Non-animal methods in science and bone marrow-on-a-chip

Dr. Melanie Ort, regulatory science group, Medical University Innsbruck, Austria

Today we talk about

Part 1: What are NAMs and where to find them

Part 2: Bone and bone marrow chip, translational research and its hurdles

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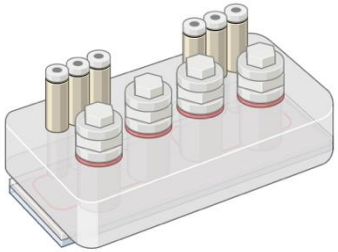
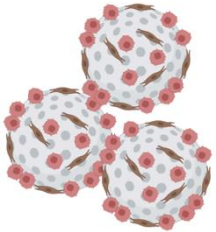
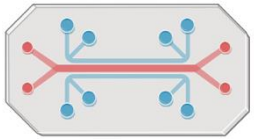
Part 1: What are NAMs and where to find them







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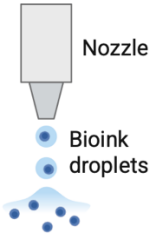
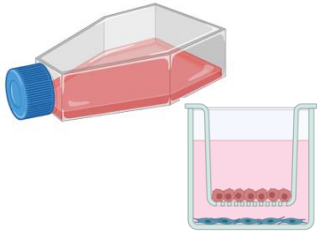
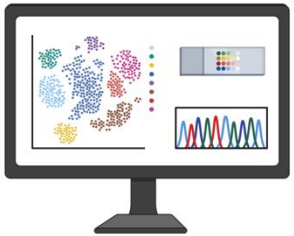
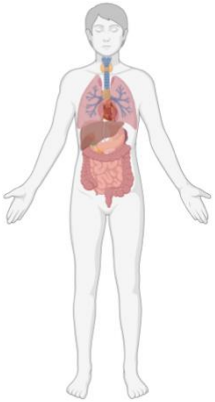
NAM: **N**on-**A**nimal-**M**ethod or **N**ew **A**pproach-**M**ethod









What systems are out there and what are they used for?

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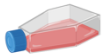
Organ on a chip 	1 or more organs with media flow, skin, lung, liver, bone
Organoid 	with or wo flow, buds, smallest functional unit, brain, lung
2D culture 	monoculture, simple, almost all cells, muscle, vascular, blood
2D+ culture / transwell 	adherent cells with non-adherent, 2 cell types, secretome, bone cells + PBMCs (blood cells)
Human biopsies 	whole tissue, complex architecture, site dependent, skin, bone marrow

System specific questions before use:

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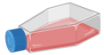
Organ on a chip

- perfusion? cell numbers? 3D or 2D?

Organoid

-stem cell derived? buds? number?

2D culture



-primary cells? Cell line? Human? Genetic background?

2D+ culture / transwell

- number of cell types? Adherent?

Human biopsies

-patient or donor derived? Isolation? Ethics?

Additonal NAMs

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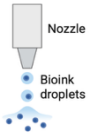
In silico

- computer modelling, toxicology, AI / LLM, databases, prediction

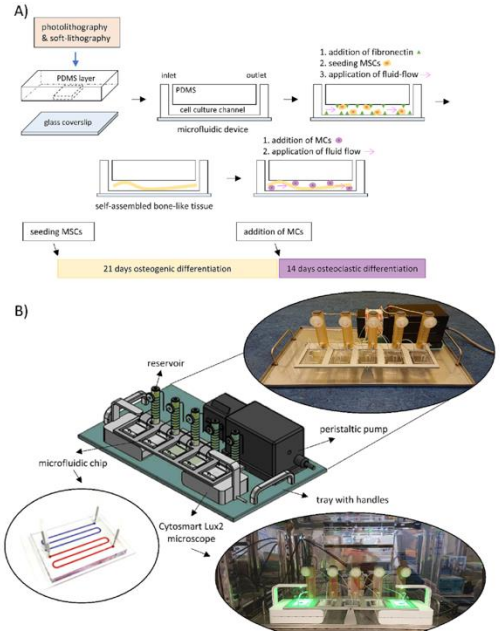
INSIGHT

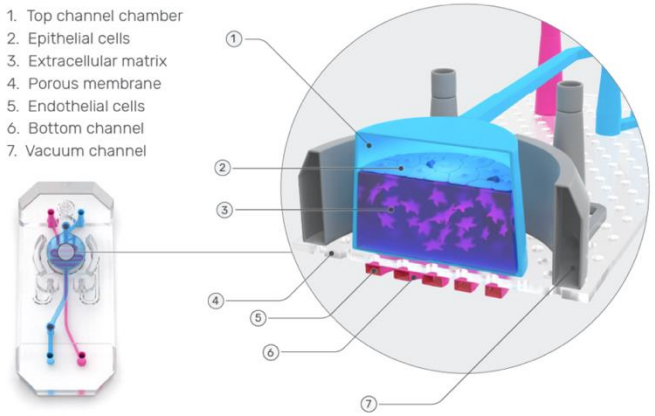
CHIASMA

Bio printing



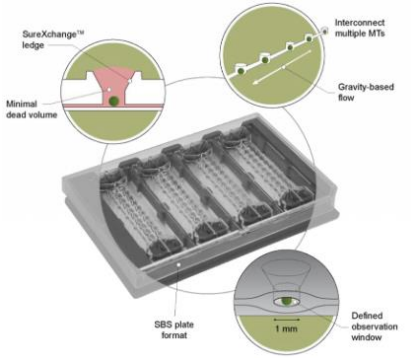
-bio inks with cells and biomaterial to create functional 3D tissues, liver, cancer





Emulate Inc., Cambridge, MA, USA

Tissuse GmbH, Berlin Germany



Inspero Inc, Schlieren, Switzerland

https://www.sciencedirect.com/science/article/pii/S875632822300145X

Where to find a lab?

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Researchgate

University homepage

Lab homepage

LinkedIn

Apply w/o job listing

CAAT newsletter

Company websites

3R centers

Webinars/Newspaper articles

Coalition to address animal Methods bias (COLAAB)

World congress WC on alternatives for animal methods

EUSAAT Conference Linz (annually, with exceptions, next one is 2027)

Human-based models, datasets & other resources

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- 9 animal alternatives and 3Rs databases
- 14 biorepositories and datasets
- Toxicology and pharmacology resources
- Information on clinical research and collaboration
- 100+ companies offering nonanimal modeling platforms

A living version of these resources will be available on animalmethodsbias.org

Community

young tpi
Transition Programme to Animal-Free Innovations

EUSAAT
European Society for Alternatives to Animal Testing
The European 3Rs Society

COLAAB
Coalition to Illuminate and Address Animal Methods Bias

CAAT
JOHNS HOPKINS
BLOOMBERG SCHOOL of PUBLIC HEALTH

CHARITÉ
UNIVERSITÄTSMEDIZIN BERLIN

Dr. Nina Stelzer

Part 2: Bone and bone marrow on a chip

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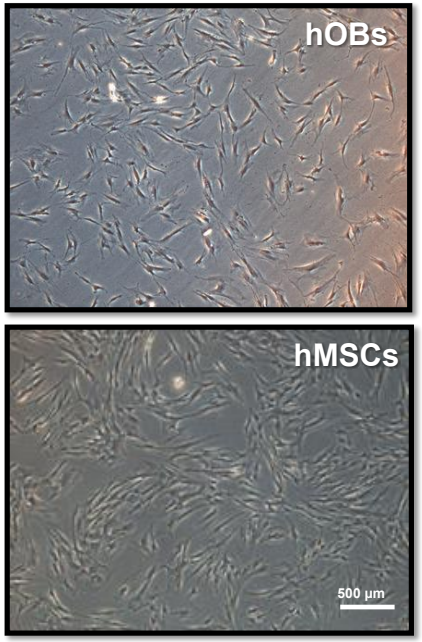
Bone marrow



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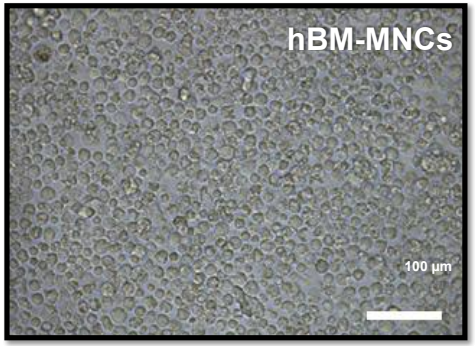
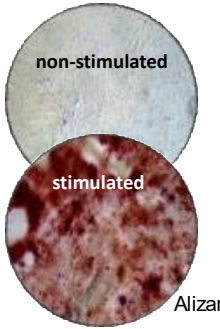
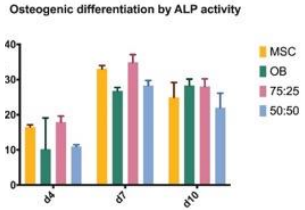
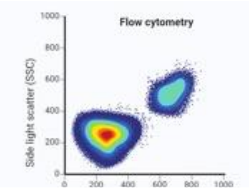


Read out



Alizarin red





One example were NAMs can help – patient specific research

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Patients with hip or knee implants

Sometimes failure due to unknown reason – aseptic loosening

Animal testing doesn’t explain or recreate common problems

Surgeons and manufacturers need new solutions

Specific hurdles

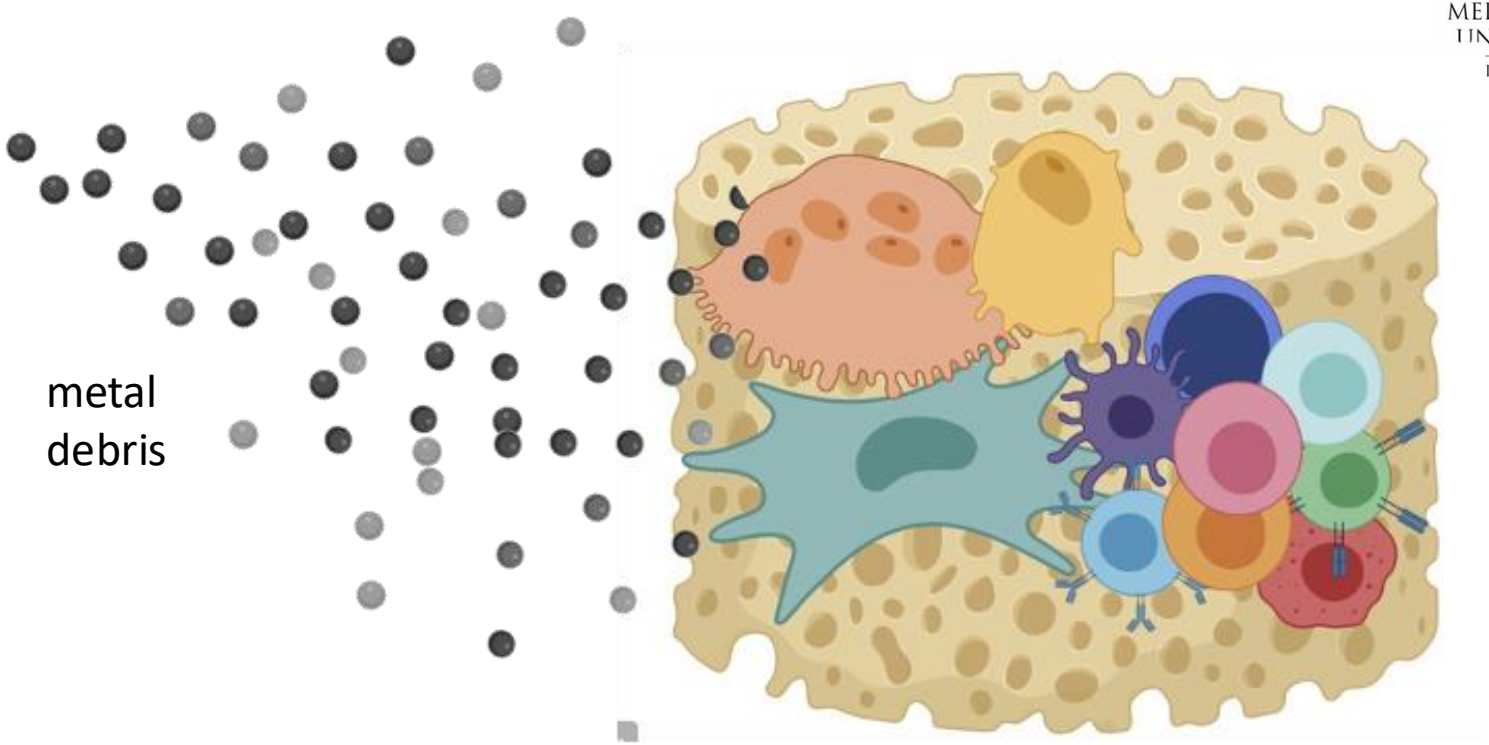
Patient heterogeneity

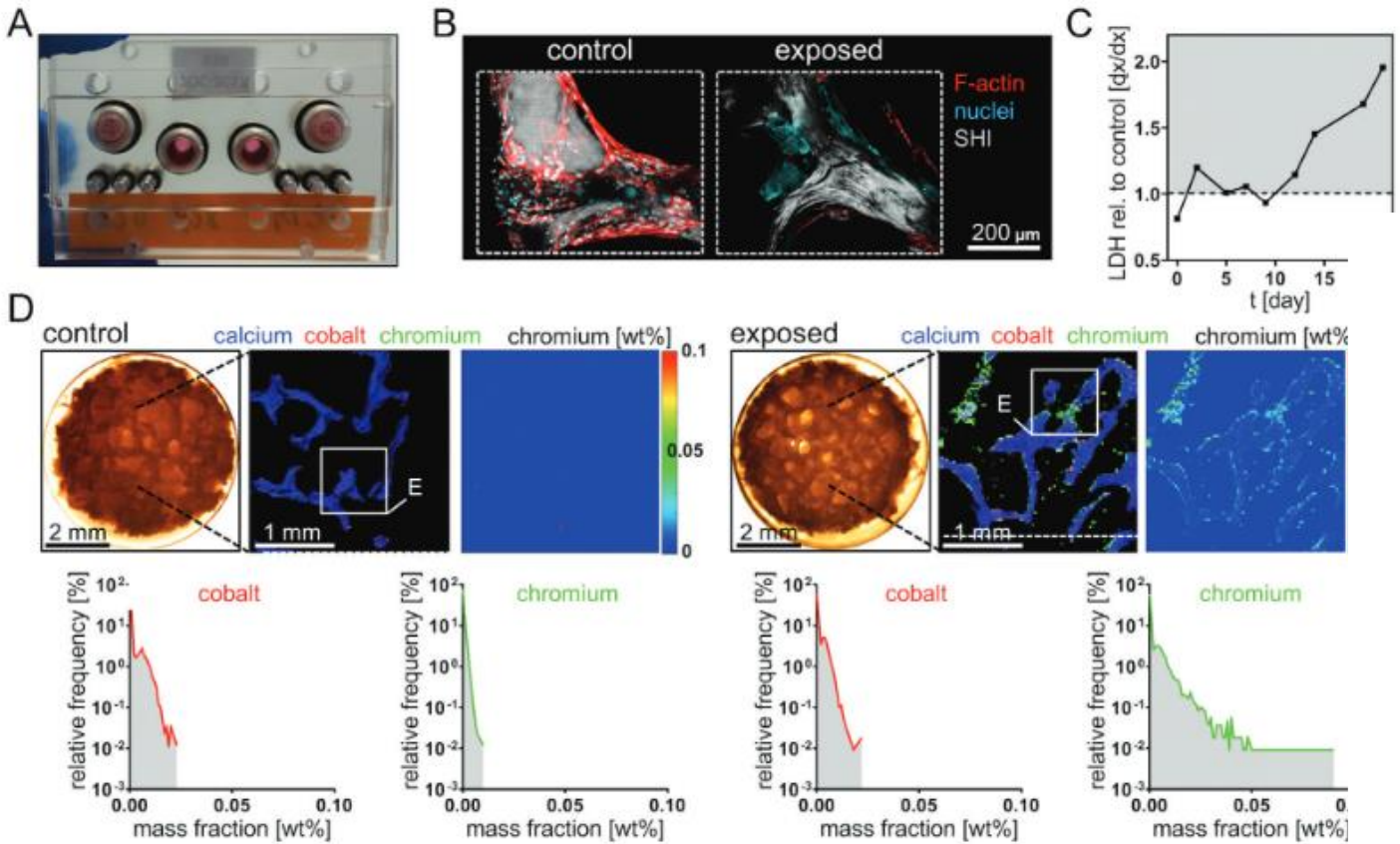
Adaptive and individual immune system

Mechanical loading – to create debris

Testing before surgery

Metal release from orthopedic implants.





Schoon et al., 2020, Advances science

J. Schoon, B. Hesse, A. Rakow, M. J. Ort et al. Metal-Specific Biomaterial Accumulation in Human Peri-Implant Bone and Bone Marrow. *Adv. Sci.* 2020, 7, 2000412. https://doi.org/10.1002/advs.202000412

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Human NAMs should be benchmarked to humans / patients not other animals

Translational research

Requires tight collaboration with clinicians

Roadmap is individual and documentation is not standardized

Requires high motivation from researcher (and clinician)

Needs same structural workflow as animal experimentation

Funding and publishing

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Often too little amount of $$$ for NAM projects

Often linked to animal work packages

Reviewers almost always ask for “validation” in animals, even if 100% human

Basic results are often considered “boring” – risk of overselling

Tierleid für Wissen? Wohl eher nicht! Eine Petition vom Referat für Ökologie der Uni Bonn.

Öko-Referat
AStA Uni Bonn

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