



Adolphe Merkle Institute (AMI)

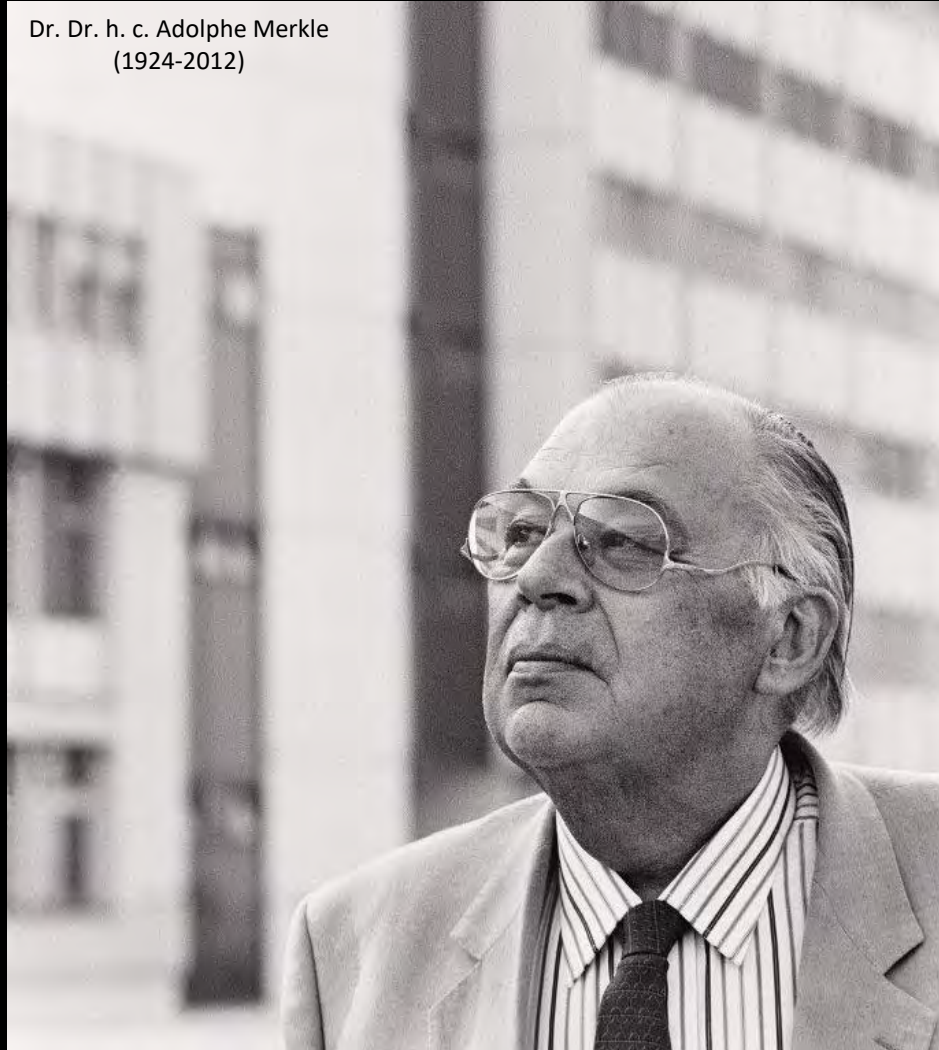
Competence in Soft Nanomaterials



2007

Fribourg entrepreneur Adolphe Merkle donated 100 Mio Swiss Francs to establish a foundation to support research and education at the University of Fribourg.

Dr. Dr. h. c. Adolphe Merkle
(1924-2012)

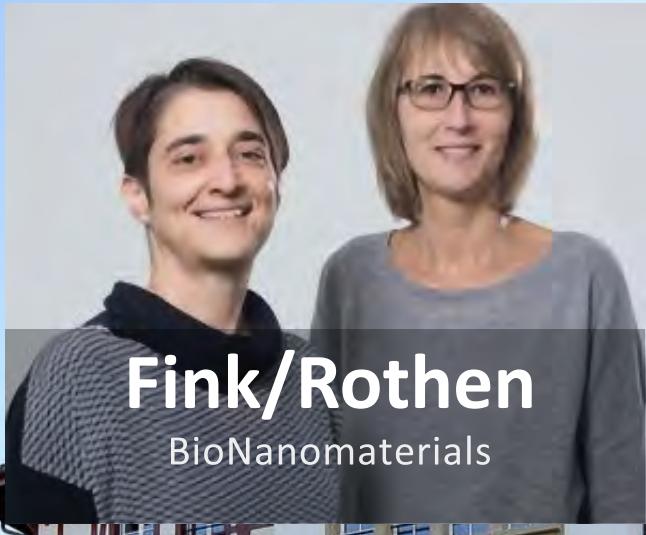


Interdisciplinary center of competence in fundamental and applied soft nanomaterials

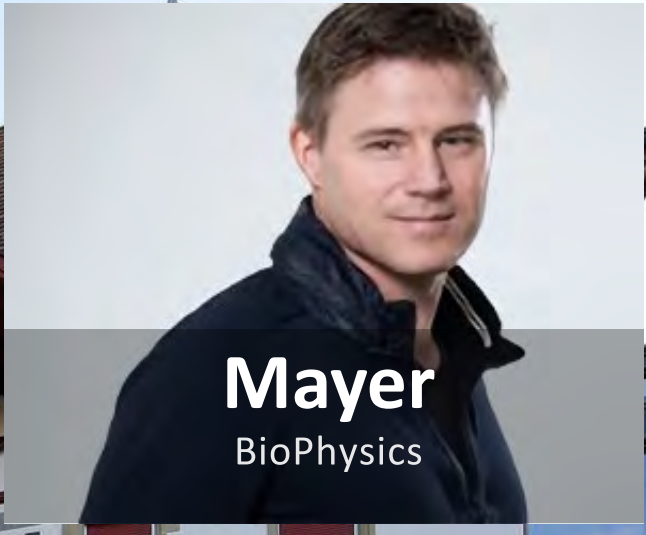
“We educate the next generation of scientists, stimulate innovation, foster industrial competitiveness, and improve the quality of life”

Faculty of Science and Medicine

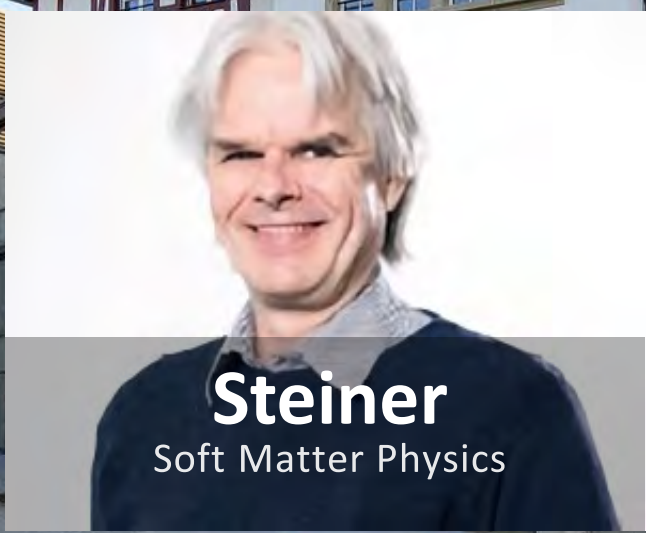




Fink/Rothen
BioNanomaterials



Mayer
BioPhysics

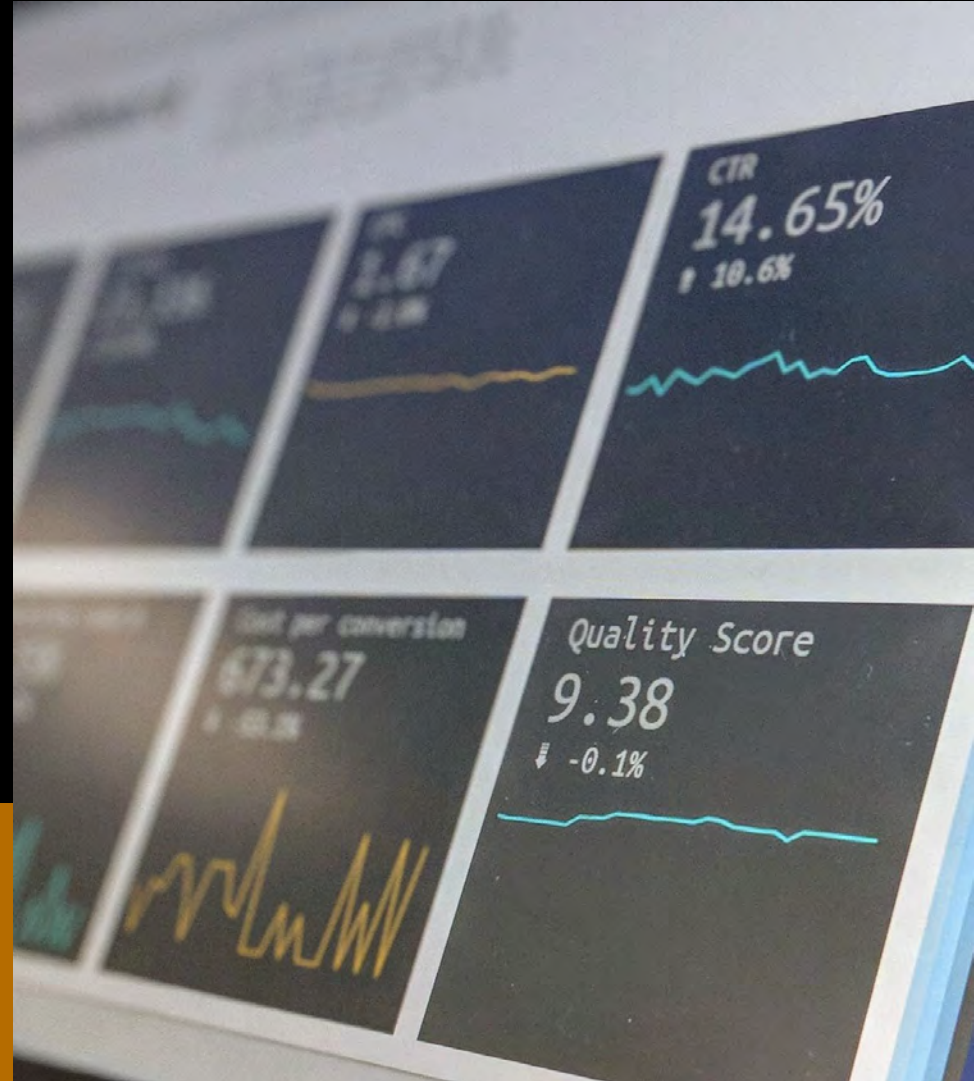


Steiner
Soft Matter Physics



Weder
Polymer Chemistry & Materials

Numbers 2021



A close-up photograph of laboratory glassware, including a beaker with a pipette and other vessels, set against a blurred background.

33 Research projects

A photograph of two young women sitting at a dark wooden table, looking at papers and books, likely in a library or study area.

**106
Employees**

(31 Nations; 400 Alumni)

A photograph of a person in a white lab coat working in a laboratory, with various glassware and equipment visible in the background.

60% PhD students

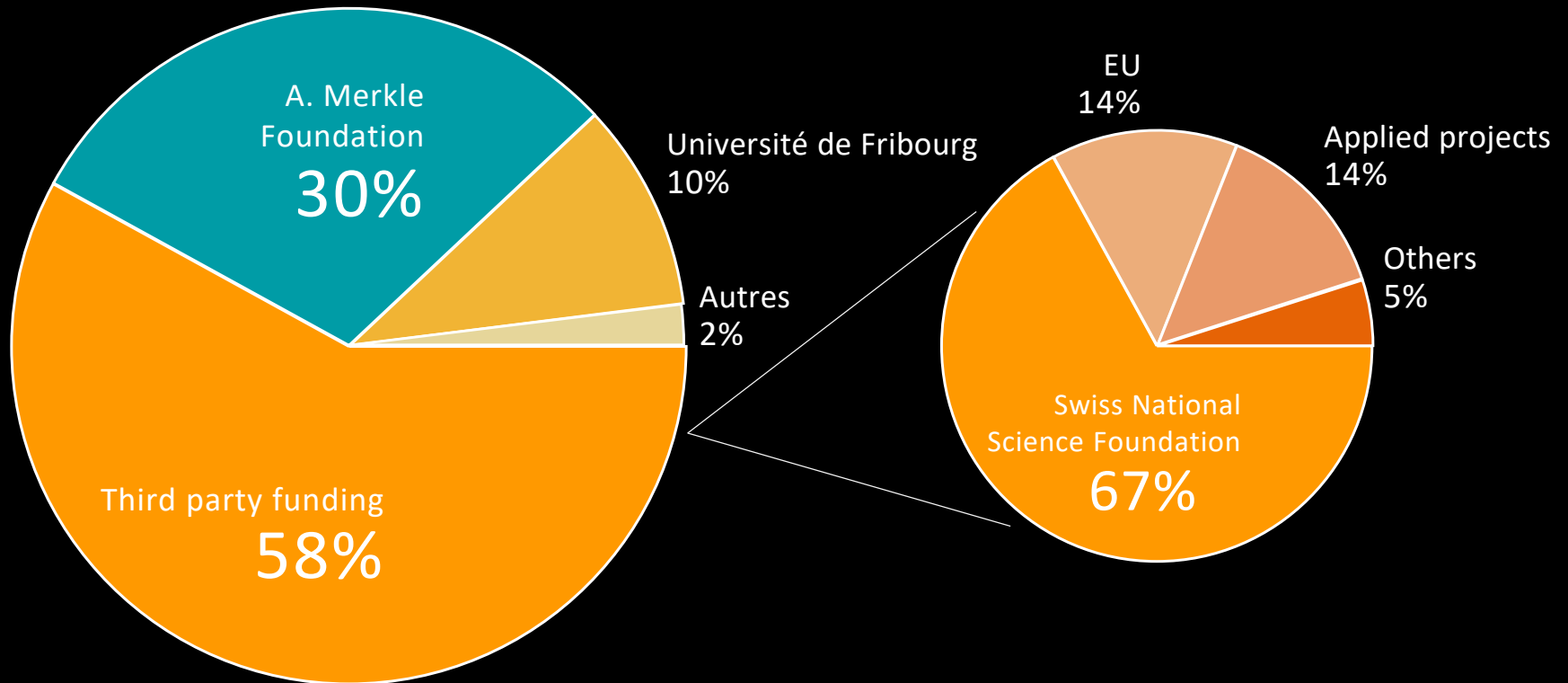
A photograph of a large group of people seated in an auditorium, attending a seminar or lecture.

18 Seminars

A photograph of two women in a laboratory setting, one is wearing a blue and white striped sleeveless top, and the other is wearing a white patterned shirt. They are looking at a piece of equipment on a table.

40% Women

Financement: Budget total (10.1 Mio CHF)



AMI Building inaugurated in 2015: 25'000 sq ft



50 state-of-art labs (chem, phys, bio, nano, process)

Auxiliary Infrastructure



Cleanroom: Class 100 with Lithography setup



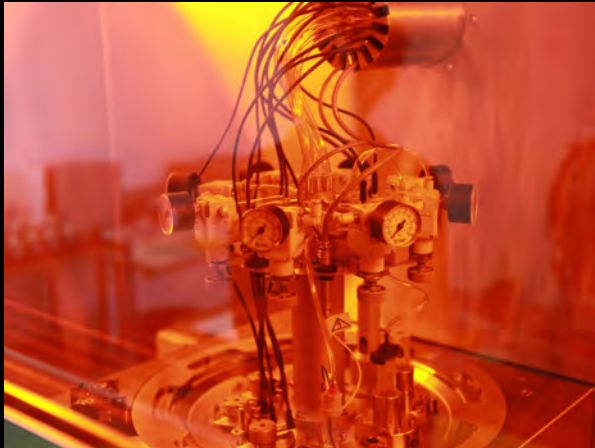
Photovoltaics: Coupled Glove-box, electrical & optical charact.



Optics Labs: Spectroscopic & confocal microsc., FCS, SERS



Fab-Lab: 3D Printing, Laser Cutting, Micro-Machining



Nanoexposure: Nebulizer, Microsprayer, Tissue Models



Polym. Proc: Extrusion, Inj. & Comp. Mold., Coating, Spinning



National Center of Competence in Research - Bio-Inspired Materials

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

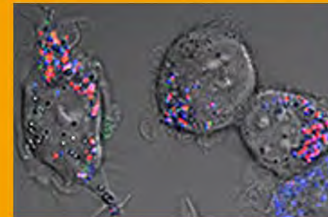
- Start 2014 (12+ Years)
- 21 PIs



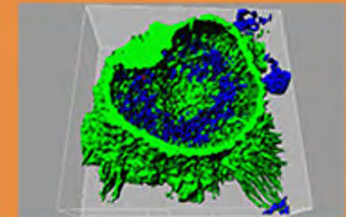
M1. Mechanically responsive materials across different length scales. Lead: Studart



M2. Biologically inspired assembly of optical materials. Lead: Scheffold



M3. Responsive bio-interfaces and surfaces. Lead: Fink/Rothen



M4. Dynamics of interacting cell-material systems.



**BIO-INSPIRED
MATERIALS**

NATIONAL CENTER OF COMPETENCE
IN RESEARCH

FNSNF

SWISS NATIONAL SCIENCE FOUNDATION

Other activities



Active Members



Supporting Members



Other activities



Swiss Nanoconvention 2022

Fribourg, July 5-6, 2022





adolphe merkle institute
excellence in pure and applied nanoscience

BioNanomaterials group – Research overview



Alke Fink & Barbara Rothen-Rutishauser

Co-Chairs BioNanomaterials
Adolphe Merkle Institute
University of Fribourg
Fribourg, Switzerland

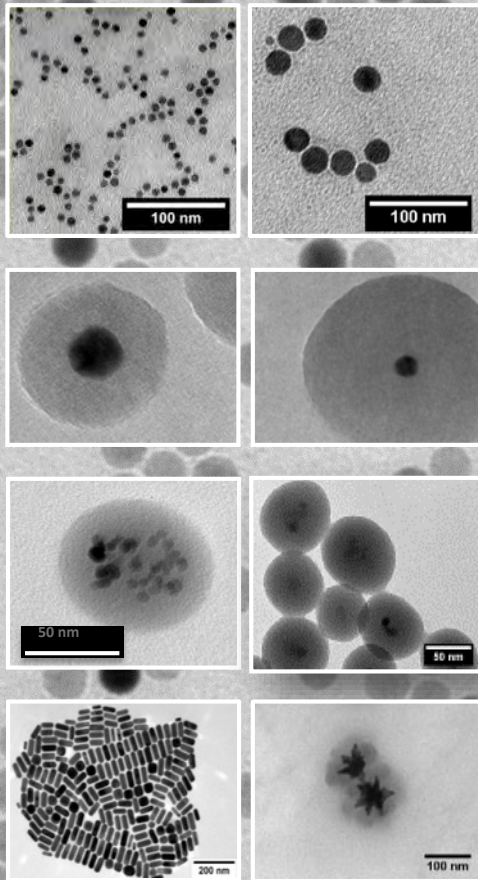


Research overview

Nanoparticles

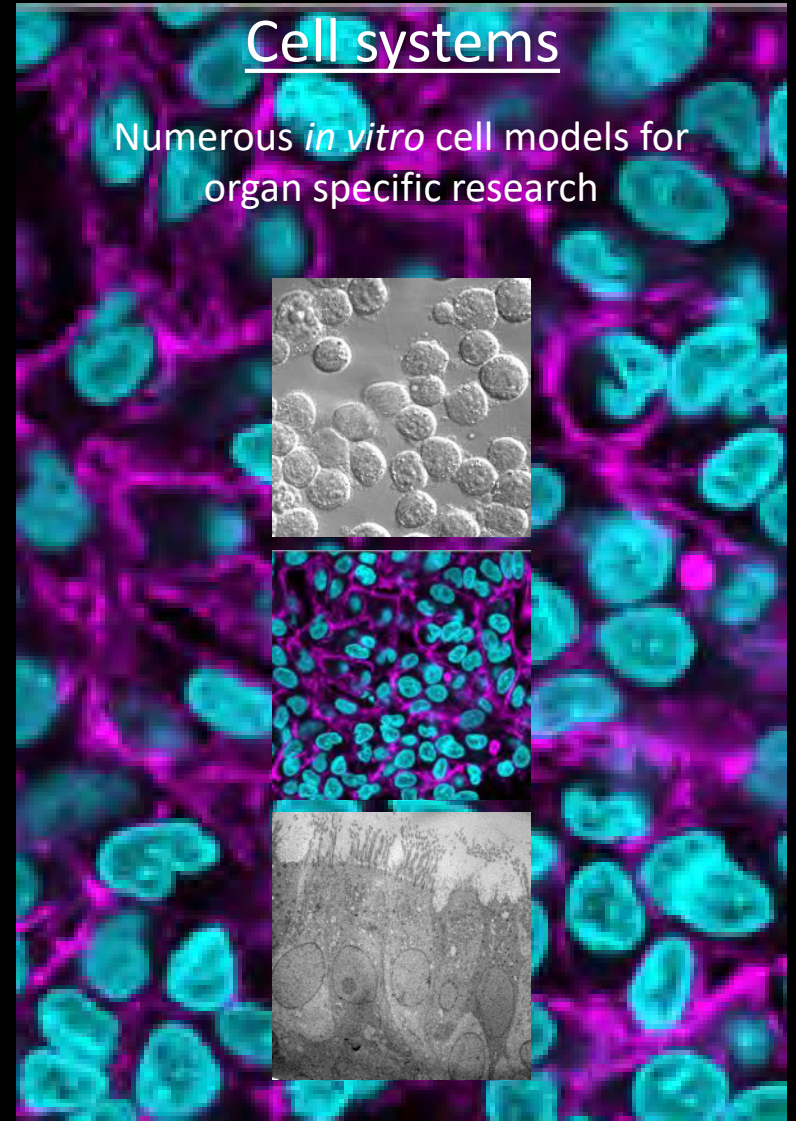
Nano-Libraries

All sizes, shapes, inorganic materials



Cell systems

Numerous *in vitro* cell models for organ specific research



Swiss NanoAnalytics

“Swiss NanoAnalytics platform within the Adolphe Merkle Institute's BioNanomaterials group offers high quality services for the analysis of nanoparticles.”

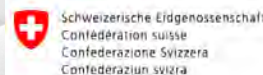


Adolphe Merkle Foundation

Cantonal laboratories



Federal Food Safety and
Veterinary Office



State Secretariat for Education,
Research and Innovation

Contact Point Nano.ch
Nationale Anlaufstelle Nano.ch
Point de contact Nano.ch
Punto di contatto Nano.ch

Nationale Anlaufstelle für den sicheren Umgang mit
Nanomaterialien, Regulation und Wissenstransfer

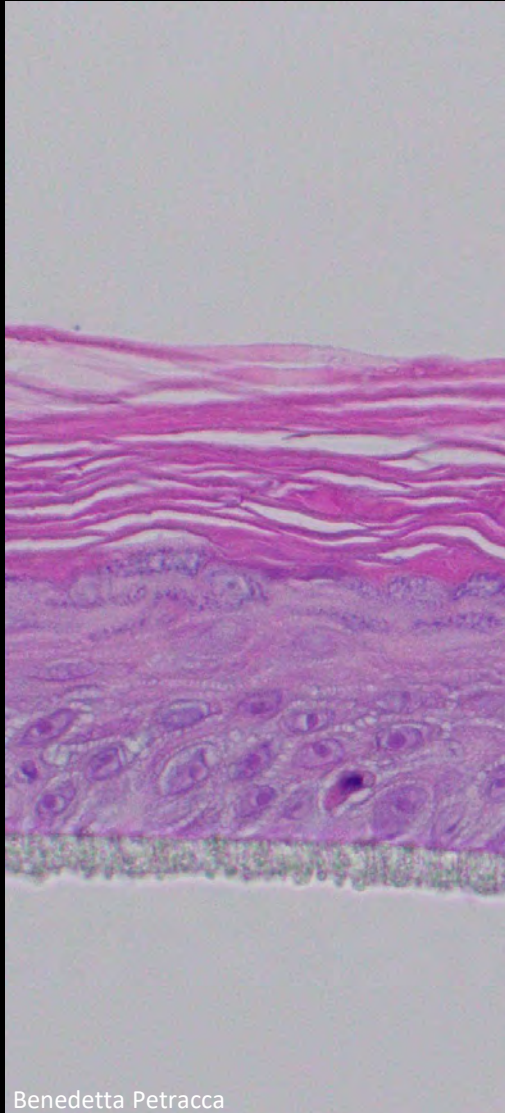


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Skin tissue engineering



Benedetta Petracca

Design of healthy and diseased skin models to develop skin protection agents against environmental stressors, *e.g.* diesel exhaust particles



Relevant for cosmetic industry

Dijkhoff et al. Impact of airborne particulate matter on skin: a systematic review from epidemiology to in vitro studies. *Part Fibre Toxicol* 17(1):35 (2020).

Dijkhoff et al. Cultivating a Three-dimensional Reconstructed Human Epidermis at a Large Scale. *J Vis Exp* (171) (2021).



Micro- and nanoplastic particles –
impacts on human health via the food chain



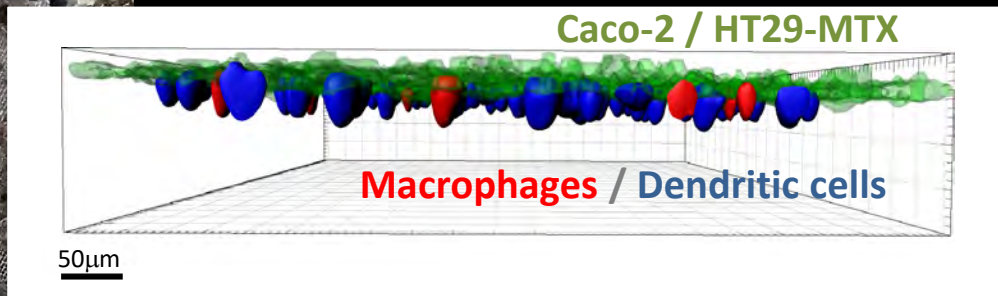
Intestine tissue engineering



Interaction of microplastic particles with a human intestine model

Lehner R, Wohlleben W, Septiadi D, Landsiedel R, Petri-Fink A, Rothen-Rutishauser B. A novel 3D intestine barrier model to study the immune response upon exposure to microplastics. Arch Toxicol 94(7):2463-2479 (2020).

Lehner R, Weder C, Petri-Fink A, Rothen-Rutishauser B. Emergence of Nanoplastic in the Environment and Possible Impact on Human Health. Environ Sci Technol. 53(4):1748-1765 (2019).





Device development



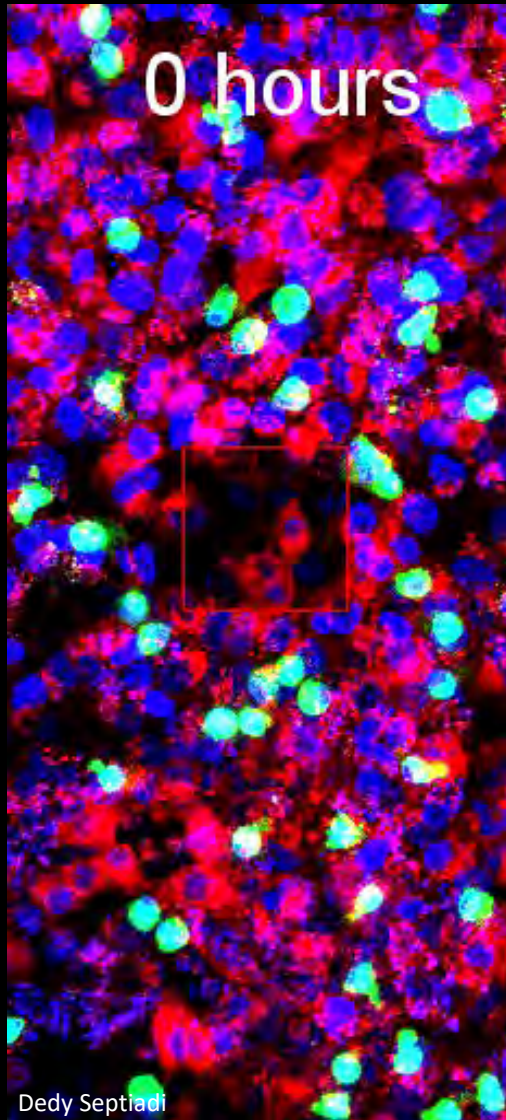
Development of a smart laboratory equipment to **extract real-time information** from **3D epithelial cell cultures**.

Design a novel and versatile platform for **non-invasive monitoring airborne nanoparticles** and environmental atmospheres in cells or tissues.





Lung tissue engineering



Dedy Septiadi



Design of human lung co-cells models that are stable for several weeks (Occupational environment)

Pre-validation of selected approaches for inter-laboratory comparisons

Relevant for new OECD guidelines
Collaboration with Hospital Fribourg
H2020 project ULTRHAS: ULtrafine particles from TRansportation – Health Assessment of Sources



Barosova et al. Inter-laboratory variability of A549 epithelial cells grown under submerged and air-liquid interface conditions *Toxicology in Vitro* 105178 (2021).
Barosova et al. Use of EpiAlveolar Lung Model to Predict Fibrotic Potential of Multiwalled Carbon Nanotubes. *ACS Nano* 14(4):3941-3956 (2020).



Acknowledgments



BioNanomaterials Group

Adolphe Merkle Foundation


University of Fribourg

Collaboration partners:

- M. Clift, Swansea University
- R. Vandebriel, H. Braakhuis, RIVM
- V. Stone, Heriot-Watt University
- S. Angeloni, Simplinext
- F. Blank, University Bern
- M. Eeman, Dow



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Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Innosuisse – Swiss Innovation Agency



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PATROLS
Advanced Tools for NanoSafety Testing



Swiss National Science Foundation



BIO-INSPIRED MATERIALS
NATIONAL CENTER OF COMPETENCE IN RESEARCH



Advancing 3R
National Research Programme