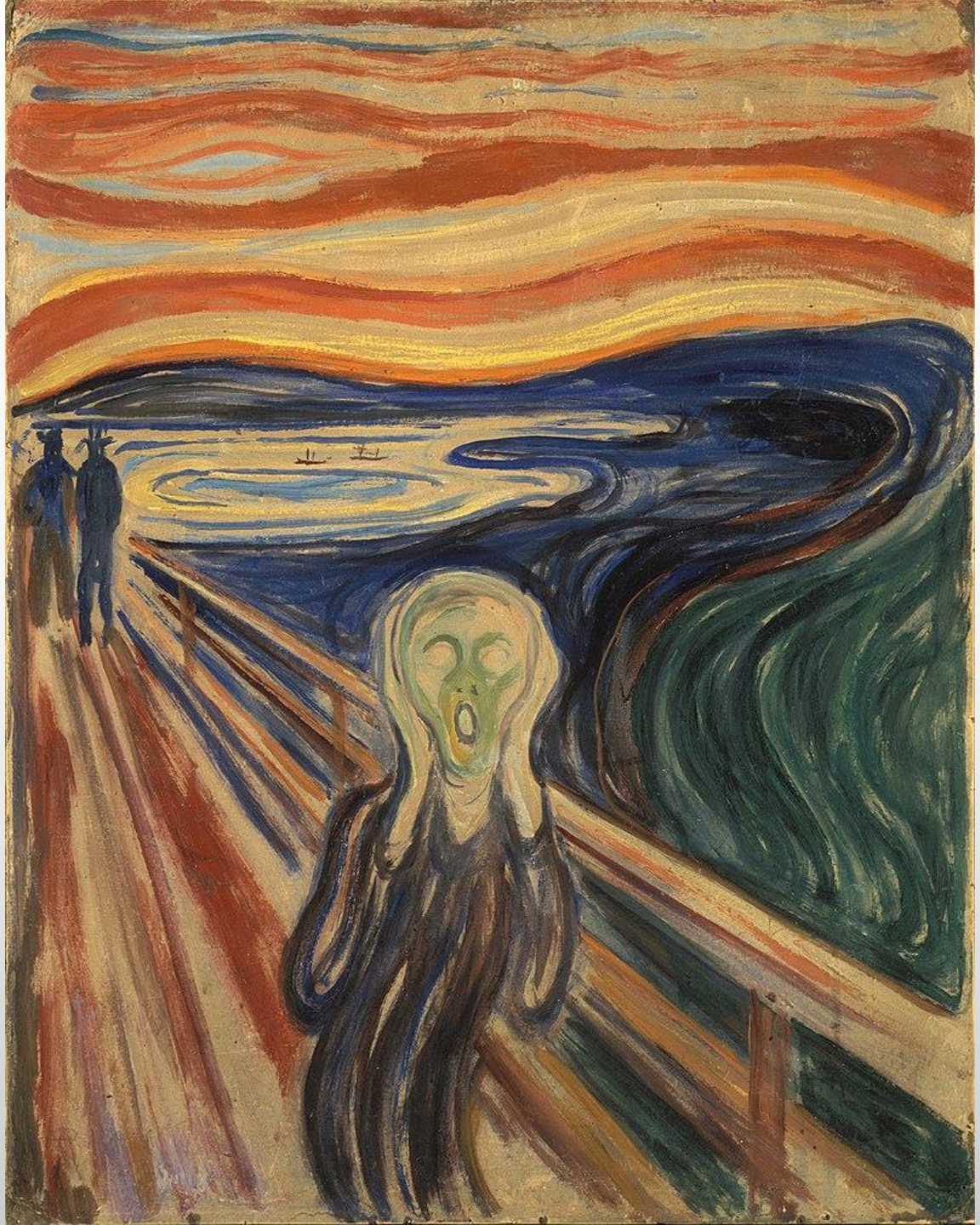
The National Centers of Competence in Research (NCCR) are a research instrument of the Swiss National Science Foundation.

Quick questions:

How far are you with Industry 4.0?

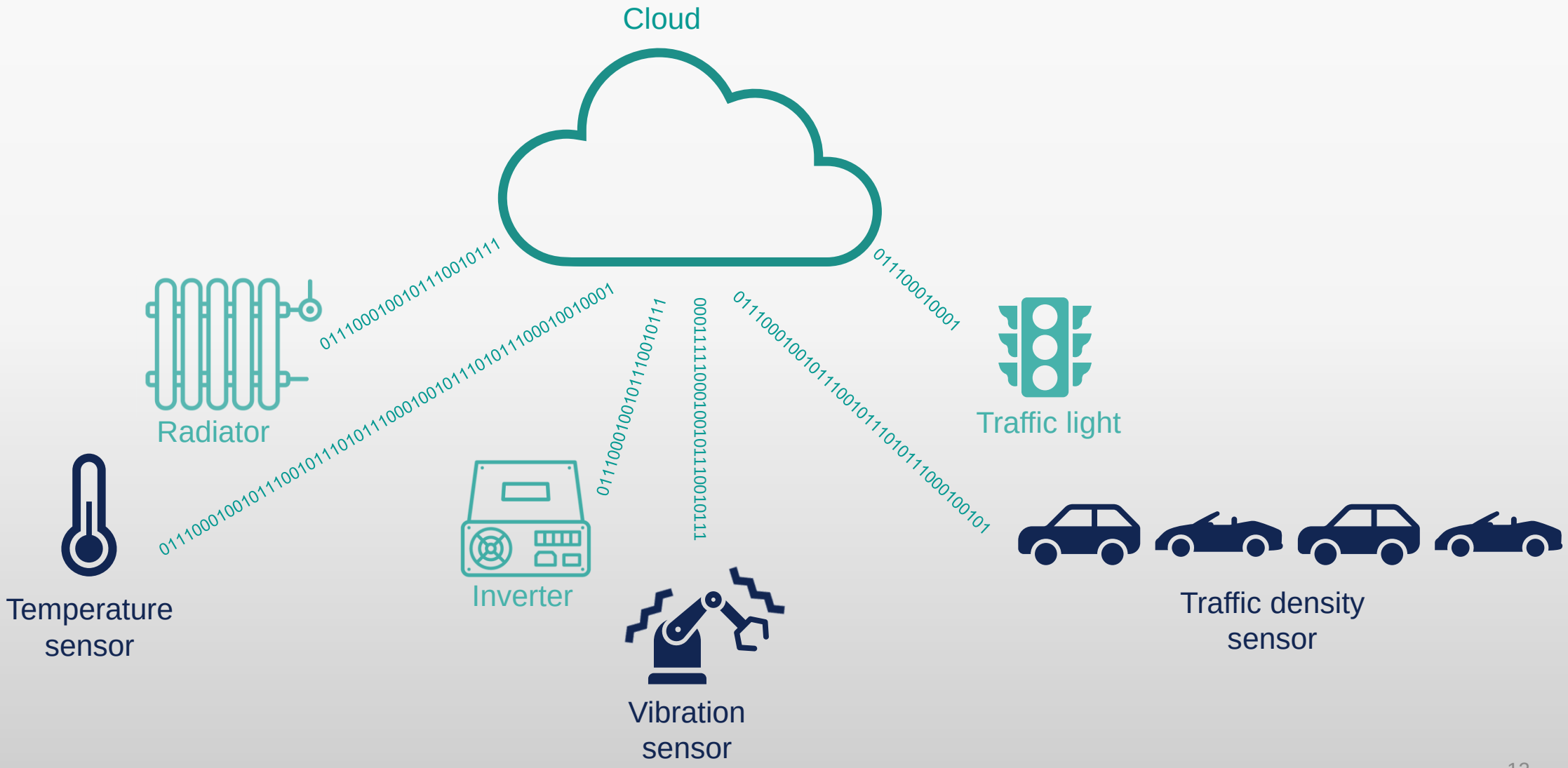
What is your IoT strategy?

Shouldn’t you be doing something with AI?



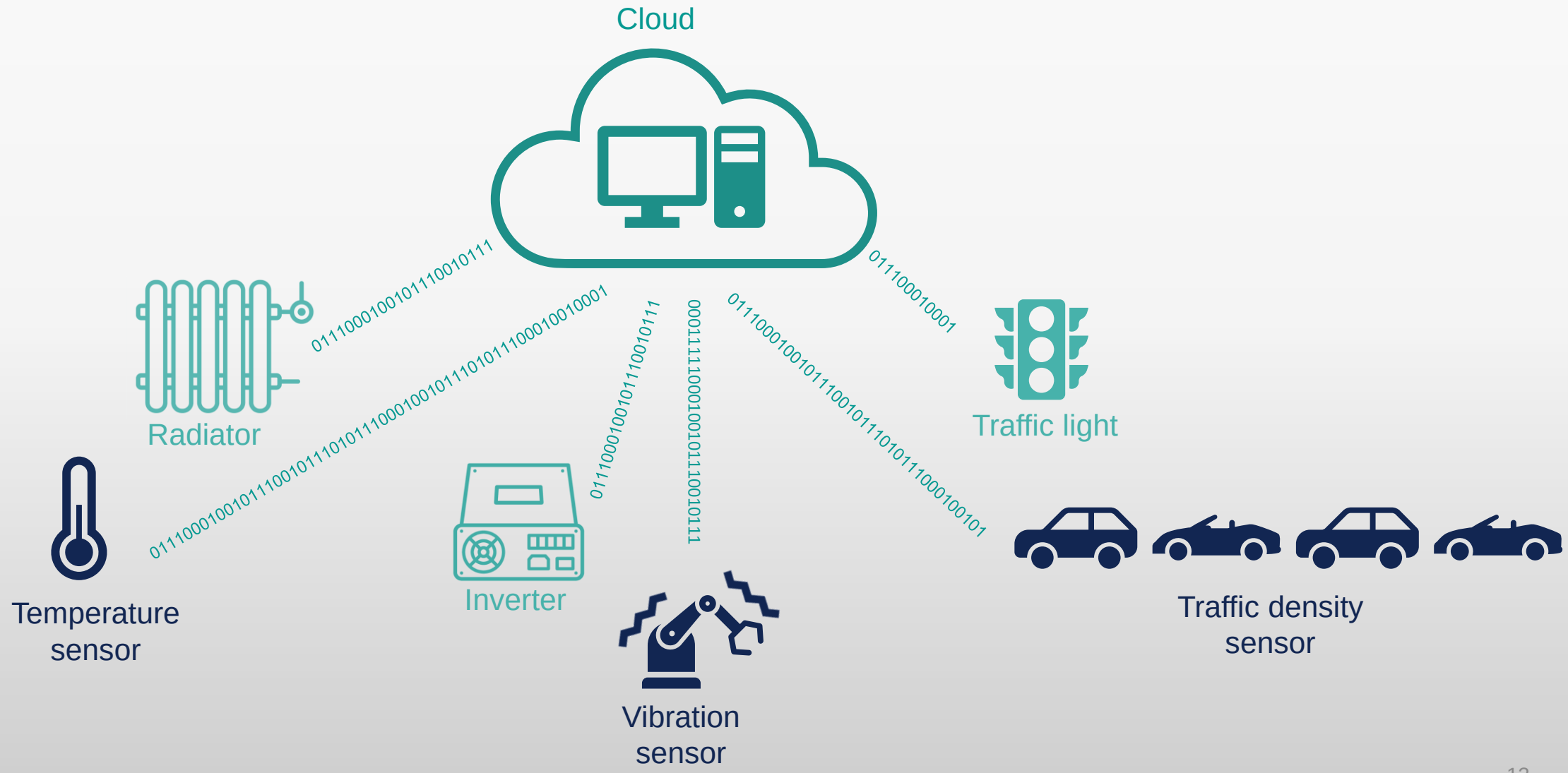
Picture source:
https://commons.wikimedia.org/w/index.php?curid=37624942

Internet of Things (IoT)



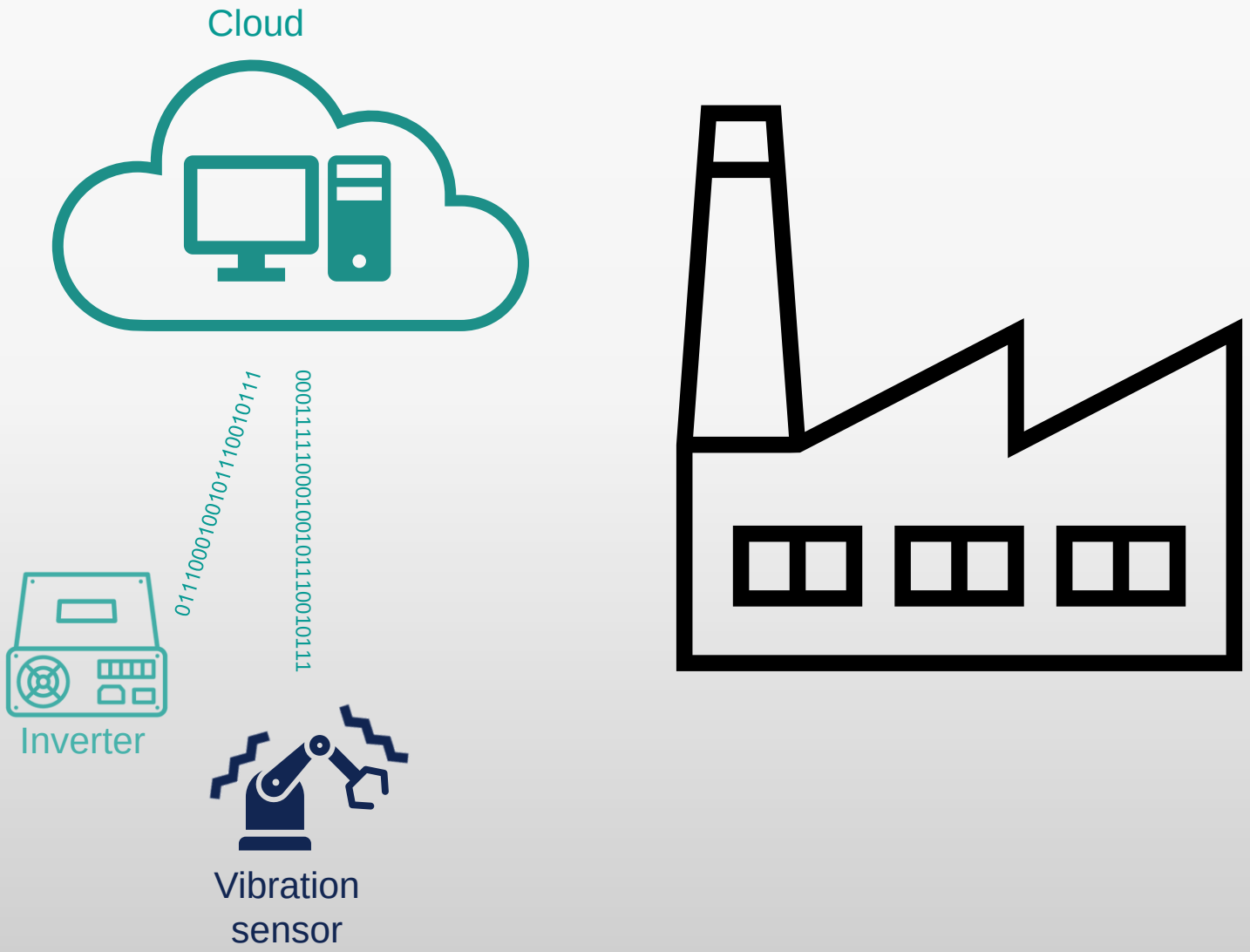
Illustrations: MS Office and Vecteezy.com

Artificial Intelligence (AI)



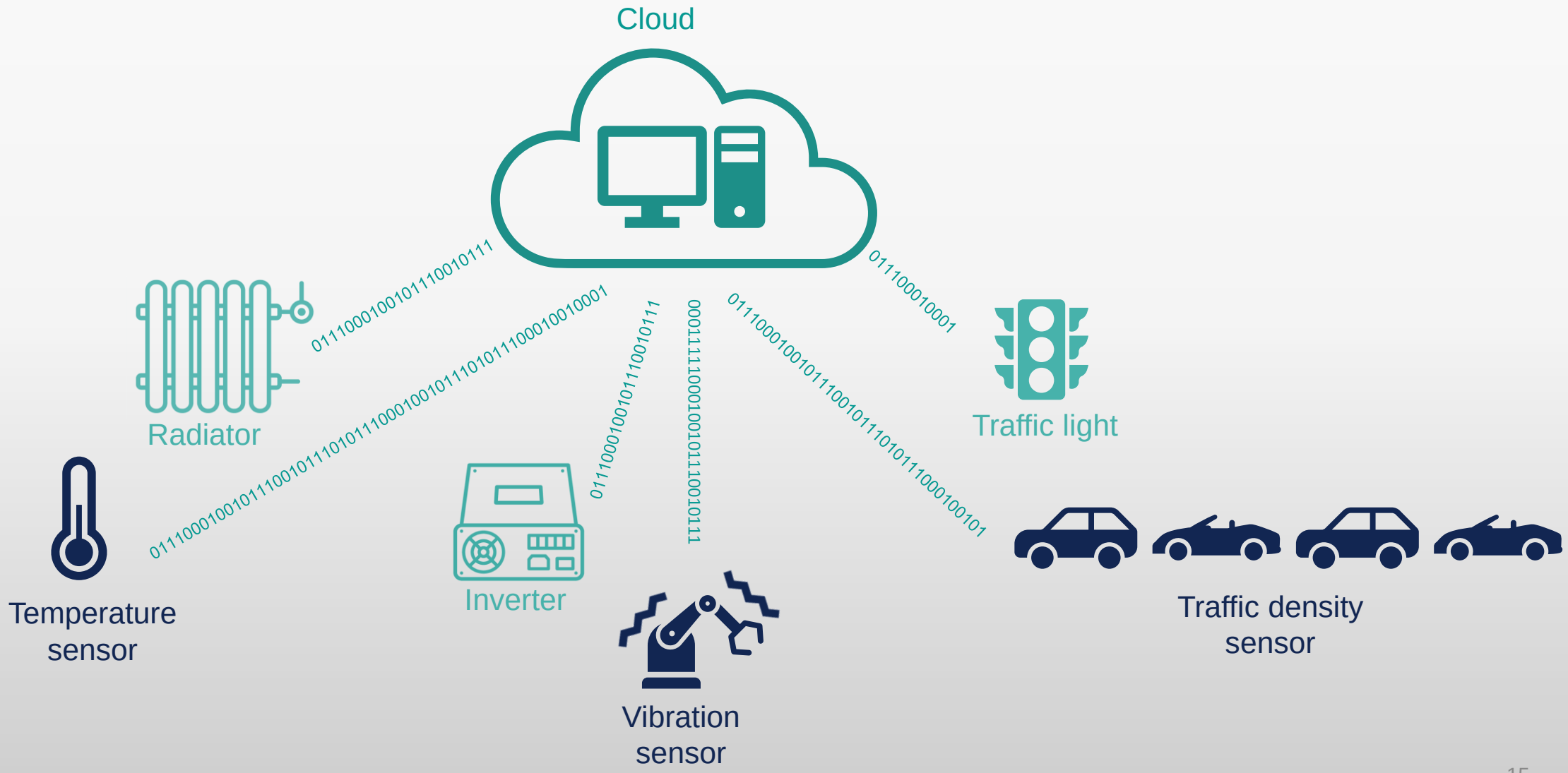
Illustrations: MS Office and Vecteezy.com

Industry 4.0



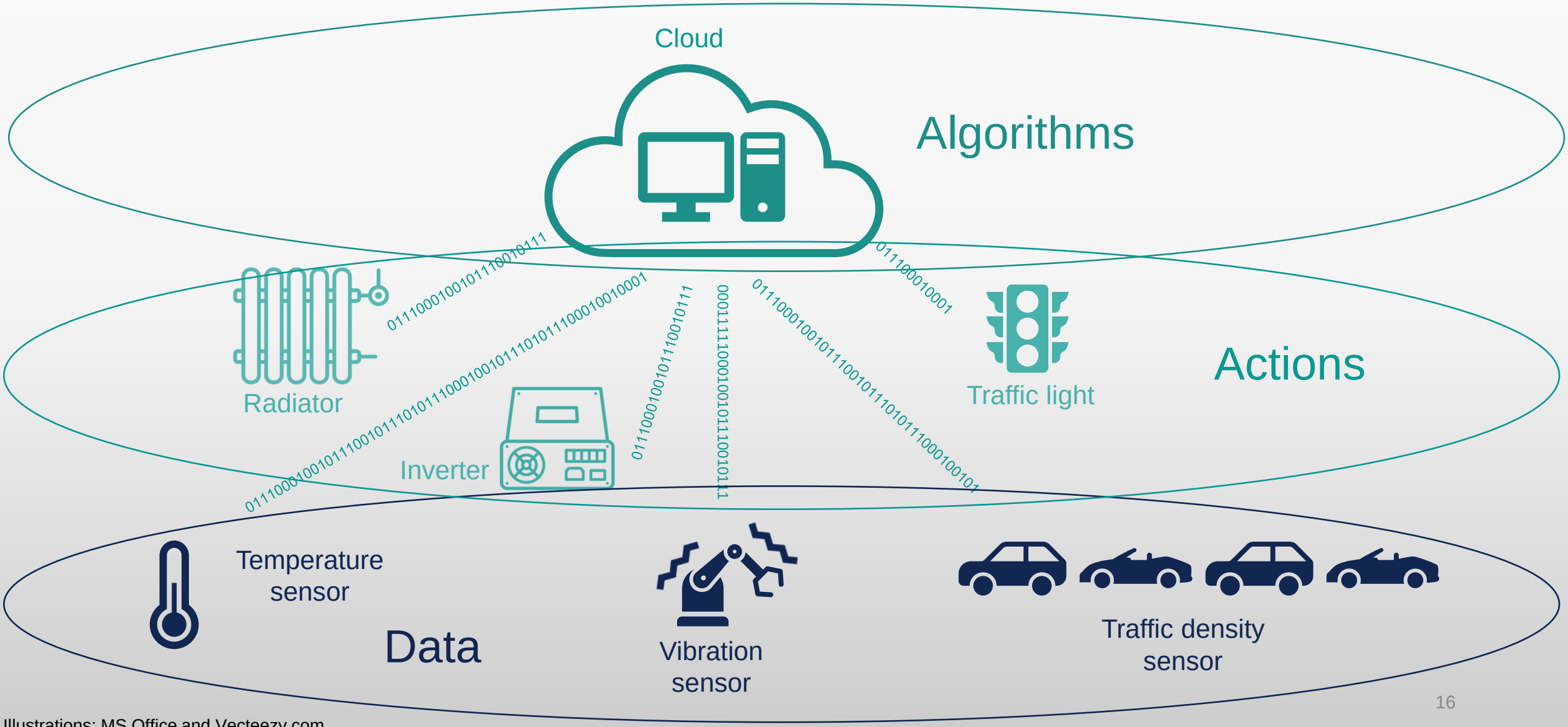
Illustrations: MS Office and Vecteezy.com

Digitalisation



Illustrations: MS Office and Vecteezy.com

Automation!



Illustrations: MS Office and Vecteezy.com

NCCR Automation – Research organisation

NCCR Automation

25+ Principal Investigators

70+ PhDs & Postdocs

Automatic Control

Director
Prof. John Lygeros

Smart Grid

Co-Director
Prof. Gabriela Hug

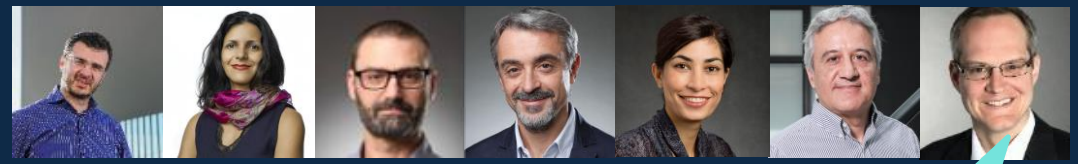
Robotics

inspire

Autonomous Vehicles

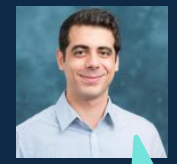
ETH zürich

EPFL



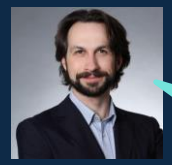
Fairness in Automation

Artificial Intelligence



Industrial Automation

Empa
Materials Science and Technology



Energy Management

Operation Management

Social Science of Automation

zh aw School of Engineering

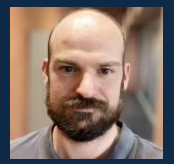
Advanced Manufacturing

OST Ostschweizer Fachhochschule

University of Basel

n|w University of Applied Sciences and Arts Northwestern Switzerland

SUPSI



University of Zurich[UZH]

Collaborations with industry

Municipalities

WEW Walenstadt:
Energy grids of the future

Sisslerfeld (AG)
Sustainable industrial parks

Industry/Academia workshops

- 1-day, 5 companies, 15 engineers, 15 NCCR Automation researchers
- Companies present control challenges
- Researchers present new control methods
- Discussion and brainstorming
- Collaboration opportunities

Companies

BELIMO, iwb, HILTI, EKZ, ALPIQ, swissgrid, tpf, HAMILTON, ELESTA Member of the PILZ Group, ABB, FESTO, SIEMENS, CARGO SOUS TERRAIN, maxon, AEW Ihre Energie., STADLER, MITSUBISHI ELECTRIC, BÜHLER, SBB CFF FFS, INFICON

How to get in touch

- Come talk to us at the NCCR Automation booth (AI & Robotics area)
- Website: www.nccr-automation.ch
- LinkedIn: NCCR Automation
- X: @NCCR_Automation
- Newsletter: https://nccr-automation.ch/#newsletter

How far are you with Industry 4.0?

What is your IoT strategy?

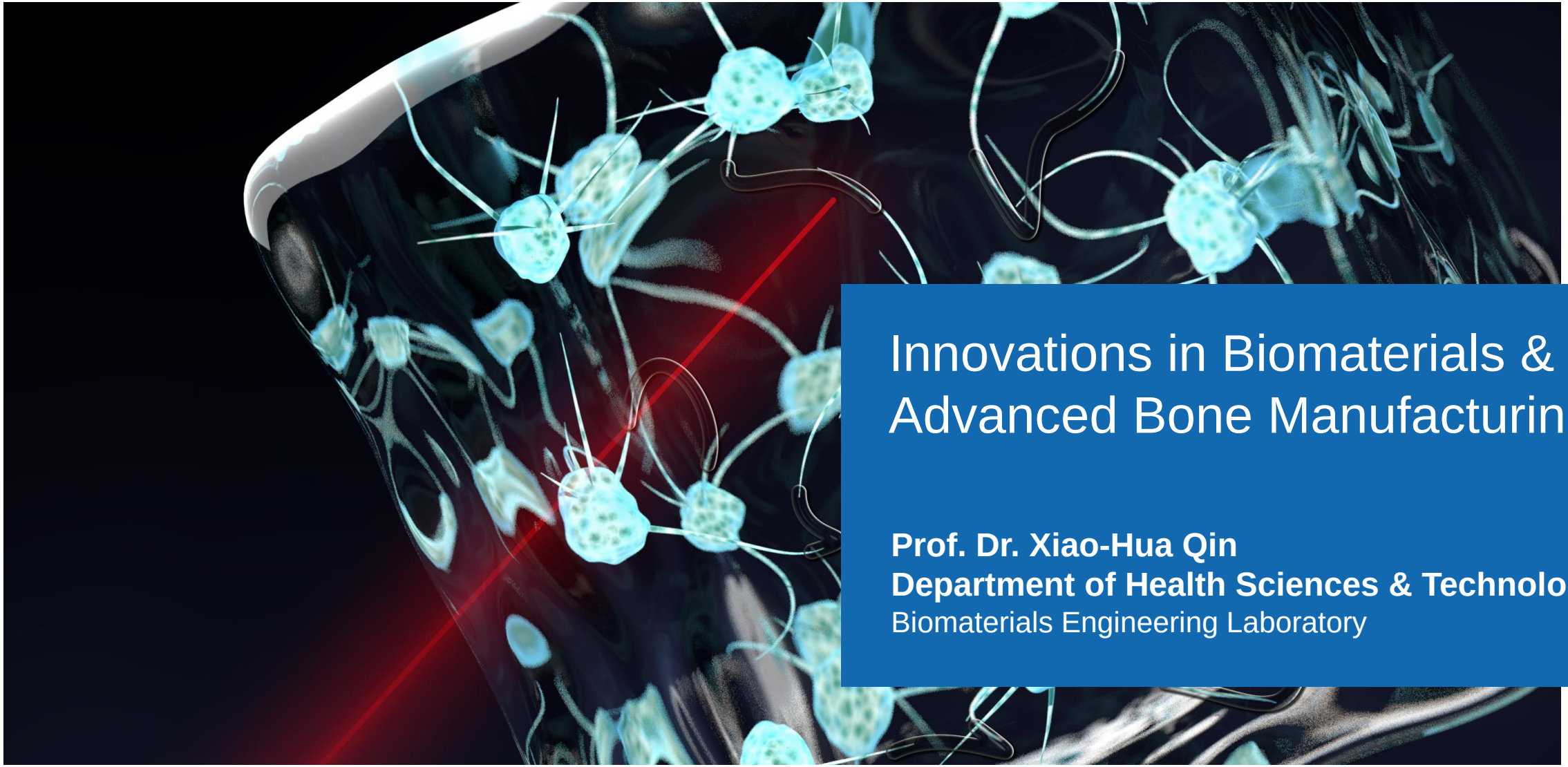
Shouldn’t you be doing something with AI?

The answer:

Automation!

Get in touch!

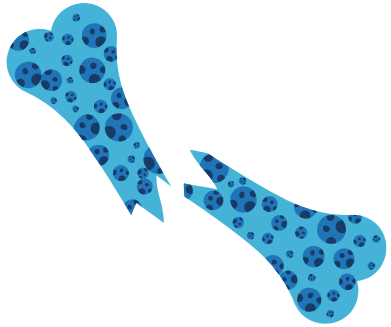
National Centre of Competence in Research Automation



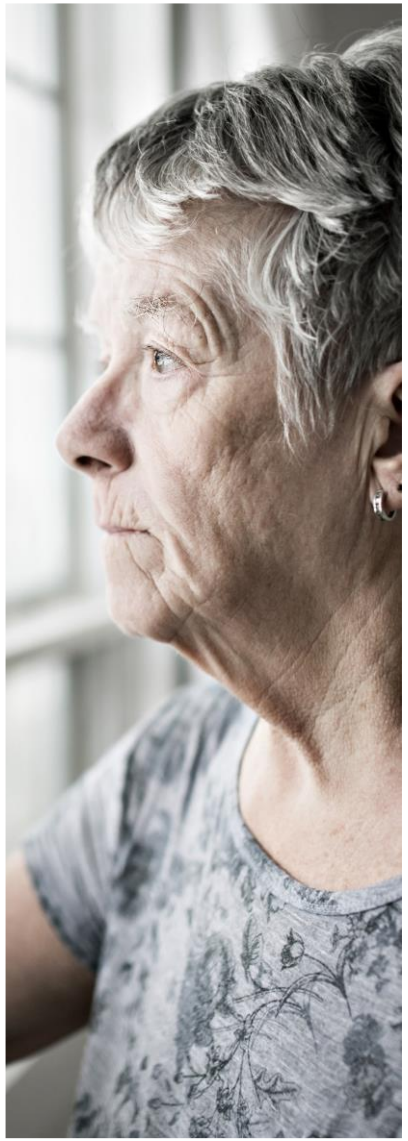
Innovations in Biomaterials & Advanced Bone Manufacturing

Prof. Dr. Xiao-Hua Qin
Department of Health Sciences & Technology
Biomaterials Engineering Laboratory

Bone health matters

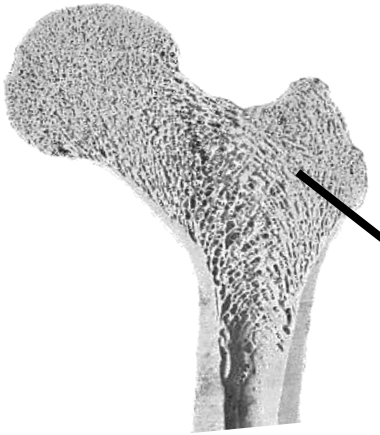


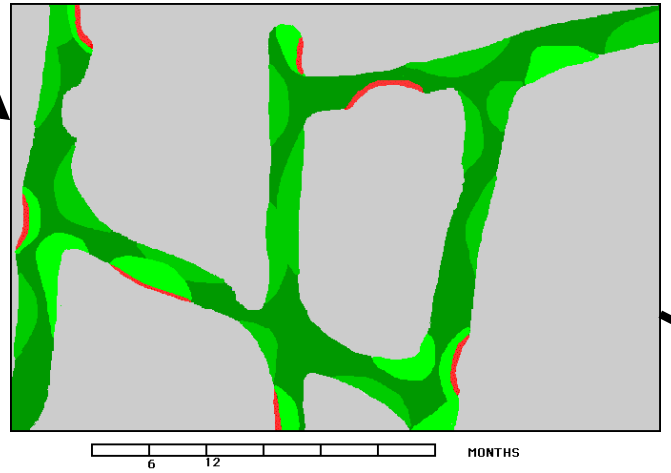
FRAGILITY
FRACTURES
€37.4
BILLION



[source: theros.org.uk/]

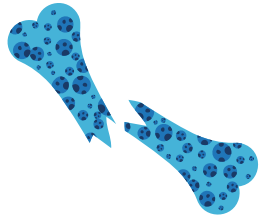
Bone health matters





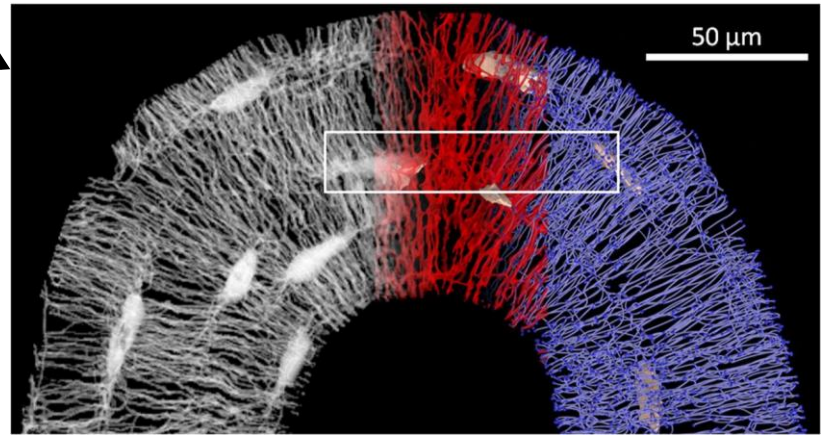
[source: http://courses.washington.edu/bonephys/]

[source: theros.org.uk/]



FRAGILITY FRACTURES

€37.4 BILLION



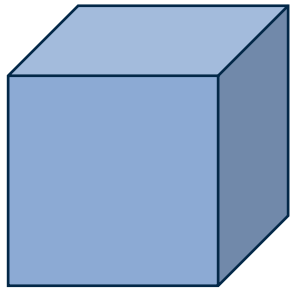
[source: R. Weinkamer - MPI]

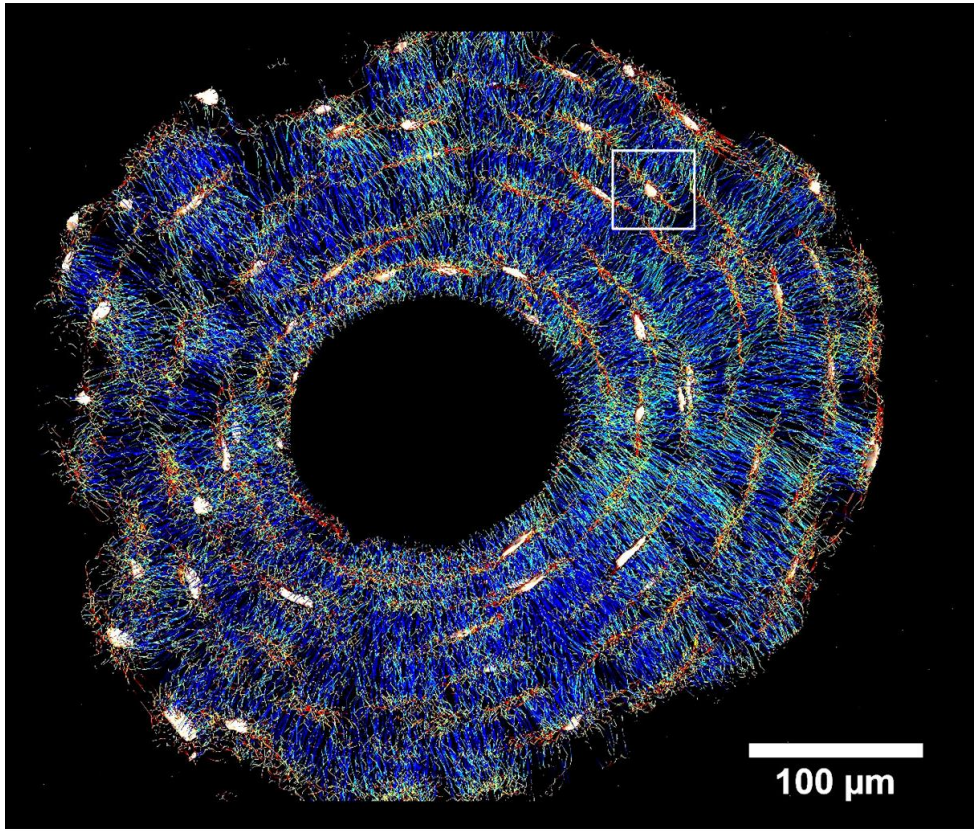
Tunnels in a rock: networks in bones

Volume fraction: **0.5%**

Density: total length of **74 km**

1 cm^3



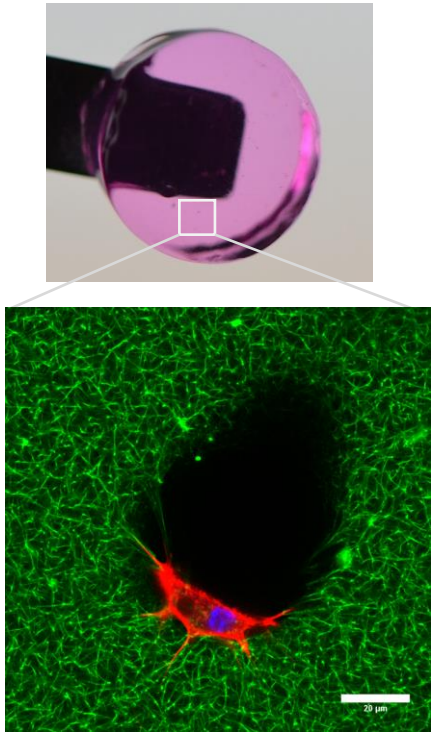


[source: R. Weinkamer - MPI]

AlpTransit Gotthard San Gottardo

Advanced manufacturing of bone models for medicine

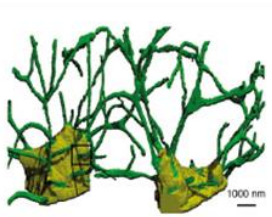
Hydrogel biomaterials

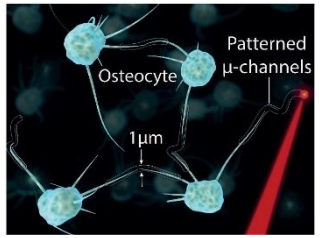


Zauchner et al. **Nat Commun** 2024, 15, 5027
Qiu et al. **Adv Funct Mater** 2023, 33, 2214393
Qin et al. **Adv Mater** 2018, 30, 1705564

3D Bioprinting

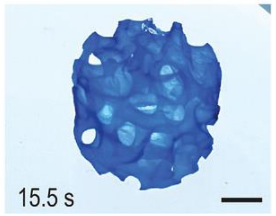
nm

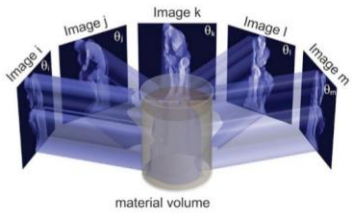




Two-photon Bioprinting

μm

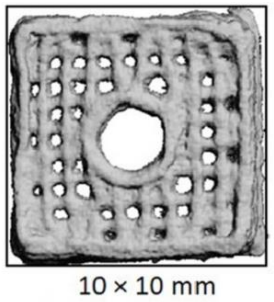


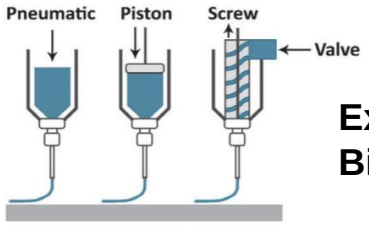


Volumetric Bioprinting

Kelly et al. **Science** 2019.

mm



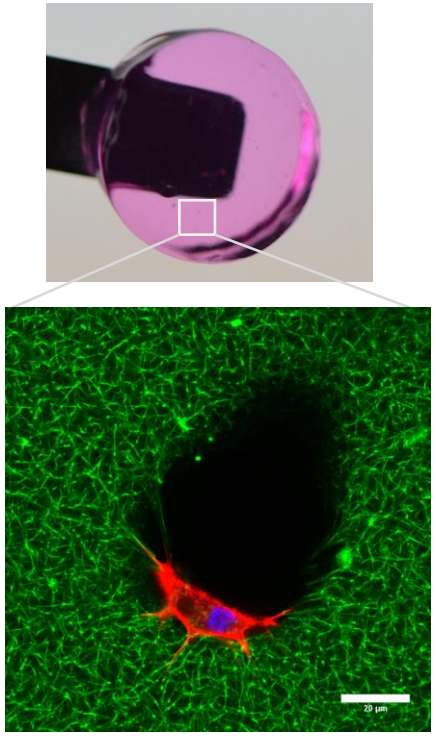


Extrusion Bioprinting

Qiu et al. **Angewandte Chemie** 2024
Gehre et al. **Acta Biomaterialia** 2024, 174, 141
Gehlen et al. **Acta Biomaterialia** 2023, 156, 49

Advanced manufacturing of miniature bone models for medicine

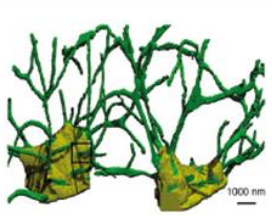
Hydrogel biomaterials

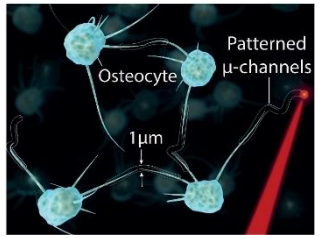


Zauchner et al. **Nat Commun** 2024, 15, 5027
Qiu et al. **Adv Funct Mater** 2023, 33, 2214393
Qin et al. **Adv Mater** 2018, 30, 1705564

3D bioprinting

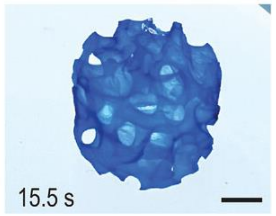
nm

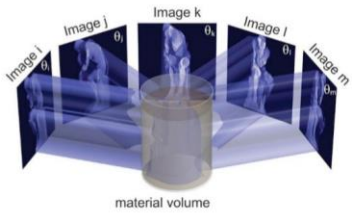




Two-photon Bioprinting

μm

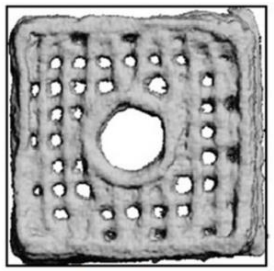


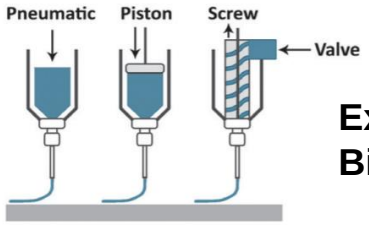


Volumetric Bioprinting

Kelly et al. **Science** 2019.

mm

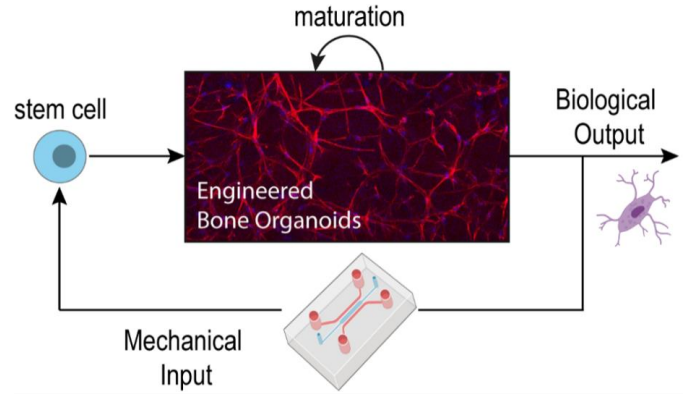




Extrusion Bioprinting

Qiu et al. **Angewandte Chemie** 2024
Gehre et al. **Acta Biomaterialia** 2024, 174, 141
Gehlen et al. **Acta Biomaterialia** 2023, 156, 49

Organ-on-a-Chip



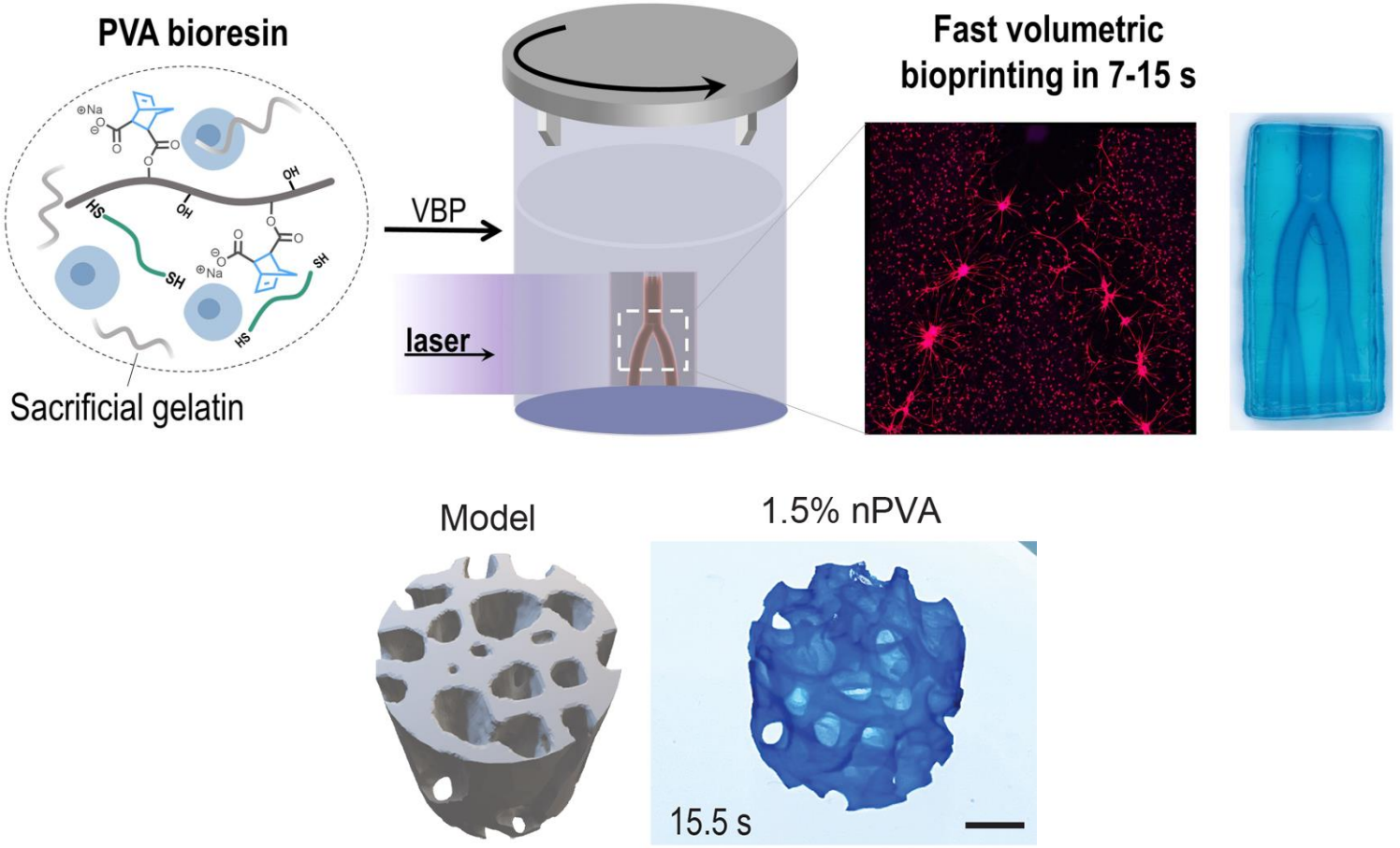
Clinical partner:

UNIVERSITÄTS-
KINDERSPITAL
ZÜRICH

Nat Commun 2024, 15, 5027

Volumetric bone bioprinting in seconds

[Source: Readily3D.com]

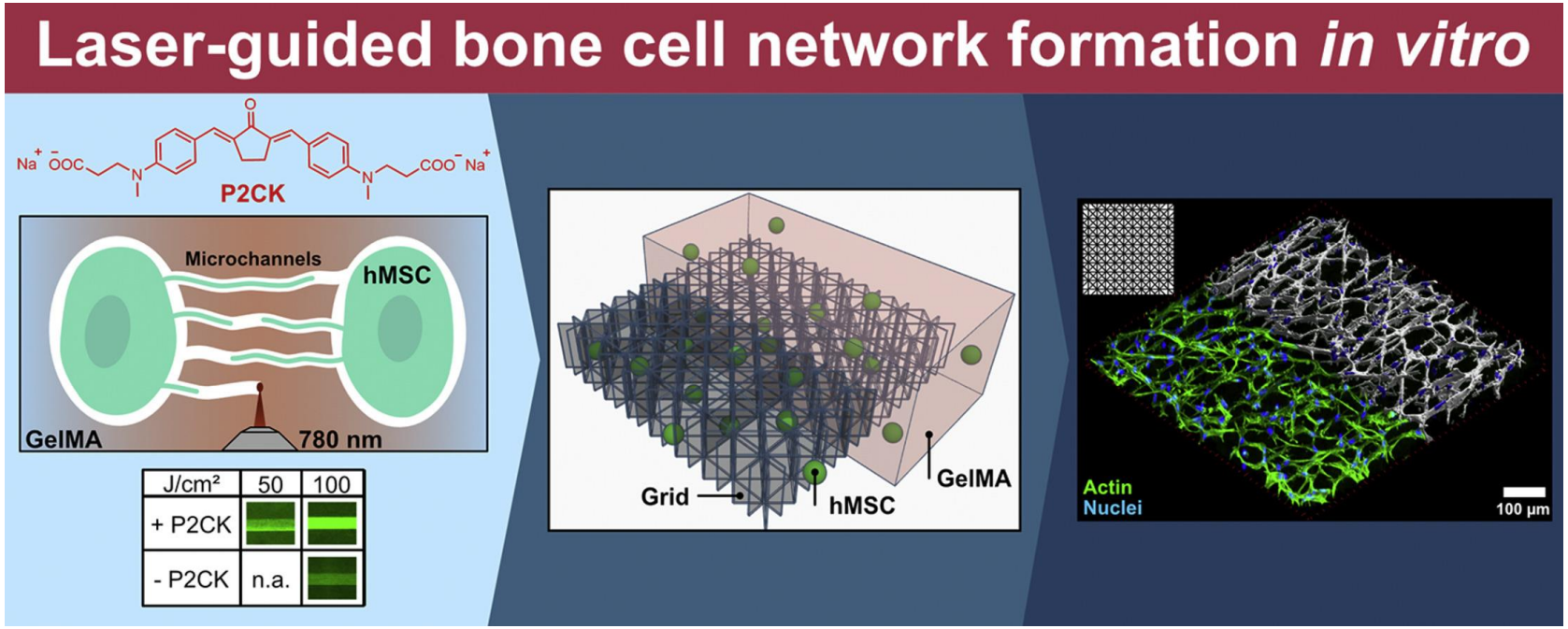


Qiu, Gehlen, Bernero, Gehre, Schädli, Müller, Qin. **Adv Funct Mater 2023**, 33, 2214393

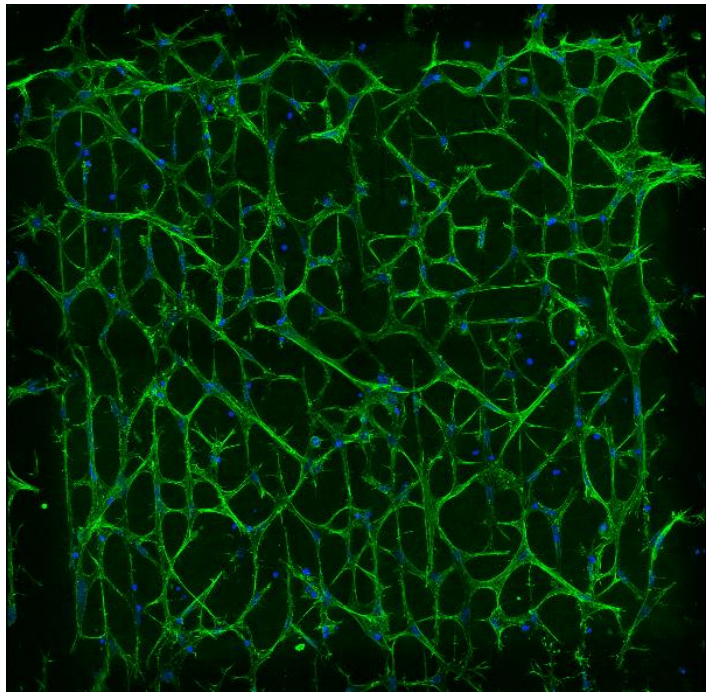
Patent Application No. PCT/EP2023/050516

Biomimicry – guiding biological growth with a grid

Laser-printed cell-guiding hydrogels

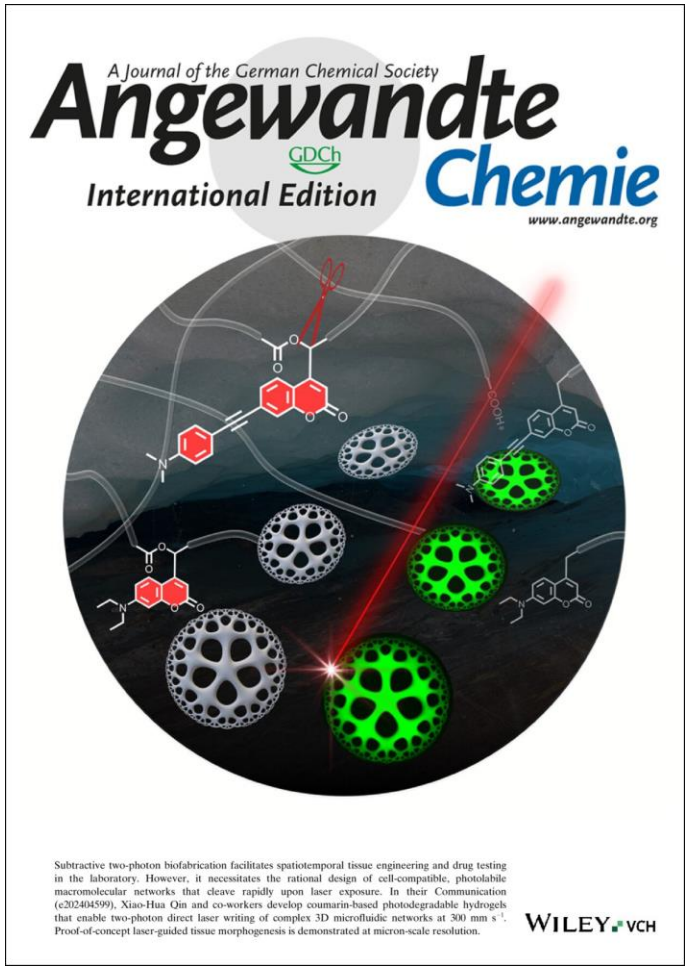


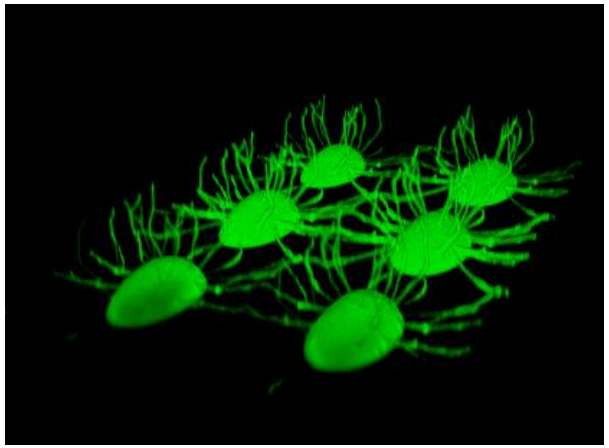
Gehre, Qiu, Jäger, Wang, Marques, Nelson, Müller, Qin. **Acta Biomaterialia 2024**, 174, 141

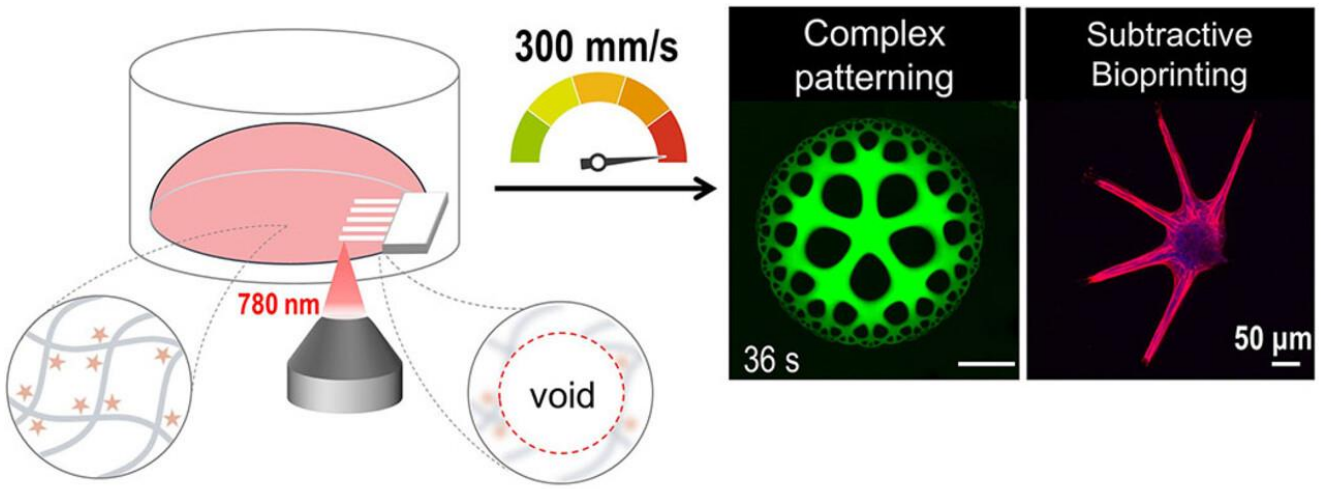


Actin Nuclei

Photodegradable hydrogels enable subtractive bioprinting at 300 mm/s



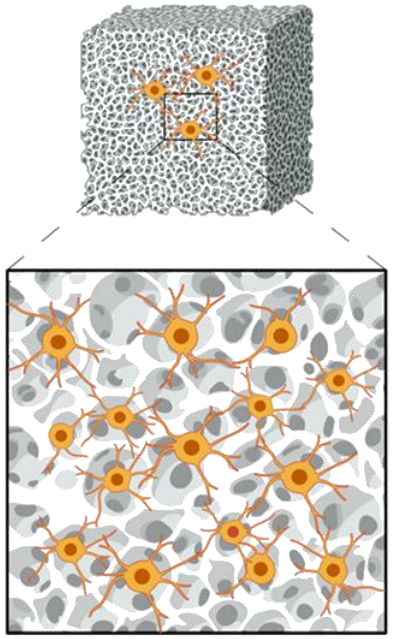


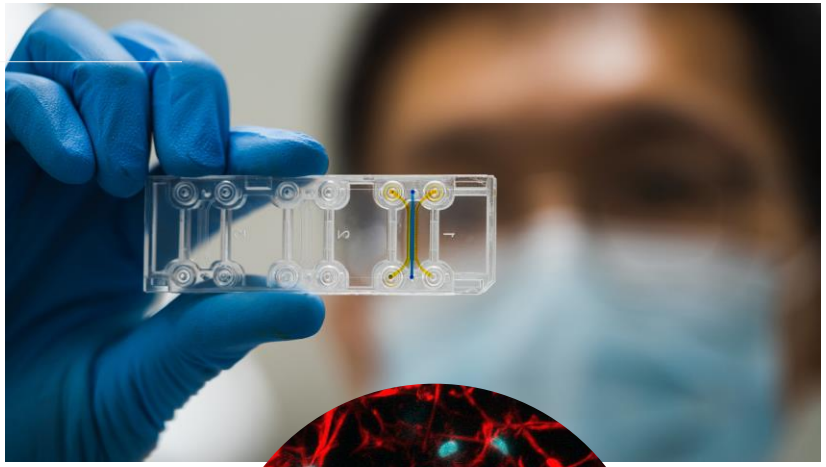


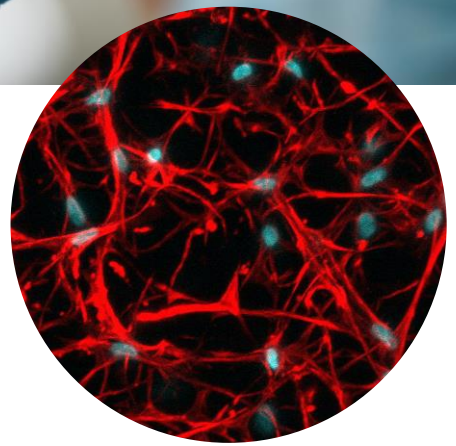
Qiu, Gehre, Nepomuceno Bao, Li, Müller, Qin. **Angewandte Chemie 2024,** e202404599.
Patent Application No. EP24188492.3.

Modeling brittle bone disease in the laboratory

New hydrogel with micropores
(5 - 20 micrometres)







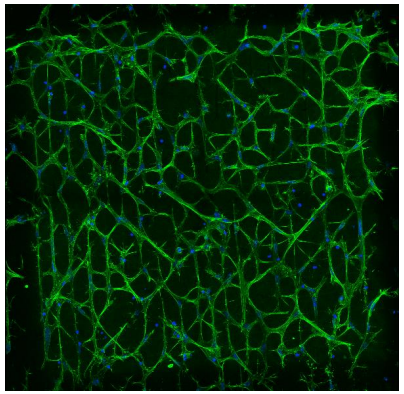
Bone cells quickly form a three-dimensional network

(Photograph: Shakata Ga Nai)

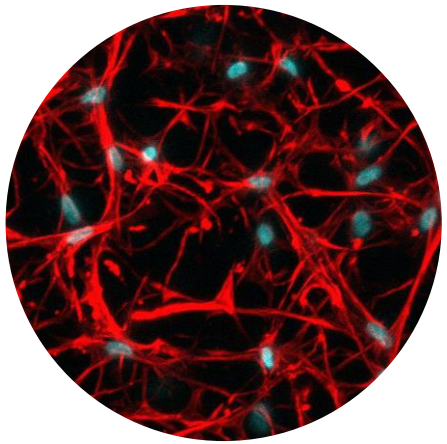
Zauchner, Müller, Horrer, Bissig, Zhao, Fisch, Lee, Zenobi-Wong, Müller, Qin. **Nature Communications 2024,** 15, 5027.
Patent Application No. PCT/EP2023/065802.

Summary - Biomaterials and Bone Tissue Manufacturing

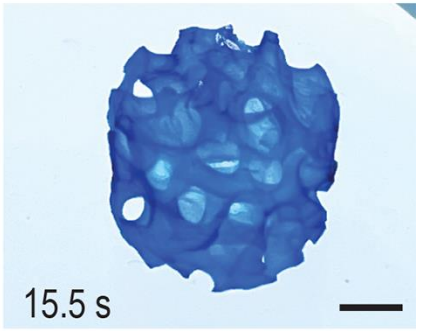
Resolution 0.2-1 µm 5-20 µm 50-100 µm



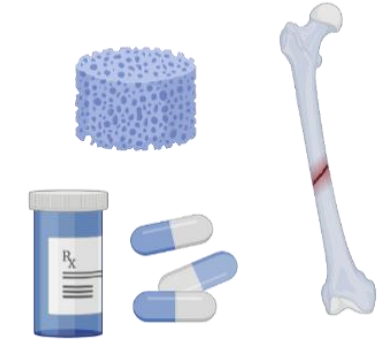
Patent Application No. EP24188492.3



PCT/EP2023/065802



PCT/EP2023/050516



Source: AIM Biotech

Drug testing for personalized treatments

[Source: raisingchildren.net.au]

[Source: raisingchildren.net.au]

Alternatives to animal testing

79 NRP
Advancing 3R
National Research Programme

Acknowledgement

Financed by SERI

European Research Council
Established by the European Commission

SNSF

MaP Competence Center for Materials and Processes

ETH zürich

alive
advanced engineering with living materials

Strategic Focus Area
Advanced Manufacturing

UNIVERSITÄTS-
KINDERSPITAL
ZÜRICH

ETH zürich
INDUSTRY DAY

Thank you for your attention!

Professor Xiao-Hua Qin
Email: qinx@ethz.ch
Web: www.bme.ethz.ch

ETH Zurich
Department of Health Sciences and Technology
Gloriastrasse 37/39
8092 Zurich, Switzerland

TREELESS

Microorganism-based cellulose materials for a sustainable future

ETH zürich
INDUSTRY DAY

21th November 2024

Treeless AG,
CH-8152, Opfikon (Zurich)
contact@treelesspack.com
www.treelesspack.com

Spin-off
ETH zürich

W.A. DE VIGIER STIFTUNG
SINCE 1987
Winner 2024

Initial Coaching supported by
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Innosuisse – Swiss Innovation Agency

zhaw

OST
Ostschweizer Fachhochschule

Berner Fachhochschule

Project supported by BAFU
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Bundesamt für Umwelt BAFU

Too Much Plastic & Low Recycling Rates

Plastic pollution will triple by 2060 – if no ACTION is taken

430 million tonnes of plastic produced annually

2/3 used for short periods only

70% of EU plastic waste is NOT recycled

Regulatory changes demand business transformation

Mission & Vision

Mission:

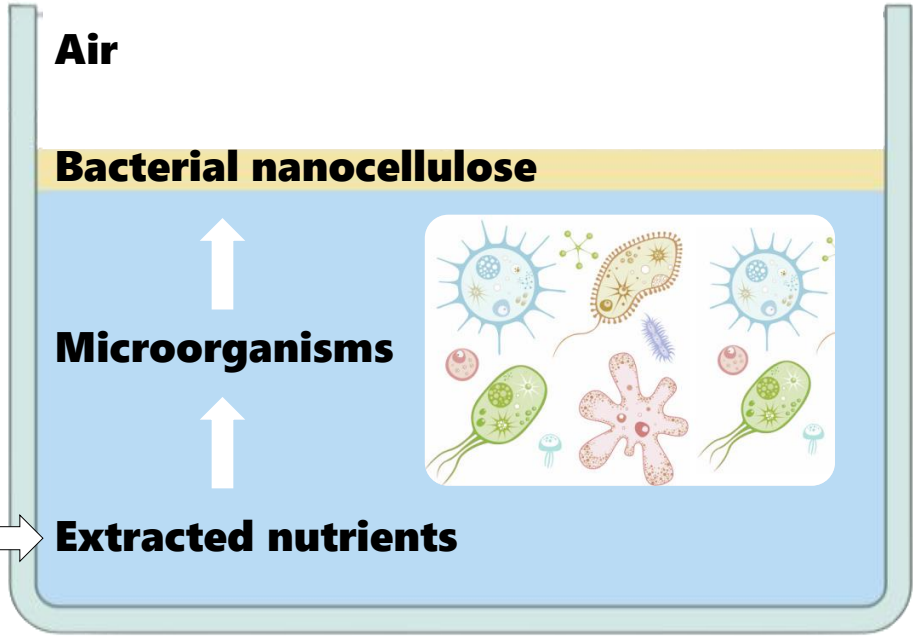
Replace harmful and polluting materials by enabling bio-based, fossil-free alternatives using microorganisms

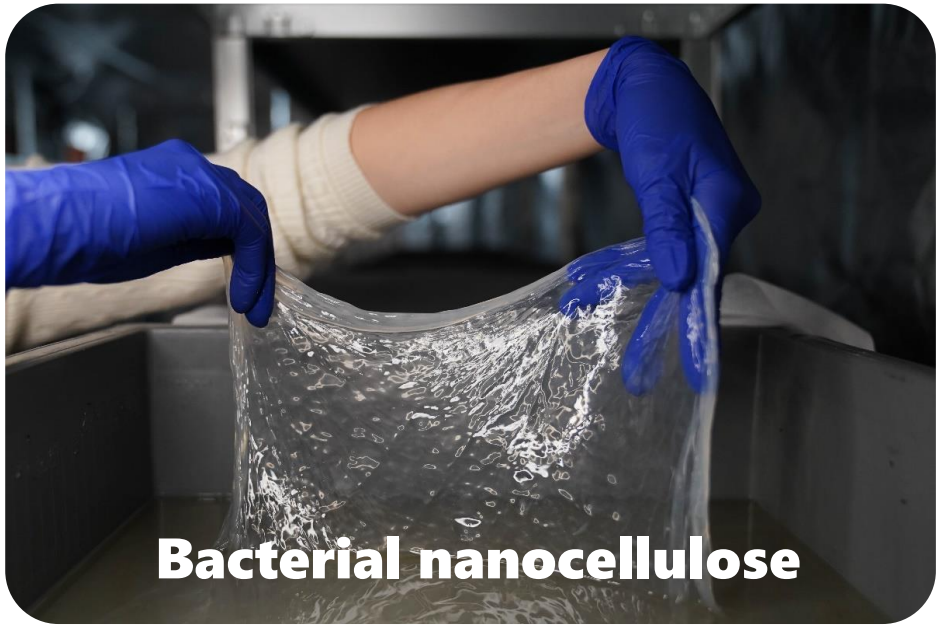
Vision:

Create materials for a better life

Revolutionizing Materials with Microorganisms

Patent pending





Circular

80% less CO_2

Cost efficient

Scalable

Product & Applications

Biodegradable

Mechanically strong

Non-toxic

Treeless

Funding secured:

Project supported by BAFU

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Umwelt BAFU

Innovation Booster
powered by Innosuisse

First sales
Demo projects
LOIs for procurement

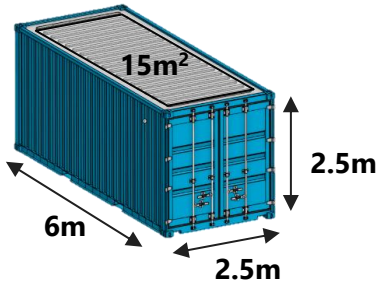
OLWO · Collano · Sika

PEPSICO · LIDL · TARA+

Scaling with Modular Production

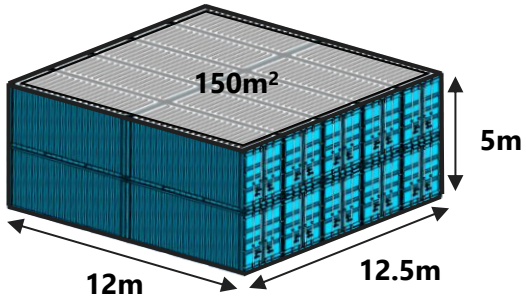
Our current pilot [1] production platform in Zurich

Modular & Decentralized Scaling



1X module

Yield: up to 4 ton gel product [2] / month



20X modules

BÜHLER

ERIDIA
A BÜHLER AND ZETA COMPANY

GIMELLI engineering

[1] Manually operated

[2] 3% nanocellulose gel suspension

Key Achievements

Pilot manual production platform – Q3/22

Organic waste suppliers (tested & 2 LOIs) – Q1/23

Patent pending (growth process and paper application) – Q2/24

BAFU Grant and Innovation Boosters – CHF 270 k – Q2/24

Raised CHF 450 k, converted from GmbH to AG

Pilot projects (ongoing & LOIs)

First generated sales

Top 12

Top 10

1st prize

1st prize

Winner

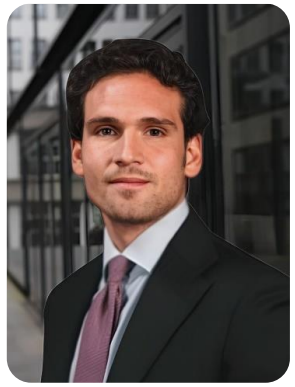
Team

Adam Korczak
MSc Mechanical Eng.
Specialized in
Biomaterials

ETH zürich

Patrycja Kucharczyk
PhD Biotechnology
Specialized in
Microorganism Research

UNIVERSITÄT BERN



Paolo Ortolani
Executive MBA
Former Entrepreneur
Business Development

Universität Zürich

Berner Fachhochschule
Haute école spécialisée bernoise
Bern University of Applied Sciences

Wood and Polymer
Chemistry, BFH

ETH zürich
Department of
Materials, ETH Zurich

TREELESS

Ecosystem of specialized collaborators

OST
Ostschweizer
Fachhochschule

Materials Technology and
Plastics Processing, OST

Empa
Materials Science and Technology

Cellulose and Wood
Materials, EMPA

zhaw

Polymer Coatings
Laboratory, ZHAW

Board of advisors:
Marcel Klaus, Former CFO Swiss Intl. Air Lines
Andreas Löwenstein, Former CEO Kopter
Oliver Kirchner, Attorney and Strategist
Philipp Bosshard, CTO & Co-Founder, YASAI
Barbara La Cara, Impact Innovation, ETH
Richard Järvinen, Chairman, Aarre

Innosuisse coaches:
Christian Brand, lead coach
Cara Tobin, impact coach
Jean-Pierre Vuilleumier, pitching and financials

Key hires planned:
Automation Engineer
Material Engineer

Roadmap

Q4/2024

Sharpening of **business strategy**

Pre-seed
450 k

Q3/2025

More pilot projects and traction

Seed
1 M

2026

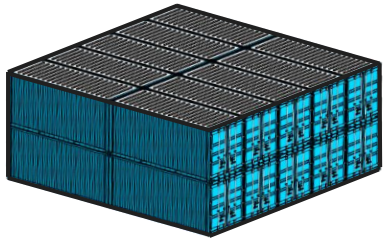
Development of an **automated MVP** module

Validate the franchising / licensing case

Series A
2 M

2027

MMP scalable modular production



Expansion via franchising / licensing

Upscale sales

Let’s grow together!

Partner with Us:
Join us in developing real-world applications
Run pilot projects together

Join Now as an Early Investor:
Seed round Q3/2025

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Thank you for your attention!

Patrycja Kucharczyk
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contact@treelesspack.com
www.treelesspack.com