

UNIVERSITY
OF OSLO

Hybrid Technology Hub

Centre for Organ on a Chip Technology

Annual Report 2025



Contents



From the director 4



Research groups 7

Krauss group	8
Scholz group	10
Rayner group	12
Stevens group	14
Gadegaard group	16
Louch group	18
Solbakk group	20
Bioanalytical chemistry team	22
Melum group	24
Corthay group	26



HTH associated research projects 29

ITOM	30
SUMO	32
Wellcome LEAP	34
Transcan-3	36

Research and engagement 38

Innovation	39
• SPARK team	39
• Patents	39
• Dofi	39
• Established companies	39
Outreach	40
• Media / Social media	40
• Popular science presentations / Articles in media	41
Education	42
• TNNN – Research School	42
• NOR-MPS 2025	44
• AIMS 2025	46
• Graduated PhD students	47



About the Centre 49

Organizational chart	50
Team members	52
Board	56
Scientific Advisory Board (SAB)	57
International collaborations	58
Retreats	60
Publications	64



Funding 66



From the director



Complex in vitro models are essential for replicating the higher-order anatomical, physiological, and pathological characteristics of human tissues and organs. Over the past decade, organoids and organ-on-chip (OoC) technologies have emerged as transformative platforms in this field.

Organoids are self-organizing, three-dimensional (3D) tissue cultures, typically derived from stem cells, that recapitulate key aspects of organ development, cellular composition, and function. OoC technologies integrate microfabrication and advanced cell culture techniques to create engineered microenvironments that mimic in vivo-like conditions, enabling the reproduction of organotypic architecture and functionality. Together, these technologies are referred to as New Approach Methodologies (NAMs). NAM technologies have advanced rapidly, increasingly providing robust models for studying organ physiology, disease mechanisms, and drug development, with growing application in personalized medicine. The “FDA Modernization Act 2.0,” passed by the U.S. Senate, highlights such systems as promising alternatives to animal testing, and NAMs are now firmly embedded in both American and European research and innovation funding calls. Looking ahead, these technologies may also enable the development of cells, tissues and func-

tional human organ representations for transplantation.

The Hybrid Technology Hub (HTH) Centre of Excellence is advancing stem cell-derived models of organs central to energy homeostasis. Our work integrates supervised differentiation protocols, microfluidics, advanced imaging and tracking technologies, integrated bioinformatics, and cutting-edge -omics approaches—including single-cell RNA sequencing and spatial transcriptomics—alongside continuous ethical oversight as the technologies evolve. In 2025, the Centre further refined liver, bile duct, and cardiac organoids, while advancing its OoC platforms. Through a European Innovation Council grant, we incorporated stem cell-based embryo (SCBEM) and placenta-on-chip models into our research portfolio. The Centre also participates in a Wellcome Leap initiative aimed at modeling aspects of aging using microphysiological systems. These efforts strengthen our research into how sex, age, and environmental factors

influence organ function and disease modeling. Across all initiatives, we remain committed to standardization, scalability, and automation, with clinical translation as our long-term objective.

To date, the Centre has published 206 peer-reviewed articles, including 44 papers in journals with an impact factor above 10 and 25 in journals above 15. A particular highlight is our work on the survival of transplanted allogeneic beta cells without immunosuppression, recognized by Nature Medicine as a key development in 2025. The Centre has filed six patents and secured NOK 414 million in complementary external funding. Major contributors include the Research Council of Norway, Health Region South-East (HSØ), and the Norwegian Cancer Society. Centre staff have received three Oslo Life Science convergence environment grants. Principal Investigators have been awarded a European Research Council (ERC) Advanced Grant, an EU “Science With and For Society” (SwafS) project, and grants from the European Innovation Council (EIC), Wellcome Leap, TRANSCAN, and Novo Nordisk. At the postdoctoral level, a joint Nordic network grant was awarded by NordForsk.

In innovation and translation, the Centre has received five SPARK grants and initiated a Research Council-funded collaboration with the Norwegian startup Onco-syne AS to develop and validate pancreas cancer-on-chip models. We have established two startups—DuctMimic AS and Sharp AI Inc.—with two additional companies currently in development.

The Centre has also formed partnerships with Novartis, Merck Group, Genentech, and AstraZeneca, while further strengthening our long-term collaboration with Symeres Inc.

On the analytical front, we have advanced mass spectrometry techniques for metabolic measurements in dual organ-on-chip platforms, enabling the study of metabolic interactions between liver and islet organoids. The recent addition of a Tomocube holotomographic imaging system enhances label-free live tracking of cells and organoids. We continue to expand our capabilities in single-cell and single-nucleus RNA sequencing and spatial transcriptomics. In bioinformatics, the Centre has completed a globally accessible distributed data-sharing (GADDS) platform to support FAIR-aligned data practices and is currently establishing an AI-based image analysis platform for phenotype surveillance and prediction in closed-loop guided morphogenesis.

The Centre organizes an annual Nordic convention and workshop on microphysiological systems (NOR-MPS 2025) and has launched an annual international satellite conference to the EUROoCs symposium focused on modeling aging with NAM technologies (AIMS 2025). In addition, we hosted the 2025 conference of the European Network for Oxysterol Research and contribute to the Research School for Training the Next Generation of Micro- and Nanotechnology Researchers in Norway (TNNN). Our PIs, postdoctoral researchers, and PhD candidates actively participate in international conferences through posters, invited talks, and keynote lectures.

I would like to extend my sincere gratitude to the Centre’s PIs, researchers, and staff for their dedication, excellence, and strong collaborative spirit. Our progress would not be possible without their commitment. I also thank our host institution, the Institute of Basic Medical Sciences at the University of Oslo, as well as the Department of Immunology at Oslo University Hospital, the University of Glasgow, and the University



HTH Centre Director Prof. Stefan Krauss on hiking trip in Nepal.

of Oxford for their continued support. We are deeply grateful to our Scientific Advisory Board, led by Professor Bengt Nordén, for their outstanding scientific guidance, and to the Centre’s Board, led by Professor Jan G. Bjälle, for their professional oversight.

Science remains the most powerful tool for advancing humanity. We are proud to dedicate our efforts to generating new

knowledge, developing advanced models and technologies, and ultimately contributing to improved understanding, prevention, and treatment of human disease.

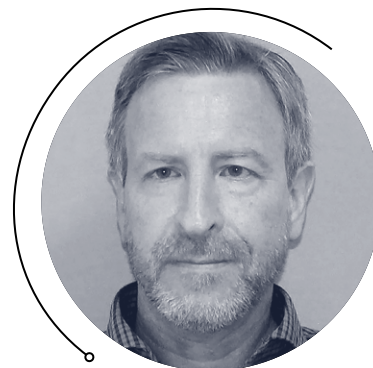
Stefan Krauss
Stefan Krauss
Centre Director



Research groups

Krauss group

Microphysiological systems and developmental pathways



Stefan Krauss
Centre Director



Coming from a developmental biology background we apply principles of self-organization to improve stem cell derived organ representations for biomedical applications.

A transformational organ-on-chip platform

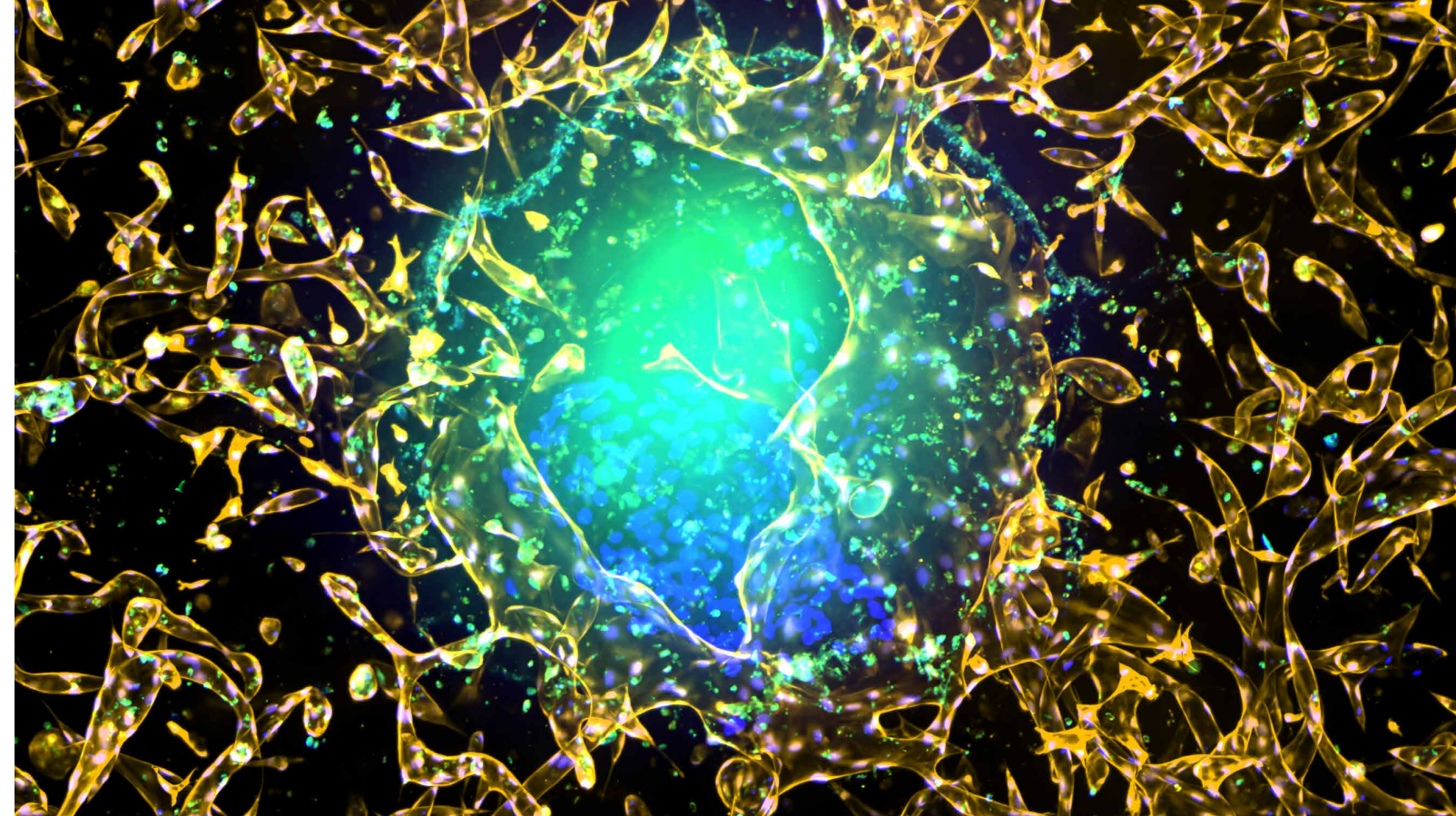
We have developed a novel, scalable directional flow organ-on-a-chip (rOoC) platform that generates controlled, unidirectional, gravity-driven flow through a combination of a 3D tilting system and an optimized microfluidic layout. The platform enables integration of organoids with endothelialized microfluidic channels and immune system components. It is currently used for i) combining stem cell-derived islets and liver organoids to reconstitute metabolic crosstalk between the two organ representations, ii) integrating and analyzing interactions between monocytes and healthy or diseased liver organoids, and iii) developing a placenta-on-chip platform. Using this platform, we published in 2025 Delon et al. "Placental Syncytium-on-Chip (PSoC)" (Adv Healthc Mater doi: [10.1002/adhm.202404462](https://doi.org/10.1002/adhm.202404462)) and Dobner et al., "Uncovering the transcriptional hallmarks of endothelial cell aging via integrated single-cell analysis" (bioRxiv, doi: [10.1101/2025.08.18.669055](https://doi.org/10.1101/2025.08.18.669055)). Using an alternative platform, we also published "Bioimpedance and Electrophysiology

Measurements of Engineered Heart Tissues Outside the Culture Medium" in Biosens Bioelectron (doi: [10.1016/j.bios.2025.117634](https://doi.org/10.1016/j.bios.2025.117634)). Based on the rOoC platform, we have received funding from the Norwegian Cancer Society to explore intravasation and extravasation in a tumor-on-chip model and have recently entered a collaboration with the Norwegian startup Oncosyne AS to develop tumor models using the rOoC platform. In addition, we have received European TRANSCAN funding to develop models of the vascular-tumor interface using the rOoC platform.

Liver organoids

With a background in developmental biology, the laboratory works toward improving the structural organization and functional performance of liver organoids to achieve a more physiologically relevant representation of the human liver. Liver architecture is shaped by morphogenetic signals from the central vein and the portal triad. Identifying these signals and applying them to direct organoid development has been a major challenge. Using hESC- and hiPSC-derived hepatocyte lineages, en-

dothelial lineages, and stellate cells, we have established stable zonation features in liver organoids and demonstrated differential responses to fibrotic challenges (I. Wilhelmsen et al., Stem Cell Res Ther doi: [10.1186/s13287-024-03852-8](https://doi.org/10.1186/s13287-024-03852-8)). As a next step, we are integrating liver organoids into the rOoC platform developed in our laboratory. We are now working toward using liver organoids for i) testing immune responses in drug-induced liver injury (A. Aizenshtadt et al., manuscript submitted), ii) developing improved physiological models (Martinez et al., "Aspects of zone-like identity and holotomographic tracking of human stem cell-derived liver sinusoidal endothelial cells," Front Cell Dev Biol doi: [10.3389/fcell.2025.1528991](https://doi.org/10.3389/fcell.2025.1528991)), iii) testing the toxicity of PFOS, and iv) assessing age-dependent and individualized responses to stressors and resilience factors (A. Aizenshtadt et al., manuscript in preparation). For this work, we have received Wellcome Leap (Dynamic Resilience) funding to model resilience to stressors using liver spheroids, adipose tissue, and immune cells (in collaboration with P. Loskill and R. Vento), with close



A melanoma tumor spheroid is recruiting a vascular network on the recirculating Organ-on-Chip platform (rOoC). The tumor spheroid altered the surrounding vessels' architecture, forming a sinusoidal structure around the main tumor mass that helps the intravasation of the tumor cells into the vascular system. A375Ma2 melanoma metastatic cancer cells are in green (celltracker), Human Umbilical Vein Endothelial Cells, HUVECs, transfected with RFP are in yellow, and their nuclei are in blue (dapi). Image credit: Andrea Dalmao Fernandez.

collaboration with S. Wilson on analytical platforms. Collaborative work with E. Melum is ongoing to model the bile duct in a microphysiological system (H. Hoyle et al., manuscript submitted).

Gastruloid development

Conventional organoid technology is based on combining individual stem cell-derived lineages into 3D structures. However, despite significant progress in organoid and organ-on-chip technologies, achieving the high physiological and histological complexity of mature organs remains challenging. A potential avenue to reach higher tissue complexity is to develop organs within their naïve embryonic 3D tissue context. Toward this goal, we have established a gastruloid subgroup that develops anteriorized mouse and human gastruloids with the aim of inducing organ formation. The group is supported by two Marie Skłodowska-Curie fellowships and a European Innovation Council (EIC) Pathfinder project, "Supervised Morpho-

genesis," coordinated by S. Krauss and comprising partners at the University of Glasgow, Imperial College, MPG Dresden, and others. The project is part of the EIC portfolio "Engineered Living Materials (ELM)." We currently analyze optimized gastruloids generated using our in-house aggregoid technology by scRNA-seq and complementary analytical methods. Publications in 2025 include Hu et al., "Spontaneous elongation of 3D gastruloids from local cell polarity alignment" (arXiv, doi: [10.48550/arXiv.2509.08929](https://doi.org/10.48550/arXiv.2509.08929)) and Smirnova et al., "Reconstituting epiblast-extraembryonic endoderm interactions restores anterior-ventral patterning in stem cell-based embryo models" (bioRxiv, doi: [10.1101/2025.11.09.687163v1](https://doi.org/10.1101/2025.11.09.687163v1)). A manuscript is in press in Nature Cell Biology, and another manuscript is in preparation.

Therapeutic WNT inhibitor development The laboratory has a long-standing track record in morphogenetic signaling and chemical biology. In this context, we have

developed a WNT inhibitor program centered on the tankyrase (TNKS) biotarget. We are currently establishing a startup company with the aim of advancing the lead inhibitor toward IND, with osteoarthritis as the primary indication. A 2025 publication on the tankyrase inhibitor is Sowa et al., "Deconstruction of dual-site tankyrase inhibitors provides insights into binding energetics and suggests critical hotspots for ligand optimization," J Med Chem (doi: [10.1021/acs.jmedchem.4c02845](https://doi.org/10.1021/acs.jmedchem.4c02845)). Two additional publications are in preparation.



Aims: The Krauss lab. works towards advanced organoids/OoC models for developing and testing therapeutic interventions.

Scholz group

Islets



Hanne Scholz
Vice Director



The Scholz Group advances next-generation beta-cell replacement therapies for type 1 diabetes by integrating clinical transplantation, stem cell biology, and gene-engineered hypoimmune cell technologies. The group has initiated development of organ-on-chip (OoC) platforms to model human islet biology, maturation, and immune interactions. This integrated pipeline positions the group at the forefront of scalable, curative cell therapies for diabetes.

Beta Cell Replacement Therapy

Beta-cell replacement through clinical allogeneic islet transplantation is a minimally invasive and effective treatment for people with type 1 diabetes and severe glycaemic instability. Procedures performed at the Department of Transplantation Medicine, Oslo University Hospital (H. Scholz) have contributed to improved metabolic control and quality of life. These clinical efforts form a key foundation for next-generation therapies using stem cell-derived and gene-engineered hypoimmune beta cells. The Scholz Group is actively engaged in international networks including IPITA, ESOT, EPITA, and NNCIT to advance global implementation of beta-cell replacement therapies. In 2025, the group contributed to the 19th IPITA Congress on pancreas, islet, and stem cell transplantation. H. Scholz was elected IPITA President-Elect (2025–2027), reflecting international recognition and leadership in the field.

Functional Islet Cells from Pluripotent Stem Cells

Functional islet cells derived from pluripotent stem cells (PSCs) are generated by mimicking pancreatic development to produce glucose-responsive beta-like cells for diabetes therapy. A key limitation remains incomplete maturation. During the current year, this was addressed by combining experimental models with deep learning-based analyses of differentiation pathways. In collaboration with Dag Kristian Dysthe, CompSci PhD candidate Franziska Schob, and partners at the Diabetes Research Institute, IRCCS San Raffaele Hospital in Milan, predictive models were developed to optimize stem cell differentiation and support clinical translation.

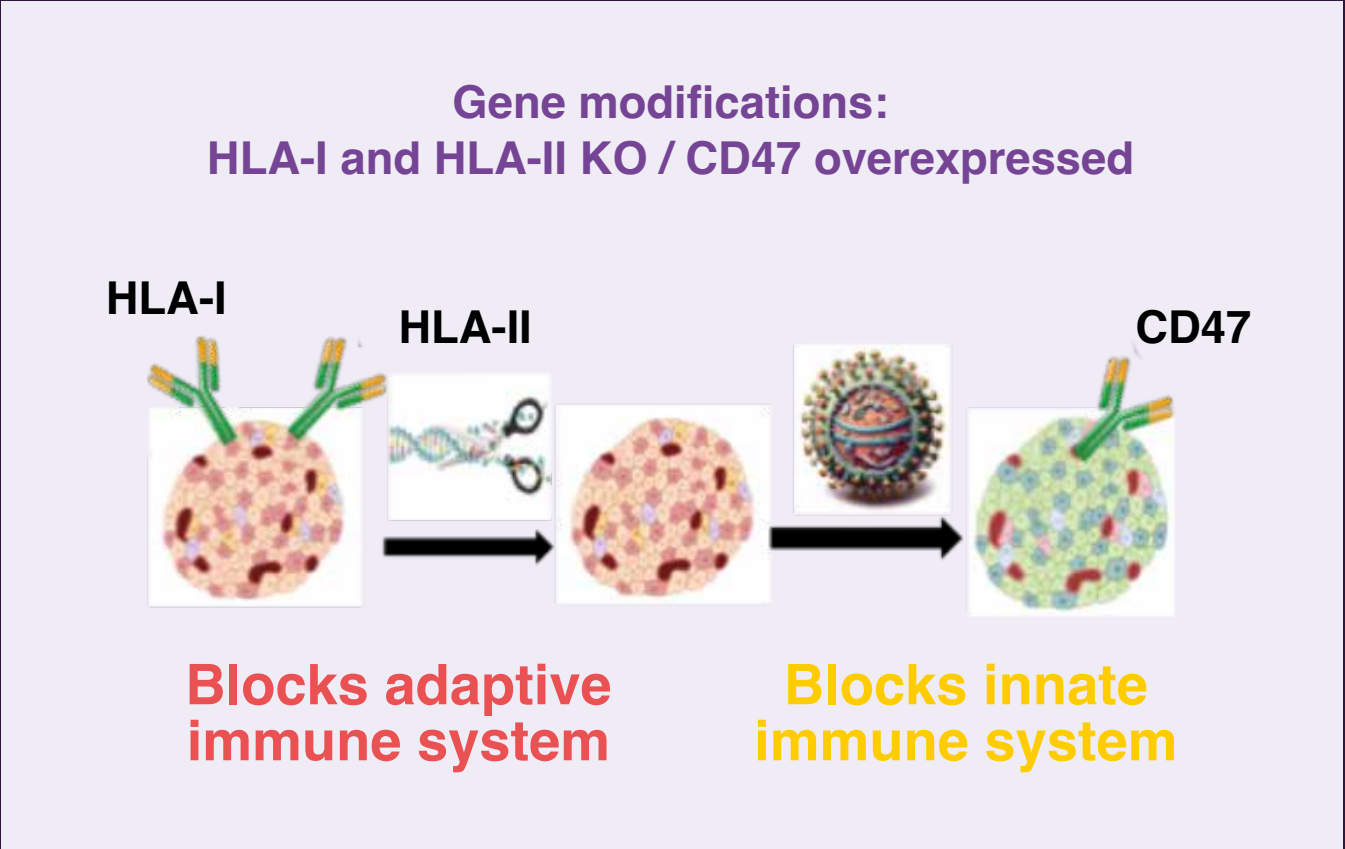
Primary human islets also contain alpha cells that produce glucagon and contribute to glucose regulation alongside insulin. This year, in vitro stem cell reprogramming

approaches were established to generate alpha cells (manuscript in preparation), supported by funding from the UiO Growth House.

Highlighted Translational Breakthrough

Highlighted in Nature Medicine as a notable biomedical advance in 2025, a first-in-human study reported in The New England Journal of Medicine demonstrated survival and function of transplanted allogeneic islet cells without systemic immunosuppression, providing proof-of-concept for immune-evasive beta-cell replacement therapy.

The Scholz Group contributed through close collaboration with Prof. Sonja Schrepfer, MD, PhD—scientist and inventor of the hypoimmune technology, Sana Biotechnology—and clinical partners at Uppsala University Hospital in an investigator-initiated study supported by a grant



The Hypoimmune Platform (HIP) enables gene engineering of primary human islet cells to reduce immune recognition. Cells are first edited to become “hypoimmune” by knocking out the genes B2M (encoding a component of class I HLA) and CIITA (a master regulator of class II HLA transcription) using CRISPR/Cas system, thereby limiting T-cell recognition (adaptive immunity). The cells are then transduced with a lentiviral vector carrying CD47 complementary DNA to provide protection from innate immune attack.

Publication 2025:

Carlsson PO, Hu X*, Scholz H*, Ingvas S, Lundgren T, Scholz T, Eriksson O, Liss P, Yu D, Deuse T, Korsgren O, Schrepfer S. Survival of Transplanted Allogeneic Beta Cells with No Immunosuppression. N Engl J Med. 2025 Aug 4. doi: 10.1056/NEJMoa2503822. * Contributed equally

Josifovska N, Niemi EM, Ramalingam M, Manivasagam G, Scholz H, Petrovski G (2025) A pilot study for decellularizing porcine cornea for future use in corneal regeneration PLoS One, 20 (12), e0339462 DOI 10.1371/journal.pone.0339462,

from The Leona M. and Harry B. Helmsley Charitable Trust.

Gene-edited islet cells were engineered at Oslo University Hospital using the hypoimmune platform (Figure), representing a key milestone toward scalable, off-the-shelf cell therapies for type 1 diabetes. The plat-

form applies approach combines targeted genome editing with protective immune-modulating signals to address both adaptive and innate immune responses. CRISPR/Cas-based editing removes HLA class I and II expression to limit T-cell and antibody responses, while CD47 expression protects cells from innate immune attack.

Together, these modifications enable transplanted islet cells to survive and function without systemic immunosuppression, supporting immune-compatible beta-cell replacement for type 1 diabetes.

Rayner group

Computational Biology



Simon Rayner
Principal Investigator



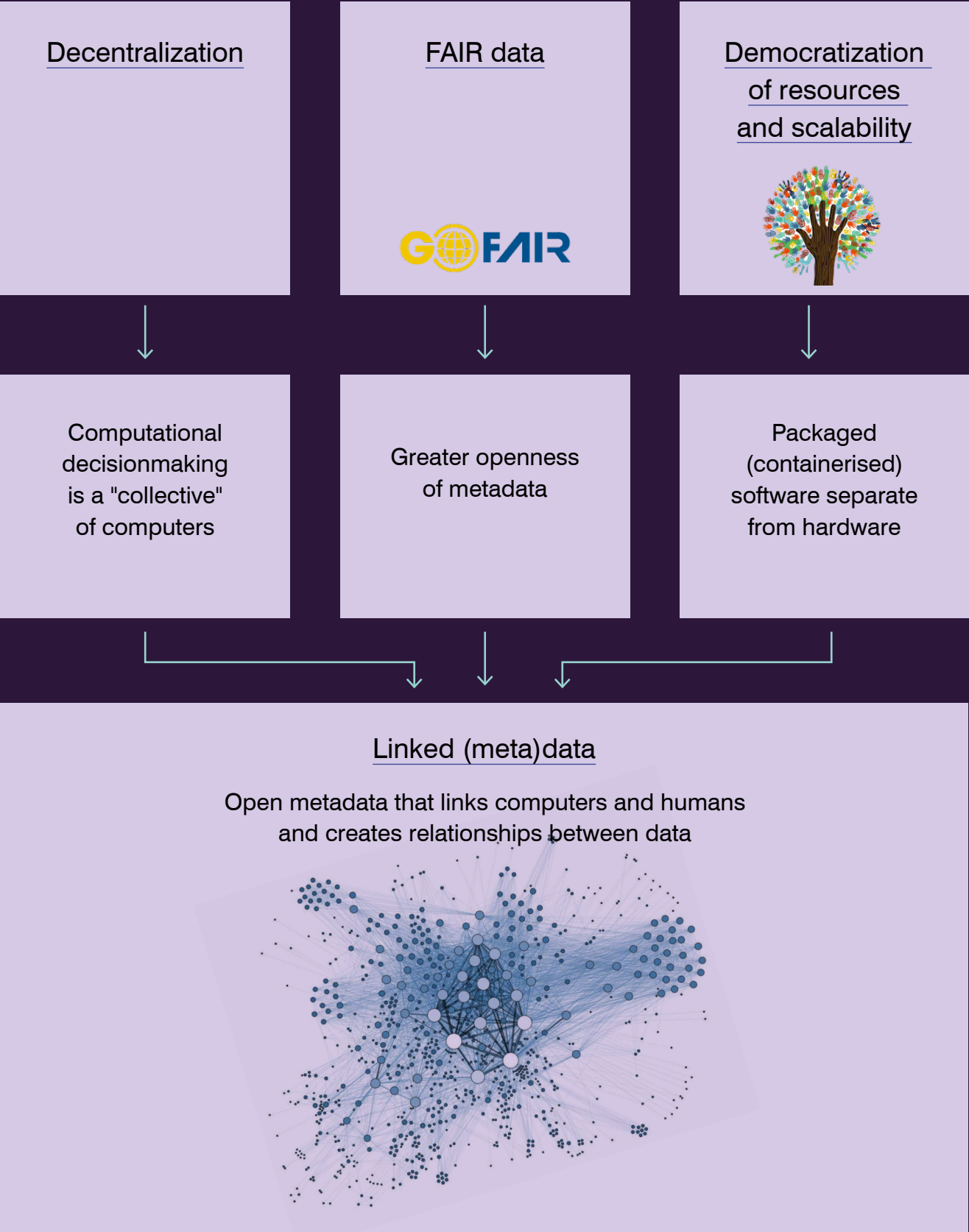
The group primarily investigates the evolutionary response of systems to external stimuli. We distinguish ourselves as a Computational Biology group rather than a Bioinformatics group, as our objective is to develop software to study and interpret biological functions, rather than simply analyzing existing datasets.

We focus on clinical data, primarily Whole Genome Sequence data, to understand how the noncoding genome varies among groups of different ancestries, and how these changes are manifested as pre-existing risk to both communicable and non-communicable diseases. With the plethora of large-scale genome studies that have been initiated in recent years, this gives us the opportunity to examine non-coding changes from a variety of perspectives. However, while we primarily use public data, we also conduct in-house experimental studies to meet specific research requirements for example to confirm and further investigate computational predictions. Our methodology spans standard Next Generation Sequencing—profiling

miRNA, mRNA, and regulatory networks—to sophisticated techniques like Single Cell Spatial Sequencing. This research aligns with HTH objectives by providing tools to examine organoids at the genetic level and evaluate how well they approximate human organs. For instance, while liver organoids replicate core structures and gene expressions, their regulatory profiles remain largely unmapped; Single Cell sequencing allows us to better understand how closely these models approximate living systems. For example, we have applied our methodologies to brain organoids to analyze the effects of Human Cytomegalovirus infection on neonatal brain development.

Finally, we are interested in addressing challenges in data standardization and integration by implementing FAIR (Findable, Accessible, Interoperable, and Reusable) principles. To support this, we developed the Globally Accessible Distributed Data Sharing (GADDS) platform. This infrastructure utilizes blockchain-based metadata quality control, private cloud storage, and version control. By employing containerized technologies, GADDS ensures scalability and decentralized trust, facilitating seamless cross-disciplinary collaboration.

GADDS Philosophy:



Stevens group

Computational frameworks for enhanced Raman microspectroscopy



Molly Stevens
Principal Investigator



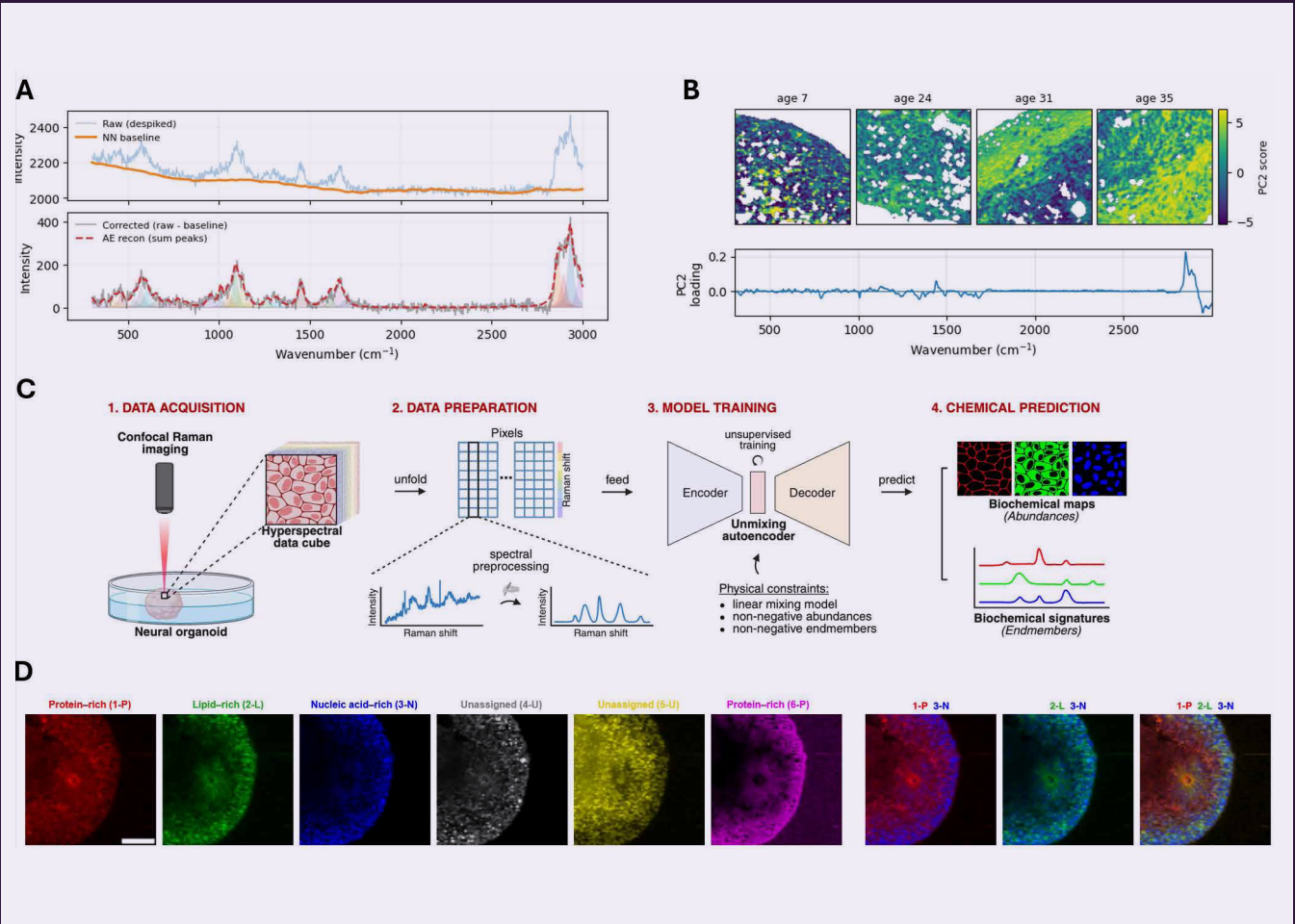
We are developing advanced imaging and sensing technologies to be able to analyze organoids and biological material on-chip.

We are developing a high-speed computational framework for label-free digital histology using Raman microspectroscopy to characterize tissue development. A major bottleneck in spectral imaging is fluorescence background removal, which is traditionally computationally intense and time-consuming. To address this, we developed a robust Neural Network preprocessing tool to automate this step, enabling high-speed, accurate background estimation across millions of spectra—a prerequisite for all stable downstream analysis (panel A, top). For chemical feature extraction, we utilize a physics-informed Autoencoder to model spectra as a sum of discrete pseudo-Voigt peaks. This ongoing work provides a descriptive framework to eventually classify tissue samples based on interpretable molecular signatures (panel A, bottom). Currently, we employ global Principal Component Analysis embeddings

to visualize spatial chemical distributions and track developmental transitions across multiple time points (panel B). Finally, we are investigating the integration of spatial models with active learning to optimize imaging workflows. By identifying the most informative wavenumbers and spatial coordinates in real-time, we aim to move beyond exhaustive scanning to accelerate data acquisition. This approach would allow us to measure only the specific regions required for tissue identification, transforming Raman microscopy into an intelligent, high-throughput tool for biological discovery.

As part of associated research, we developed a non-invasive, label-free imaging platform that integrates spontaneous Raman microspectroscopy with deep learning-based hyperspectral unmixing for unsupervised, spatially resolved biochemical

analysis of neural organoids. This approach enables the use of 3D-neural organoids as powerful in vitro models of human neurodevelopment, disease, and drug response, without relying on invasive, label-based imaging techniques that disrupt tissue architecture, require prior knowledge of molecular targets, and offer limited multiplexing capacity. These constraints restrict the ability to interrogate intact organoids under physiologically relevant conditions and to capture their intrinsic biochemical heterogeneity. By leveraging autoencoder neural networks, our approach overcomes key limitations of conventional Raman chemometric methods, including sensitivity to noise, reliance on predefined reference spectra, and reduced robustness in complex biological mixtures (panel C). The platform enables accurate, high-resolution mapping of cellular and subcellular biochemical features with improved perfor-



↑
A: Neural Network (NN) estimated baseline to raw spectrum (top). Autoencoder (AE) reconstruction of baseline corrected spectrum. Reconstruction done as sum of pseudo-Voigt peaks (bottom). B: Ventralized hindbrain organoid visualised using Principal Component Analysis embeddings (top). Principal Component direction used to estimate embeddings (bottom). C: Schematic diagram of our organoid imaging pipeline combining Raman microspectroscopy and deep learning-enhanced hyperspectral analysis. D: Abundance maps of derived tissue-specific endmember signatures - including single-channel images (left) and multi-channel images (right).

mance compared to standard hyperspectral analysis techniques and strong agreement with fluorescence microscopy benchmarks (panel D).

Overall, our work on computational frameworks for Raman microspectroscopy establishes versatile and scalable tools with broad applicability to organoid research, developmental biology, disease modelling, and drug discovery.

Related papers
D. Georgiev, R. Xie, D. Reumann, X. Zhao, A. Fernandez-Galiana, M. Barahona, M. M. Stevens. “Label-free biochemical imaging and timepoint analysis of neural organoids via deep learning-enhanced Raman microspectroscopy.” Under review.

Gadegaard group

Chip design and integration



Nikolaj Gadegaard
Principal Investigator

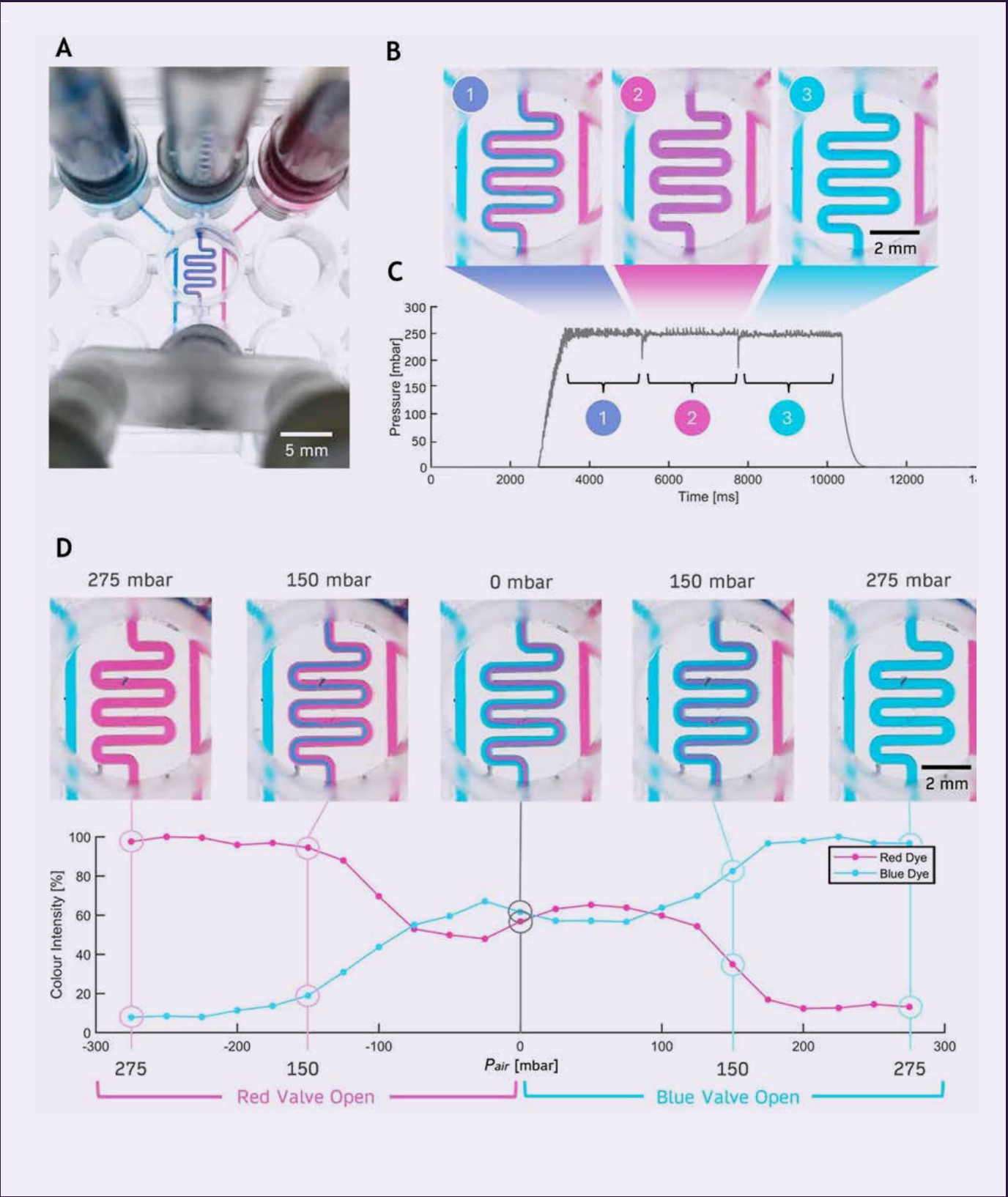


The Biomedical Interfaces at Glasgow (BIG) focuses on the design, simulation and scalable fabrication of microfluidic and organ-on-chip (OoC) technology.

The group has developed rapid tooling for injection moulding of microfluidic devices. More recently, the group has integrated flow control on-chip for mixing or actuation. This is illustrated in the adjacent figure. The valve features two male Luer lock connectors, connecting it to the two outlets of our pneumatic system. To illustrate the microfluidic switching and regulation capabilities, a dedicated microfluidic device was developed. The figure shows the device under perfusion, where each inlet supplies different coloured media (colour blue from inlet 1, and red from inlet 2). This is easily seen in the mixing channel as laminar flow. By activating membrane 1, the membrane

expands and closes the respective inlet blocking the blue-coloured medium from entering the channel. Consequently, only the red-coloured medium flows into the mixing channel. The opposite is also possible by activating membrane 2 alone. By controlling the applied pressure to the membrane, it is possible to achieve dynamic control over concentration in the channel. The correlation between applied pressure and colour balance was quantified through colour deconvolution, which measured the relative intensity of each individual colour in the mixing channel as a function of pressure. When membrane 1 is pressurized to 275 mbar, the blue channel is fully

closed, preventing any flow. As a result, the mixing channel is almost entirely filled with red-coloured medium, which reaches a colour intensity of 97.6%. However, when the pressure is reduced to 150 mbar, MV1 is relaxes slightly, allowing a small volume of blue-coloured medium to enter the mixing channel, increasing its relative intensity to 18.9%, while the red decreases to 94.5%. A further reduction of pressure results in a more pronounced change until both colours are equalized at 0 mbar.



Louch group

Cardiomyocyte function



William Edward Louch
Principal Investigator



Employing stem-cell derived cardiomyocytes to investigate cellular structure and function in health and disease.

Each heartbeat arises from the precisely coordinated contraction and relaxation of cardiomyocytes. This activity is initiated at the subcellular level by the release of calcium from the sarcoplasmic reticulum at highly specialized junctions. At these sites, invaginations of the cell membrane known as t-tubules, together with their associated proteins, form intimate contacts with calcium release channels—the ryanodine receptors (RyRs)—located in the SR (Figure 1). Despite decades of research, the exact spatial organization of these proteins and the nature of their interactions remain poorly defined. A major challenge lies in the extremely small separation between the opposing membranes, which is only about 7-8 nm, placing these structures beyond the resolution of conventional microscopy. Further complicating our understanding of calcium release and contraction in cardiomyocytes is the realization that calcium levels near the RyRs are controlled by an array of other calcium handling proteins (Figure 1). In addition, there are complex post-translational modifications of RyRs which alter their calcium sensitivity.

To gain better insight into this complicated topic, we apply emerging super-resolution microscopy techniques. These methods enable precise localization of RyRs and other key calcium-handling proteins, including L-type calcium channels (LTCCs) and sodium-calcium exchangers (NCXs). Of these new techniques, MINFLUX is arguably the most exciting, as it provides an incredible resolution of 2 nm. This has allowed us to localize individual RyRs in 3D space for the first time (Figure 2). We are also employing live-cell super-resolution imaging, to directly relate nanoscale protein organization to calcium release dynamics in real time.

Much of our insight into cardiomyocyte calcium homeostasis has come from the use of rodent cardiomyocytes, due to limited availability of living human tissue. However, with the advent of induced pluripotent stem cell (iPSC)-derived cardiomyocytes, it has now become possible to conduct similar investigations in human cells. Through collaboration with the Hybrid Technology Hub, we have examined the struc-

tural arrangement of various calcium-handling proteins in these cells, including RyRs, and structural proteins present within contractile units called sarcomeres (Figure 3). This work has importantly revealed key differences in the structure and function of cells sourced from patients with inherited mutations. For example, we have recently shown that patients with truncations in a sarcomeric protein called titin exhibit abnormally shortened sarcomeres, leading to impaired force production and contractility. We are continuing with this work to understand how patient-specific mutations can disrupt the heartbeat, and how we can tailor each patient's treatment on an individual basis.

William Edward Louch
Principal Investigator



Figure 1: Contraction of cardiomyocytes is dependent on the release of calcium from Ryanodine Receptors (RyR2), which in turn is regulated by the position of the channel, its post-translational modifications, and other proteins that control nearby calcium levels. From Gonano et al., Circ Res, 2025.

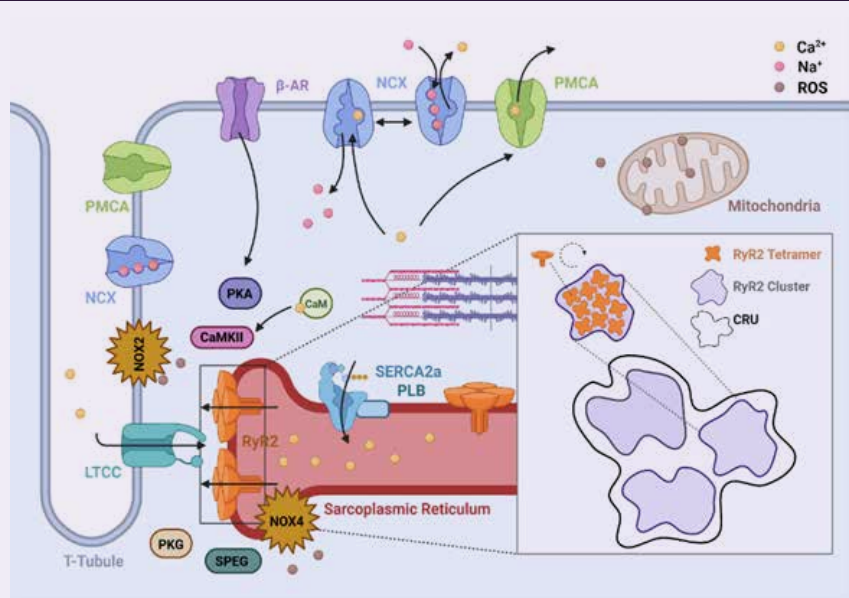


Figure 2: RyR imaging at increasing levels of resolution. Confocal imaging of a cardiomyocyte at the indicated region reveals RyR clusters (A, zoom in shown in B), but the configuration of individual channels is only revealed by MINFLUX imaging (C). From Clowsley et al., Nat Comm, 2025.

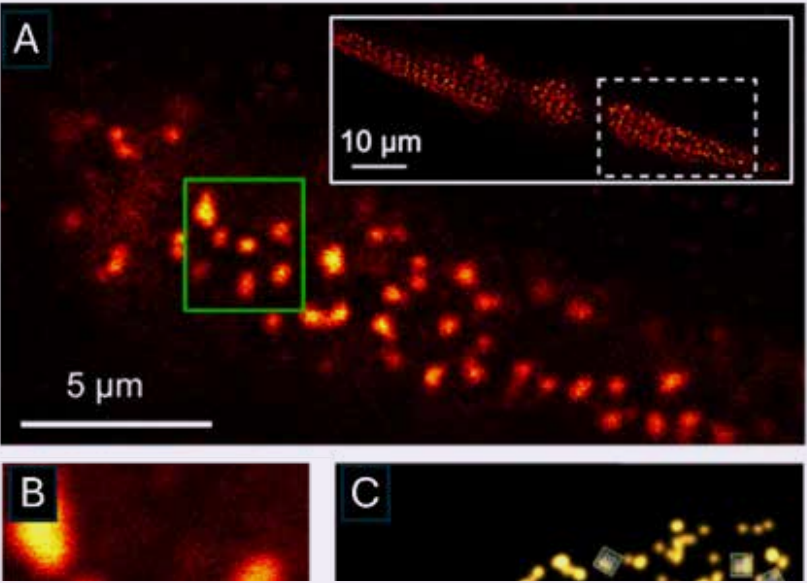
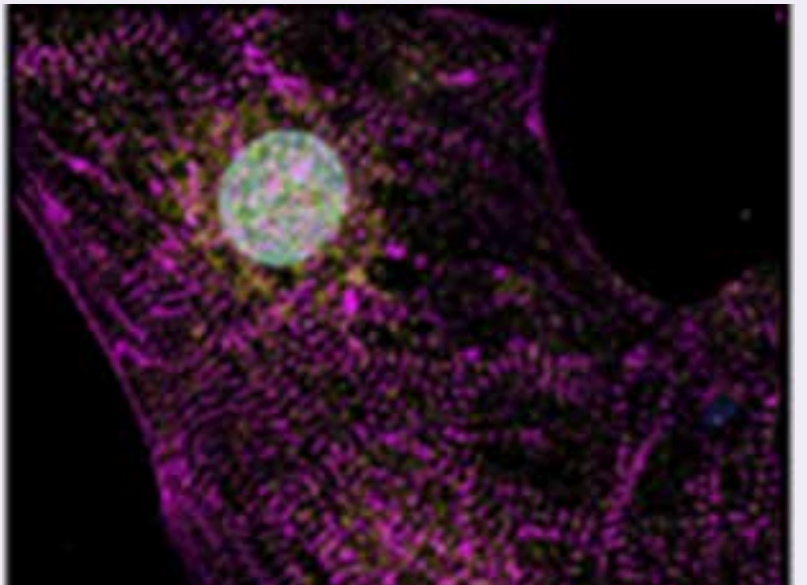


Figure 3: A human iPSC-derived cardiomyocyte stained for RyR2 (green) and the sarcomeric protein α -actinin (magenta). Courtesy of Pugal Erusappan.



Solbakk group

Ethic of organoids



The ethics group focuses on the law and ethics of organoids. In 2025, this included contributions to two EU funded projects.

The European Innovation Council Pathfinder Challenges funded SUMO project (Supervised morphogenesis in gastruloids) coordinated by HTH with Stefan Krauss as PI, started in November 2022 at which time Heidi Beate Bentzen came onboard to address the ethics requirements and conduct tasks related to creating best practice guidelines for the gastruloid research field, a role she has continued since. An embedded ethics approach is used, where the ethics is interwoven with the science and best ethics practices are developed in tandem with the scientific advancements. To achieve this, quarterly ethics review meetings chaired by Bentzen are attended by the entire consortium, and ethics issues are discussed collaboratively. Significant work went into making an embedded ethics matrix, and in addition to the SUMO consortium, this work also included SUMO Ethics Advisory Board member Rosario Isasi, and other leading scientists in the field. Bentzen attended a 2-day Engineered Living Material Portfolio meeting at InnoRenew in Izola, Slovenia in October.

The Marie Skłodowska-Curie Actions Doctoral Network funded TOP-GUT project

(Training for Organoids modelling Physiology and Pathology in the human gastrointestinal tract), which started in November 2023, continued through 2025. One of the network's 11 PhD Candidates is based in Oslo and supervised by Heidi Beate Bentzen who is the local PI. Alongside two colleagues, Bentzen will also provide the legal and ethical training for all the PhD Candidates in the network. Stefan Krauss is on the TOP-GUT Advisory Board. Bentzen attended the annual meeting at i3S in Porto, Portugal in April.

Further networking in the field was achieved by Bentzen chairing the ethics session at the annual Nordic Organoid and Microphysiological Systems Convention (NOR-MPS), where the Norwegian Directorate of Health, the Biotechnology Advisory Board, and two SUMO PIs were amongst the speakers, and the Biotechnology Advisory Board were co-organizers. Bentzen was also on the organizing committee of a 2-day policy workshop in London, United Kingdom in June on Harnessing Health from Data Within and Between Nations, under the joint auspices of The Academy of Medical Sciences and the Norwegian

Academy of Sciences and Letters (DNVA). The workshop brought together leading scientists and policy makers from the Nordics and the United Kingdom. In addition to her teaching in research ethics and data protection law at the Faculty of Medicine, she also lectured on law and ethics of biotechnology at OsloMet in February.

Bentzen also participated in COST Action CA21151 Generation of hiPSCs from haplo-selected cord blood samples, and attended one 3-day meeting in Heraklion, Greece in May, and a 1-day meeting on data curation at The Royal College of Pathologists in London in December.

Together with Professor Dan Jerker B. Svantesson, Heidi Beate Bentzen published a chapter on Legal Issues When Transferring Health Data Between the EEA and Australia, in a book published by Springer on International Transfers of Health Data (https://doi.org/10.1007/978-981-97-9983-1_5).



Jan Helge Solbakk
Principal Investigator



Art on floor at Domus Medica.
Image credit: Thomas Cornblat

Bioanalytical chemistry team



Steven Wilson
Principal Investigator



Hanne Røberg-Larsen
Associated Partner



The bioanalytical chemistry team specializes in employing mass spectrometry for analyzing organoids and organ-on-a-chip systems.

The Bioanalytical Chemistry group consists of two permanent scientific staff members, Steven Ray Wilson (PI, HTH) and Hanne Røberg-Larsen (group leader, associated member HTH). The group also includes 4 PhDs. This team supervises around 15 master students. The activity of the group can roughly be divided into three parts:

1. Novel approaches to sample preparation and analysis of organoids and OoCs.

Two main approaches are being explored. The first is "AFFL-LC-MS", which allows for biosamples to be analyzed with minimal sample preparation, skipping steps such as protein precipitation and off-line extraction steps. The AFFL approach allows for cell culture media, packed with salts, nutrients and proteins to be directly injected onto a mass spectrometry system, for e.g. drug metabolism studies. The system has been validated according to FDA guidelines, and was shown to be remarkably robust, allowing thousand-scale injections of unprepared samples without any maintenance. In collaboration with Merck Life

Science, the platform is now being expanded to a broad set of drugs, assessed with a 96-compound panel. The platform will be further applied for liver organoid analysis in early 2026.

A second approach is being explored is electroextractions. The team, in collaboration with SINTEF and others, have in 2025 received funding from e.g. the NRC (proof of concept funds "verifiseringsmidler") and the Novo Nordisk Foundation (Pioneer Innovator grant) to develop chip variants of EME. The team has designed and manufactured chips (Figure 1) and a prototype describing a novel electroextraction chip was submitted in 2025. Our team is also participants/PIs in a FRIPRO application lead by Frøydis Sved Skottvoll (SINTEF) related to the abovementioned technology.

2. Studying the effect of PFAS on organoids

PFAS (per- and polyfluoroalkyl substances) are a group of synthetic chemicals used in a broad range of products and are poten-

tially problematic because they persist in the environment, accumulate in living organisms, and have been linked to adverse health effects, including hormonal disruptions and increased cancer risk. BACH is developing analytical methods to studying the effect of PFAS, using organoids and models, supported by a FRIPRO grant. In 2025, BACH has developed methods for measuring a broad range of PFAS in MPS relevant platforms and a manuscript is in preparation. In addition, several other projects studying the effect of PFAS on MPS platforms are ongoing and expected to be published in 2025.

3. Chemical analysis of gastruloids

BACH is also developing approaches to studying gastruloids, employing LC-MS for sterolomics and proteomics. In 2025, a sterolomic mapping was undertaken following a methodical optimization of our platform, allowing for single organoid- and gastruloid analysis (see Figure 2)



Figure 1. Zoom-out of electroextraction chips which are manufactured in a scalable and reproducible fashion using micro- and nanofabrication technology. The design has been submitted as a patent application.

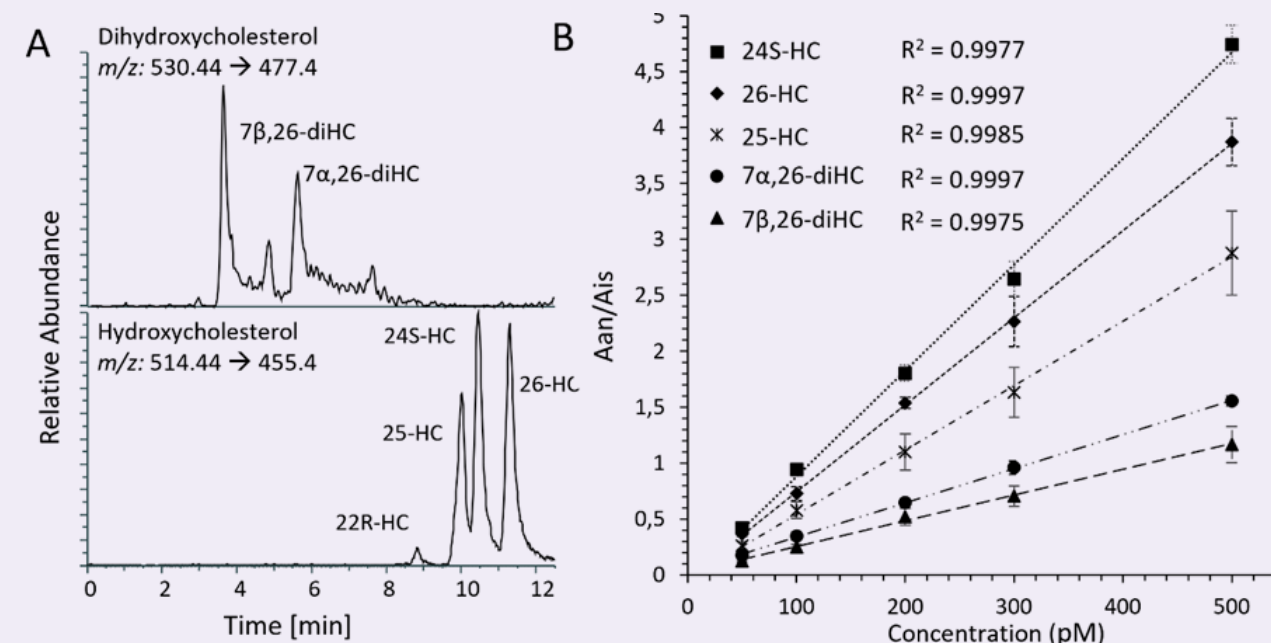


Figure 2. A sterolomics platform was tailored for enabling small sample analysis for oxysterol measurements in single organoids and gastruloids. The method, in addition to revealing novel oxysterols in early stages of development, allowed for quantification through a validated approach.

Melum group

Experimental liver research



The group's primary focus is understanding the mechanisms behind cholangitis, with an emphasis on immunology, the immune system's interaction with the microbiome, and the role of cholangiocytes in inflammatory processes.

The experimental liver research group focuses on understanding bile duct inflammation and is part of the Norwegian PSC research center (NoPSC) and the Hybrid Technology Hub (HTH). Our laboratory activities take place at both the Research Institute of Internal Medicine and HTH. In 2025 the group consisted of the group leader, four senior researchers, five post-docs, five PhD students, the lab manager, one researcher and two technicians. During Espen Melum's paternity leave during part of the autumn of 2025 Brian Chung was the acting group leader. The overarching topic in the group is to understand mechanisms regulating cholangitis with a clear focus on immunology and the interaction of the immune system with the microbiome and the role of cholangiocytes in propagation of inflammatory processes. All projects in the group have a clear translational focus either by using human material, human relevant animal models or in vitro / ex vivo assays. A key aspect of the work in the group is to establish new methods for characterizing and modelling PSC. Together with HTH we are addressing these questions using organoid and bile-duct-on-a-chip technology.

Our strong collaboration with HTH on the bile-duct-on-a-chip was further strengthened in 2025. In November 2025 Henry Hoyle, who leads the team in the group working on the chip, graduated from the University of Oslo's SPARK program for commercialization. The SPARK program has been very useful for the team to develop an innovative mindset and understand how commercialization should be done. The spin-off company DUCTmimic was incorporated in 2025 aiming to offer CRO services to the pharmaceutical industry for assessment of off-target effects on the bile duct. This commercialization process was also supported by a new qualification grant from the Norwegian Research Council in 2025. The first version of our bile-duct-on-a-chip now forms the foundation for three ongoing projects and the remaining data for the first publication using the chip was finalized in 2025. In parallel with the first version of the chip running "in production" we made significant advances for the version 2 of the chip where we will integrate the immune system. In March 2025 Sarah Peisl joined the bile-duct-on-a-chip team as an exchange PhD student from Bern in Swit-

zerland and has been using the system to specifically interrogate the response to bacterial compounds. Sarah is in training as a transplant surgeon and is doing her PhD on bile duct diseases in mouse models and during her stay in Oslo she will align the chip-based assessments with her observations in mouse models in Bern. To further strengthen the team Mughilan Selvarajah was recruited as a PhD student to work on disease modelling and drug effects using the chip. Mughilan trained in at Norwegian University of Science and Technology (NTNU) in Trondheim as a civil engineer and did his masters at the Radiumhospital where he continued for one year in the Stenmark lab before joining our group as a PhD student in October 2025.

In addition to the chip-based projects, that are integrated projects within HTH, the experimental hepatology group also has large projects related to single-cell sequencing and spatial transcriptomics using both human and murine material. These studies aim to uncover driving mechanism for bile duct disorders of high relevance for the chip system as well as being of



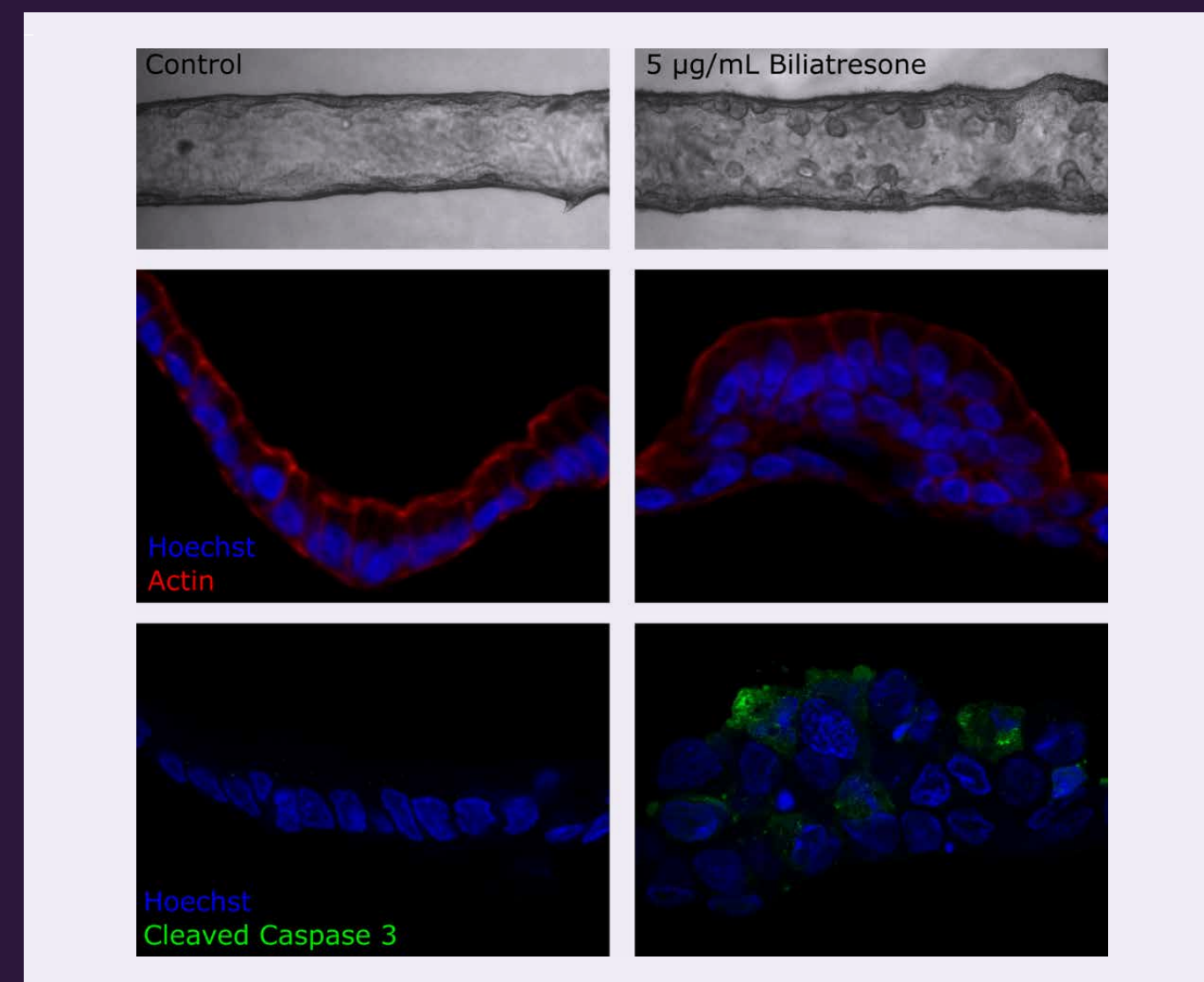
Espen Melum
Principal Investigator

methodological relevance for other projects at HTH. In 2025 we finished several of our ongoing spatial transcriptomics and single-cell/nuclei based assessments of PSC compared to disease controls and animal models of cholestatic disease. We published the largest study of PSC samples examined with spatial transcriptomics across different areas in the liver and indications for transplant and found that the metallothionein pathway was upregulated at the parenchyma-fibrosis interface compared to disease controls. This finding was followed up with validation at the protein level and we also found that the

same pathway was upregulated in a PSC relevant mouse model.

Another study starting from a mouse model examined pathology in NOD.c3c4 mice using spatial transcriptomics at different time-points of disease development. This analysis highlighted a CD226-NECTIN2 interaction in the mice, identification of this interaction was aided by a database of biologically proven interactions. The CD226-NECTIN2 interaction was solidified at the protein level and was also shown to be present in PSC patients. In the autumn of 2025, we followed up this finding

with functional in vitro experiments. Besides the human and NOD.c3c4 project we continued our spatial transcriptomics-based projects in the bile duct ligation (BDL) and oxazolone induced cholangitis model. Our available datasets from human PSC patients are attractive datasets for several ongoing targeted assessments in collaborative projects out of which one was published in 2025. In parallel with the publication of the sequencing-based datasets we have made them available to the community through a new portal (<https://riim-data.no/index2.html>) developed by Jonas Øgaard in the group.



↑
Images of the bile duct on a chip with and without treatment for 24 hours with Biliatresone, a plant toxin which induces the disease Biliary Atresia in animals. Brightfield images show an increase in dense round structures forming within the bile duct after treatment. Actin staining (red) shows changes to cell polarity within these structures and cleaved caspase 3 (green) shows the presence of apoptotic cells after treatment. Nuclei are stained blue.

Corthay group

Tumor immunology



By recapitulating the tumor microenvironment in vitro, tumor on chip systems accelerate the creation and optimization of next generation cancer immunotherapies.

Recreating an immunocompetent tumor microenvironment on a chip

Solid tumors are composed of cancer cell clusters embedded in a stroma of extracellular matrix and non malignant cells, including fibroblasts, endothelial cells and diverse immune populations. To better understand and enhance anti tumor immune responses, our group is developing microfluidic tumor on chip models that recreate this complex microenvironment in vitro. The platform enables detailed dissection of the cellular and molecular interactions that occur in human tumors, with the aim of supporting the development of novel cancer immunotherapies. To date, we have reconstructed a basic tumor microenvironment on chip as 3D co cultures in biomimetic hydrogel, incorporating cancer cells, tumor specific T cells, and tumor associated macrophages. Cell-cell interactions and key processes such as proliferation and cell death are monitored and visualized over several days using high content time lapse microscopy.

Statistical analysis of spatial patterns in tumor microenvironment images

Advances in tissue labeling, imaging, and automated cell identification now make it possible to visualize distinct immune cell populations within human tumors. Yet a robust framework for quantifying spatial patterns in the tumor microenvironment (TME) has been lacking. To fill this gap, we developed with collaborators in Paris “SpatioPath”, a null hypothesis testing framework that separates statistically significant immune cell associations from random spatial distributions. By using embedding functions to represent cell contours and tumor regions, SpatioPath generalizes Ripley’s K function to quantify both cell-cell and cell-tumor region interactions. We validated the method on synthetic simulations and applied it to multi color images of lung tumor sections, uncovering reproducible spatial motifs — for example, mast cells accumulating near T cells and the tumor epithelium, while T

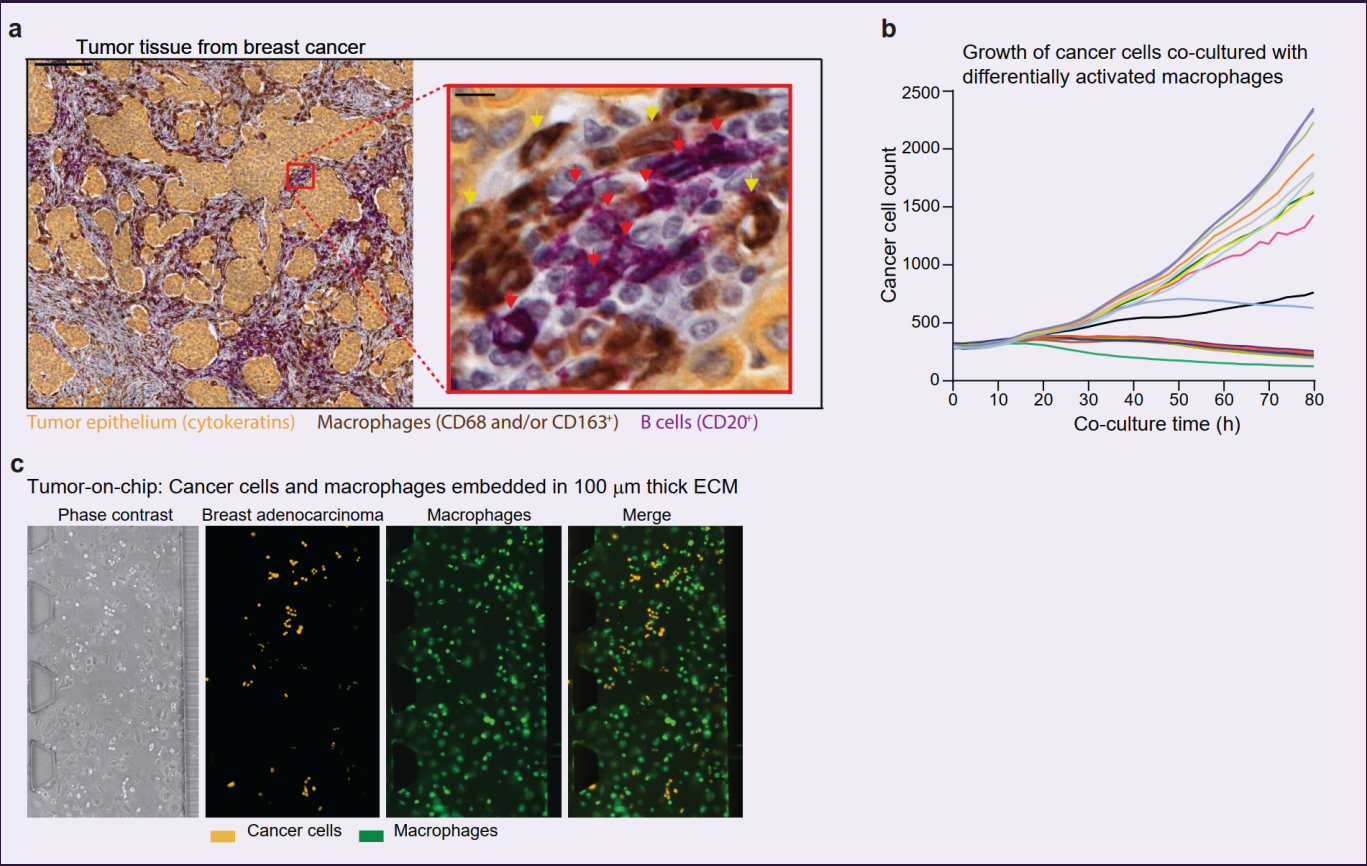
cells are located at greater distances. These findings reveal distinct patterns of spatial organization within the TME. SpatioPath improves our ability to characterize anti tumor immune responses and holds promise for identifying spatial biomarkers associated with patient outcomes.

Immunological surveillance against cancer across mammals

Although larger, longer lived species have many more cells and hence, in principle, a greater opportunity for malignant transformation, they do not experience a proportionally higher cancer burden. This implies the evolution of natural cancer resistance mechanisms, but these mechanisms remain poorly understood. The cancer immunological surveillance hypothesis of Burnet and Thomas (1950s) proposes that immune surveillance is a major determinant of species specific cancer resistance. To test this evolutionary interpretation, we examined the relationship between cancer mortality risk and



Alexandre Corthay
Principal Investigator



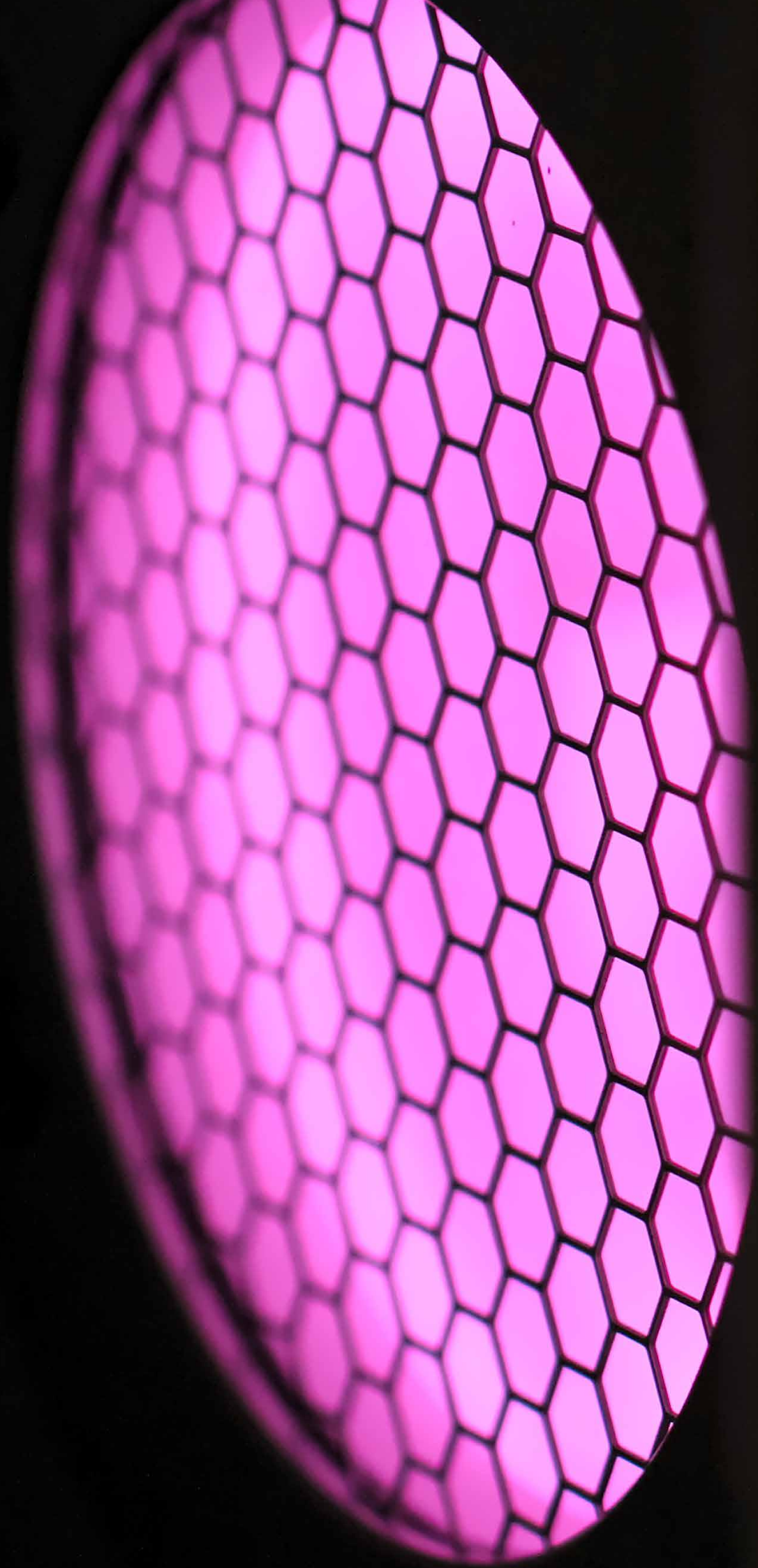
a) Tumor tissue from a patient with human epidermal growth factor receptor 2 (HER2)-enriched breast cancer shows extensive infiltration of macrophages (brown) and B cells (purple). The tumor epithelium is shown in yellow. b) The growth of cancer cells in co-culture with human macrophages depends on the activation state of the macrophages. c) Human breast adenocarcinoma cells and macrophages embedded in a 100 μ m thick 3D extracellular matrix (ECM) in a tumor-on-chip maintained for 6 days.

indicators of effective antigen presentation across mammals. We found that expansion of the MHC class I gene complex — together with stronger selection for allelic diversity at these loci — correlates with sharply reduced cancer mortality risk. These results indicate that efficient presentation of a diverse peptide repertoire by somatic cells contributes to cancer suppression across mammals and provide cross species evidence supporting the cancer immunosurveillance hypothesis.

Related papers

M. M. Benimam, V. Meas-Yedid, S. Mukherjee, A. Frafjord, A. Corthay, T. Lagache, J.-C. Olivo-Marin. 2025. Statistical analysis of spatial patterns in tumor microenvironment images. *Nature Communications*. 2025.

O. Vincze, P. Minias, A. Corthay, F. Colchero, J.-F. Lemaître, L. Maille, T. Malkócs, J. Hagemann, D. A. Conde, S. Pavard, A. M. Dujon, B. Ujvari, F. Thomas, A. M. Boddy, C. C. Maley, D. Chevallier, T. Sepp, T. Pradeu, and M. Giraudeau. 2025. Immunological surveillance against cancer across mammals. *Nature Communications*. 2025.



HTH associated research projects

ITOM

Integrated technologies for tracking organoid morphogenesis (2022–2026)

About the project

There is a significant need for developing reliable human organ representations (termed organoids) for drug development, personalized drug testing, and on the longer run for organ transplantations. The advent of human induced pluripotent cell (hiPSC) technology has allowed developing *in vitro* human organoids that show features of the organs they represent, but are significantly less structured and less mature than their human counterparts. The field therefore requires high-content tracking tools and algorithms to guide organoid development. Developing such technologies will represent a leap towards reliable personalized organoids with organ-like histology and functionality.

In this project we will work on three technological platforms to track organoid morphology.

1. Confocal Raman microscopy that allows label-free visualization of Raman active molecules in fixed and living specimens.
2. High-resolution spatial transcriptomics and desorption electrospray ionization-mass spectrometry (DESI-MS).
3. Lightsheet microscopy for fast and slow time-lapse imaging of cells in the organoids.

Based on the imaging data, we will develop statistical physics models for organ/organoid pattern formation *in vitro*. The information will be used to tailor statistical models to improve organoid formation *in vitro*.

As specified in the contract the project leadership was in 2025 transferred from Stefan Krauss to Hanne Røberg-Larsen.

PROJECT LEADER

Dr. Hanne Røberg-Larsen
Department of Chemistry, UiO

PARTICIPANTS

Prof. Stefan Krauss
Hybrid Technology Hub CoE, UiO

Prof. Luiza Angheluta-Bauer
Department of Physics, UiO

Prof. Dag Kristian Dysthe
Department of Physics, UiO

Prof. Steven Ray Haakon Wilson
Department of Chemistry, UiO

Prof. Alexander Refsum Jensenius
Department of Musicology, UiO and CoE-RITMO

Prof. Molly Stevens
Imperial College London, UK

Prof. Joachim Mathiesen
Niels Bohr Institute, University of Copenhagen, DK

Dr. Richard David Jun-Geet Ho
NJORD Physics - Centre for Studies of the Physics of the Earth, UiO.

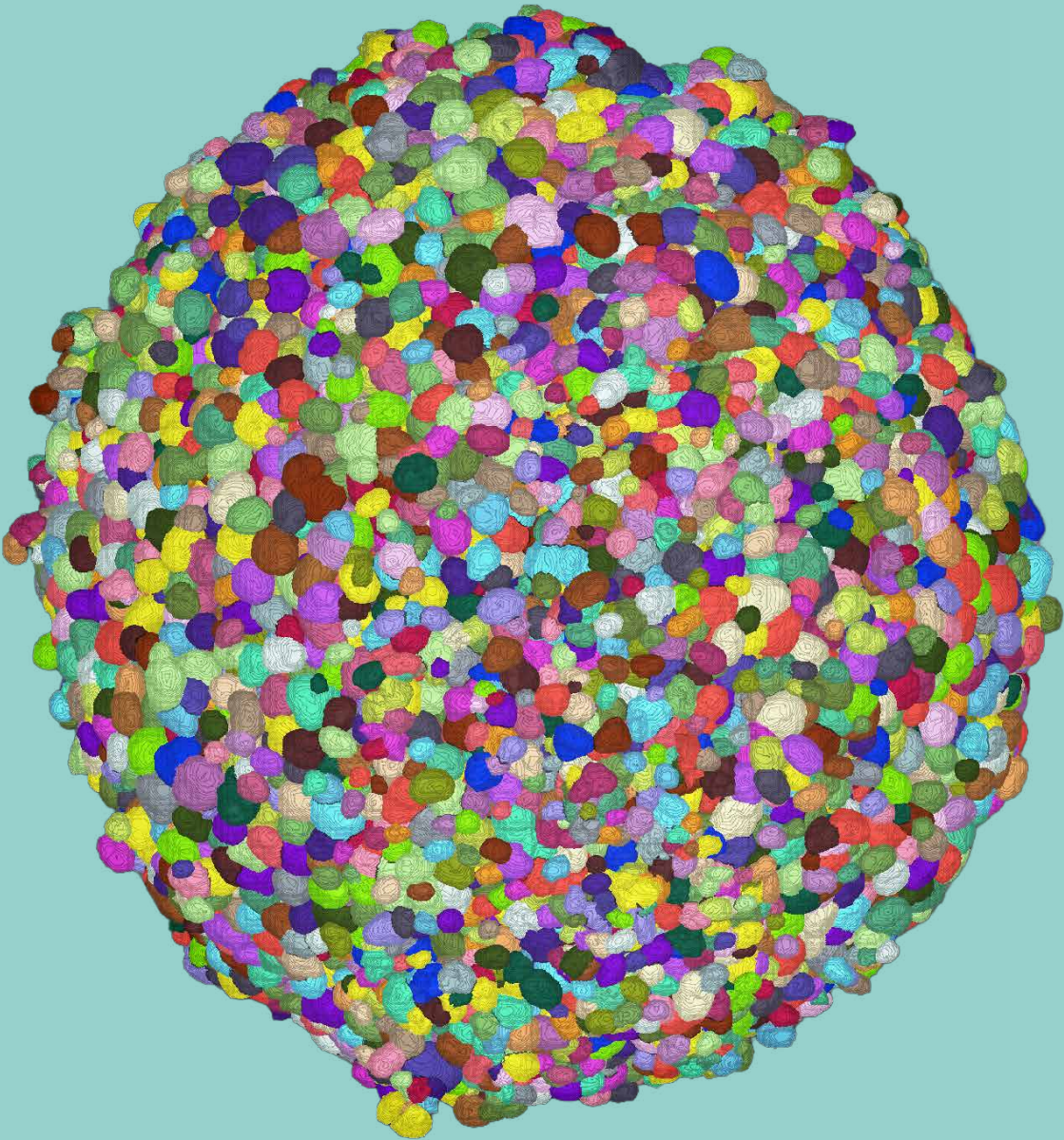
Dr. Joachim Mossige
RITMO Centre for Interdisciplinary Studies in Rhythm, Time and Motion, UiO.

FUNDING

The 4 year project is funded by the UiO: Life Science convergence environment program with 16,9 million NOK

FURTHER INFORMATION

<https://www.uio.no/english/research/strategic-research-areas/life-science/research/convergence-environments/itom/>



↑ The image shows 3D data of segmented cell nuclei for a 3-day-old mouse gastruloid derived from the MP1 mESC cell line and stained with DAPI stain to make the cell nuclei visible. The sample was imaged with a light-sheet microscope, and the cell nuclei were segmented using a machine learning algorithm. Diameter of sample: 300 micrometer (credit: Sunny Dai and Jana Harizanova at the Core Facility for Integrated Microscopy at the University of Copenhagen)

SUMO

Supervised morphogenesis in gastruloids (2022–2027)

About the project

The lack of realistic *in vitro* organ models that can faithfully represent *in vivo* physiological processes is a major obstacle affecting the biological and medical sciences. The emergence of stem cell engineered organ models called organoids represents a viable alternative to animal research. However, current organoid technology has yet to produce larger histological and physiological faithful organ models. Specifically, current organoids are too small, not vascularized and lack the 3-dimensional organization found *in vivo*. In this interdisciplinary project we aim to challenge all these limitations by using the emerging gastruloid technology guided by cutting edge bioengineering and artificial intelligence.

The work of the consortium focuses on:

1. Developing mouse gastruloid technology to achieve reproducible heart and gut development.
2. Vascularization of gastruloids to produce 1 cm³ ELM.
3. Advancing human gastruloid technology within ethical boundaries.
4. Developing correlative live imaging technologies and Raman spectroscopy as a benchmarking and tracking tool for gastruloids.
5. Developing machine learning (ML) based tracking algorithms in 3D.
6. Establishing a standardized close-loop system and DBTL platform for upscaling.
7. Implementing a DBTL platform to establish a PoC environmental toxicology pipeline.
8. Providing an ethical, safety and regulatory framework for advanced human gastruloid technology.
9. Engaging in a social dialogue with the public advanced human gastruloid technology.
10. Strengthening gastruloid/organoid community; Disseminate technology to the European biotech industry.

The SUMO project enters a thematic “Engineered Living Matter” portfolio that comprises 7 projects.

PROJECT LEADER

Prof. Stefan Krauss
Hybrid Technology Hub – Centre of Excellence, Institute of Basic Medical Sciences, University of Oslo (UiO) and Oslo University Hospital

PARTICIPANTS

- Prof. Jan Helge Solbakk**
Centre for Medical Ethics, Institute of Health and Society, University of Oslo
- Prof. Molly Stevens**
Imperial College of Science, Technology and Medicine, London
- Prof. Nikolaj Gadegaard**
University of Glasgow
- Dr. Jesse Veenvliet**
Max-Planck-Gesellschaft Dresden
- Dr. Jens v Kries**
Forschungsverbund Berlin
- Dr. Iftach Nachmann**
Tel Aviv University

FUNDING

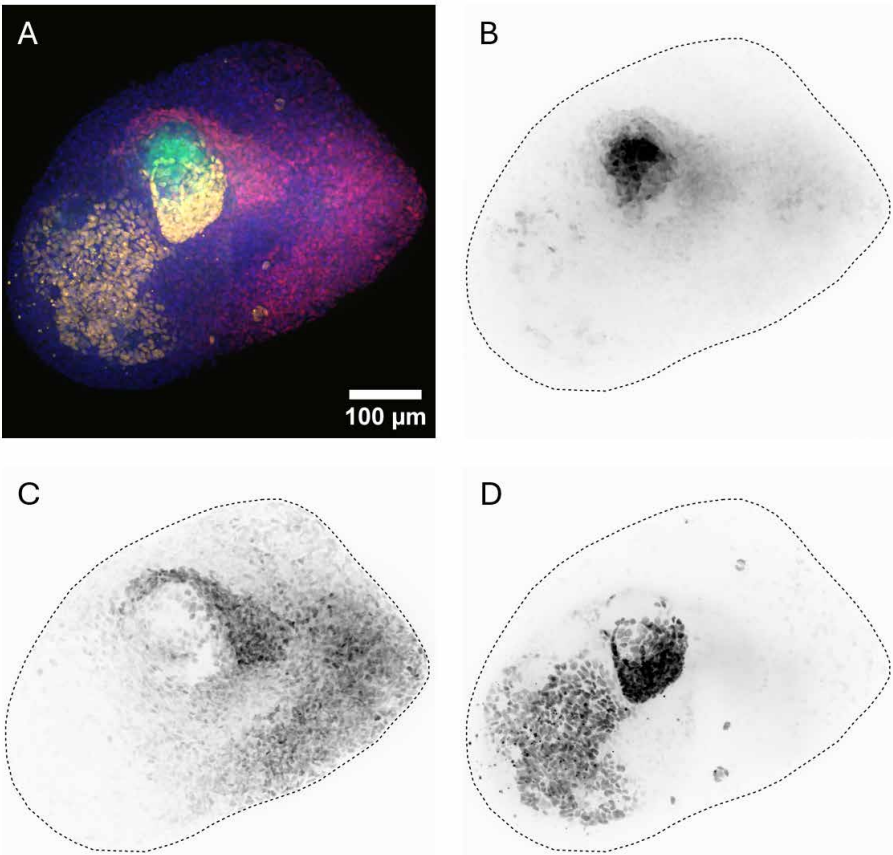
The 5 year project is funded by the EU program: HORIZON.3.1 – The European Innovation Council (EIC) with 4,95 million Euro

FURTHER INFORMATION

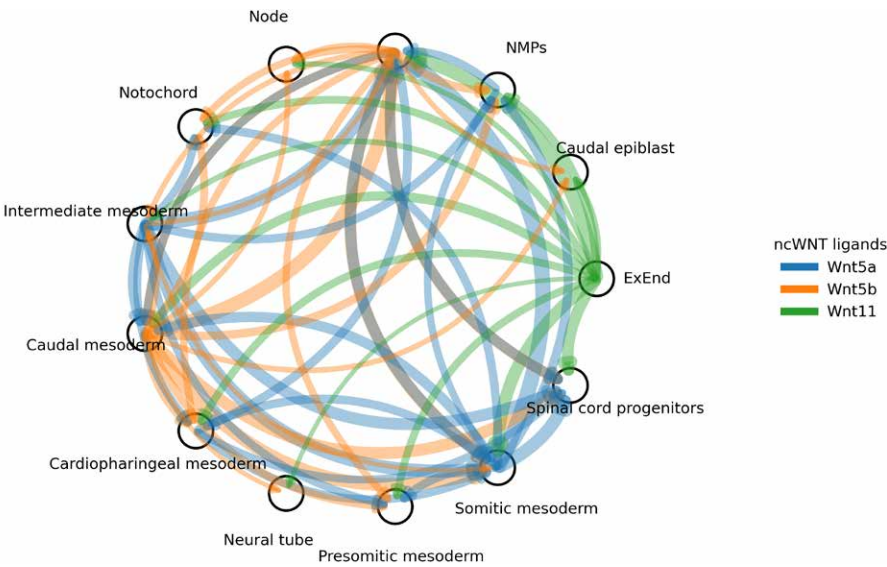
<https://cordis.europa.eu/project/id/101071203>

<https://supervised-morphogenesis.eu>

https://cordis.europa.eu/programme/id/HORIZON_HORIZON-EIC-2021-PATHFIN-DERCHALLENGES-01-05



5-day (120 h) mouse gastruloid co-aggregated with RACL cells (a Visceral Endoderm analogue). Our data show that this co-aggregation induces the formation of the anterior Primitive Streak and Node, structures that are absent in control (non-co-aggregated) gastruloids.
A. Combined immunostaining for Sox17 (yellow) – Definitive Endoderm, Brachyury (green) – Node, and FoxF1 (red) – Mesoderm.
B–D. Single immunostaining for Brachyury (B), FoxF1 (C), and Sox17 (D), respectively.
Image credit: Sergei Ponomartsev and Natalia Smirnova.



Cell chat chart derived from single-cell RNA sequencing (scRNA-seq) data of 4-day (96 h) mouse gastruloids co-aggregated with RACL cells (a visceral endoderm analogue). The chart highlights cell clusters expressing Wnt ligands (Wnt5a, Wnt5b, and Wnt11) and the clusters expressing their corresponding receptors (arrow head), indicating potential signaling interactions and cross-talk between these tissues.

Wellcome LEAP

Female resilience on-chip:
Monitoring dynamic resilience using
Multi-Organ-Chips linking metabolic
state and immune response in
pre- and postmenopausal women
(2023–2026)

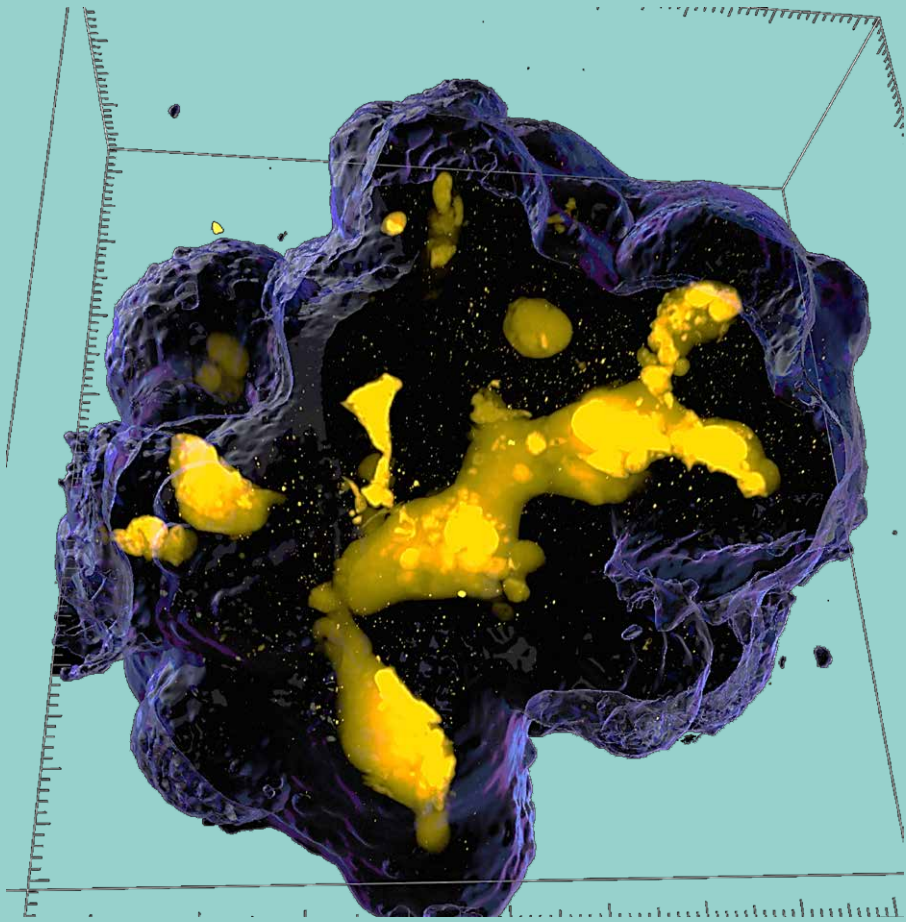
About the project

Current research on dynamic resilience has been limited to observational clinical settings and simplified *in vitro* assays. However, in order to investigate the mechanisms that control and alter resilience and to identify associated biomarkers, advanced *in vitro* models that can be subjected to stressors in defined ways are urgently needed. Organ-on-Chip (OoC) technology has the potential to address these limitations by enabling the connection of multiple tissue models and the integration of immune components, allowing for studies on human physiological processes with a granularity that current models do not provide.

In this project we unite experts in OoC platform design, organoid development, immunology, genomics, bioinformatics/artificial intelligence, and clinical research to create a resilience-on-chip platform. We believe that metabolic changes during aging contribute to an inflammatory environment, impacting resilience and having immune metabolic effects. We hypothesize that dynamic resilience mechanisms are centrally impacted by metabolic changes during aging that create an overall inflammatory environment which leads to loss of resilience and hence are of immune metabolic nature.

To explore this hypothesis with high granularity, we propose:

1. Leveraging a three-organ Multi-Organ-Chip (MOoC) connecting hormone, metabolic and immune sensitive organs (WAT, liver and lymphoid tissue).
2. Applying a series of readouts that allow the dynamic monitoring of immune metabolic changes in an integrated approach.
3. Interrogating the platform with a battery of stressors.
4. Benchmarking the in vitro data set with the human in vivo situation on a patient-specific level.



3D rendering of liver organoids derived from donor tissue. Central accumulation of an added dye (yellow color) indicates functional transporters, and the formation of bile canaliculi.

PROJECT LEADER

Prof. Peter Loskill
Natural and Medical Sciences Institute at the University of Tübingen (NMI), Germany.

PARTICIPANTS

NMI-μOrgano team
Prof. Dr. Peter Loskill
Dr. Claudia Teufel
Dr. Madalena Cipriano

NMI-MIA team
Dr. Nicole Schneiderhan-Marra
Dr. Alex Dulovic NMA

Wellcome Sanger Institute team
Dr. Roser VentoTormo

University of Oslo team
Prof. Stefan Krauss
Prof. Dr. Espen Melum
Dr. Aleksandra Aizenshtadt
Dr. Mathias Busek

Clinical and Regulatory Advisory Board
Prof. Dr. Sara Y. Brucker, EKUT
University Women's Hospital, Tübingen.

Prof. Dr. Espen Melum, Research Institute of Internal Medicine (RIIM), UiO.
Dr. Heidi Beate Berntzen, UiO.

FUNDING

The 3-year project is funded by the Wellcome Leap Dynamic Resilience program with 6,3 million USD.

FURTHER INFORMATION

<https://wellcomeleap.org/dr/program/>

Transcan-3

Human avatar on chip for advancing personalized cancer therapies by integrating vascular and immune components in a Tumor-on-Chip model (HAVOC).
2025-2028

Background and rationale

Despite advances in breast cancer treatment, a subset of tumours remains lethal due to their ability to evade immune surveillance. This immune escape is driven by the tumour microenvironment (TME), which consists of tumour endothelial cells (TECs), immune cells, cancer-associated fibroblasts (CAFs), and the extracellular matrix (ECM). TECs acquire aberrant phenotypes that promote tumour progression by driving pathological angiogenesis, remodelling the ECM, and modulating immune responses. These changes limit immune cell infiltration and reduce the effectiveness of current immunotherapies, highlighting the need for human-relevant models that capture the complexity of the TME and enable systematic therapeutic testing.

Hypothesis

We hypothesize that a microfluidic tumour-on-chip platform that accurately models the breast cancer TME—particularly TEC behaviour and immune cell dynamics—will enable preclinical evaluation and rational tailoring of immunotherapeutic strategies.

Primary aim

To establish a human-relevant in vitro model of breast cancer incorporating key TME components, including TECs, using a robust and scalable microfluidic tumour organ-on-chip (TrOoC) platform.

Secondary aims

To optimize a scalable microfluidic system for modelling tumour-specific and patient-derived TMEs, allowing high-throughput and high-resolution analysis of tumour–TME–immune cell interactions. We will comprehensively characterize the heterogeneous TME interactome using complementary state-of-the-art technologies. In parallel, we will perform personalized on-chip testing of standard therapies and evaluate therapeutic bispecific antibodies alone and in combination with existing TME-modulating treatments.

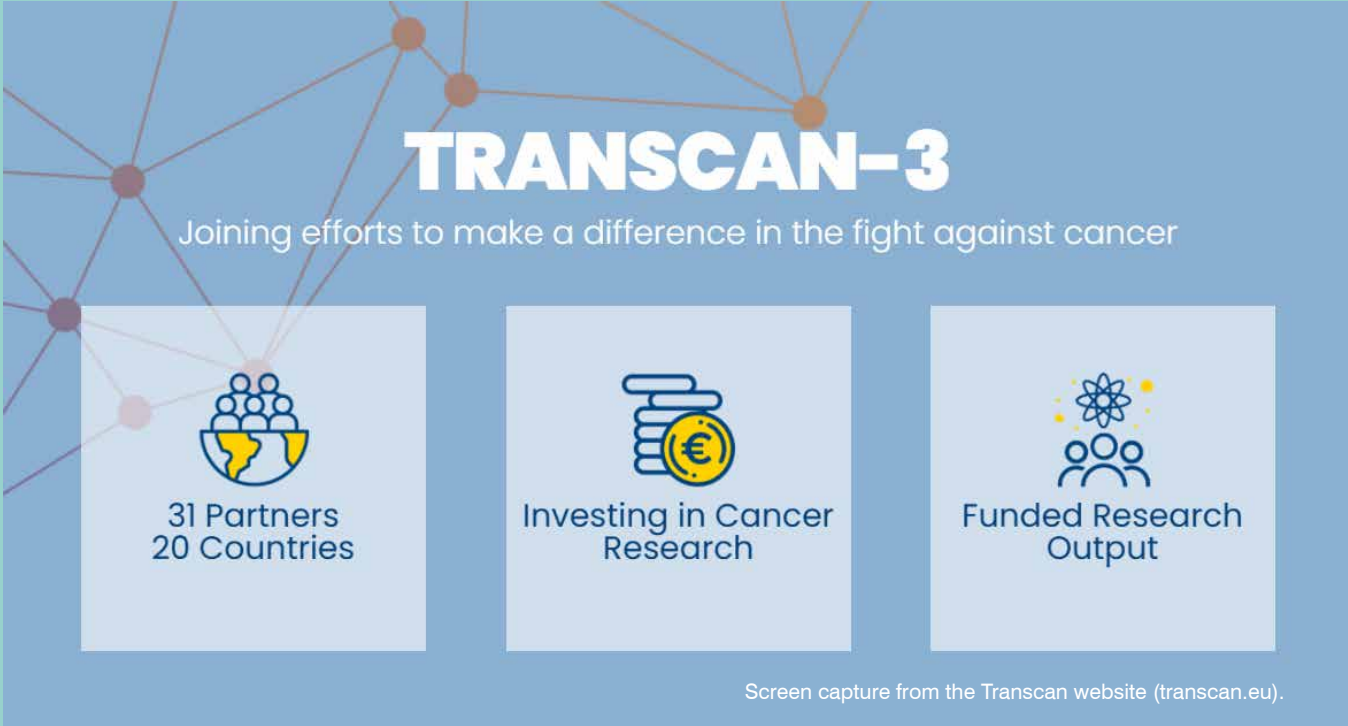
Methods

We will adapt a scalable, tubeless microfluidic platform to support co-culture of tumour organoids, TECs, CAFs, and peripheral blood mononuclear cells. Initial optimization will use commercial and in-

house-derived cell lines, followed by integration of patient-derived material. The TrOoC platform will support long-term culture and will be analysed using immunofluorescence microscopy, multicolour flow cytometry, cytokine profiling, and single-cell RNA sequencing. Therapeutic testing will assess the efficacy of bispecific antibodies alone or in combination with established therapies.

Expected results and potential impact

We anticipate that the TrOoC platform will recapitulate key functional features of the breast cancer TME, enabling mechanistic studies of tumour–immune interactions and TEC-driven immune evasion. This system is expected to provide a robust preclinical tool for evaluating TME-targeted therapies and enabling patient-specific treatment testing. Ultimately, the platform has the potential to improve therapeutic stratification and outcomes in breast cancer and may be adapted to other tumour types to support precision oncology.



PROJECT COORDINATOR

Dr. Laura de Rooij
CeMM Research Center for Molecular Medicine, Vienna, Austria.

PARTICIPANTS

Prof. Stefan Krauss
Oslo University Hospital, Oslo, Norway
Prof. Peter Loskill
University of Tübingen, Tübingen, Germany.

FUNDING

The HAVOC project is funded through the TRANSCAN-3 Joint Transnational Call 2024 entitled “Combination therapies against cancer: new opportunities for translational research.” The project will be conducted over three years with a total budget of €975,000.

FURTHER INFORMATION

<https://transcan.eu/output-results/funded-projects/havoc.kl>



SPARK team

SPARK is a two-year UiO:Life Science innovation program to further develop ideas within health-related life sciences for the benefit of patients and society.

DUCT chip – An artificial bile duct on a chip recapitulating immune functions

Project leader

Henry Hoyle, Division of Surgery, Inflammatory Diseases and Transplantation, OUS.

Team members

Anna Katharina Frank, Espen Melum, Stefan Krauss, Mathias Busek, Aleksandra Aizenshtadt and Kayoko Shoji

Patents

Krauss S, Nazare M, Lehtio L, Waaler J, Wegert A, Leenders R.G.G "compounds". Application submitted 19. June 2018 IPO patent application number 1810071.9. Published 29.12.2019 WO2019/243822

Krauss S, Waler J, Lehtio L, Leenders R.G.G. Wegert A. "compounds" application submitted 6. July 2020 IPO patent application number 2010359.4

Krauss S, Aizhenshtadt A, Mikel Martinez, Busek M "Cell Culture Device". Application submitted 19 July 2021 UK patent application (Appl. 2110366.8)

Wilson, Skottvoll, Kutter, Pedersen-Bjergaard, Krauss, Mielnik, Nguyen."Microfluidic Device for Analyte Extraction" Number: NO 20250245

Dofi

14/09/2020 DUCT chip – An artificial bile duct on a chip recapitulating immune functions; Espen Melum, Anna Frank, Stefan Krauss

13/08/2021 Human iPS derived zone specific hepatocytes; Aleksandra Aizenshtadt and Stefan Krauss

10/01/2023 Devise for analytical Electromembrane Extraction from 3D cell culture, Organoids and organ-on-a-chip platforms; Frøydis Sved Skottvoll, Steven Ray Wilson, Stig Pedersen Bjergaard, Jörg P. Kutter, Michal Mielnik, Aleksandra Aizenshtadt, Stefan Krauss

Established companies

DuctMimic AS

DuctMimic specializes in in vitro modeling of the bile duct, providing innovative solutions for pharmaceutical companies.

Team:

Henry Hoyle, PhD Founder & CEO
Anna Frank, PhD Founder & CSO
Espen Melum, MD PhD Founder & Chairman

Sharp AI Ltd

Sharp AI promotes neural-network based denoising solutions for scientific and medical imaging.

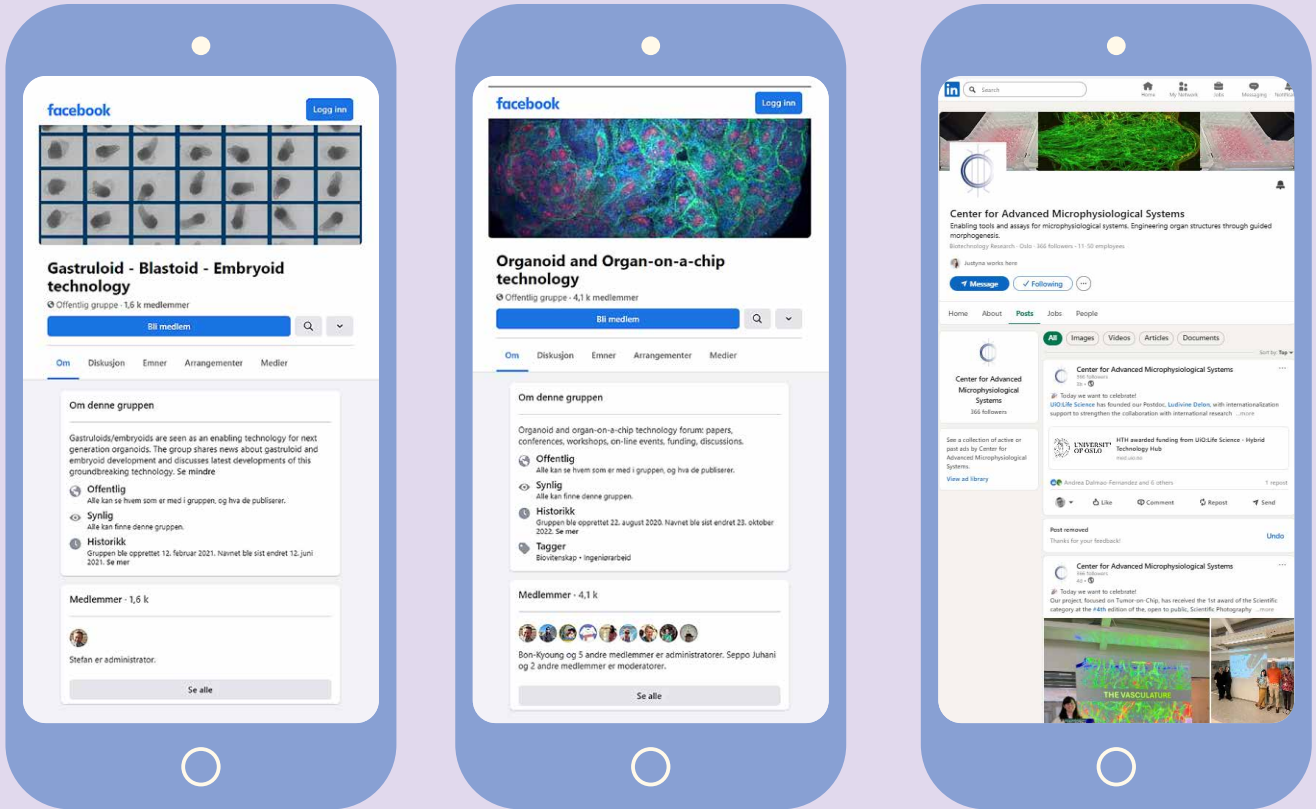
Team and founders:

William Edward Louch
Yufeng Hou
Martin Laasmaa

Research and engagement

Outreach

Media / Social media



Facebook

HTH manages two public Facebook groups focused on gastruloids and organoids, with 1700 and 4300 followers, respectively.

<https://www.facebook.com/groups/143900280909369>

<https://www.facebook.com/groups/304082784189295>

Linkedin

HTH managed group

<https://www.linkedin.com/groups/12584551/>

<https://www.linkedin.com/company/center-for-advanced-microphysiological-systems/posts/?feedView=all>

1700 + 4300
followers

Popular science presentations / Articles in media

Kristopher Schau møter forskere:

Kan dyrking av menneskelige organer revolusjonere medisinsk forskning?

*"Kristopher Schau meets researchers:
Can the cultivation of human organs revolutionize medical research?"*

Interview and podcast with HTH director Stefan Krauss in Forskning.no

<https://www.forskning.no/bioteknologi-medisin-norges-forskningsrad/kristopher-schau-moter-forskere-kan-dyrking-av-menneskelige-organer-revolusjonere-medisinsk-forskning/2479012>

Lovende resultater av ny behandling med transplantasjon av genmodifiserte øyceller mot diabetes type 1

"Promising results of a new treatment using transplantation of genetically modified islet cells for type 1 diabetes"

Comment by HTH vice director Hanne Scholz in OUS news.

<https://www.oslo-universitetssykehus.no/om-oss/nyheter/lovende-resultater-av-ny-behandling-med-transplantasjon-av-genmodifiserte-oeyceller-mot-diabetes-type-1/>

A mother's heart: How pregnancy shapes women's heart health

Article coauthored by HTH PI Bill Louch in ScienceNorway.no.

<https://www.sciencenorway.no/heart-pregnancy-researchers-zone/a-mothers-heart-how-pregnancy-shapes-womens-heart-health/2509290>

Slik skiller kvinnehjertet seg fra mannehjertet

"How the female heart differs from the male heart"

Chronicle coauthored by HTH PI Bill Louch in Forskersonen.no

<https://www.forskersonen.no/hjertet-kronikk-meninger/slik-skiller-kvinnehjertet-seg-fra-mannehjertet/2508247>

From Placental Syncytium-onChip to Trophoblast Invasion on-chip

Precentation by HTH student Thea Josephine Wergeland on National Conference on Womens health research.

<https://www4.uib.no/en/research/research-centres/driv-center-for-womens-health-research/featured/programme-national-conference-on-womens-health-research>

Avansert cellerterapi – en kur for type 1-diabetes?

"Advanced cell therapy – a cure for type 1 diabetes?"

Comment from HTH Vice director Hanne Scholz in "Alt om din helse".

<https://www.altomdinhelse.no/diabetes/avansert-cellerterapi-en-kur-for-type-1-diabetes/>

Brikkemagi skal gi færre dyreforsøk og bedre legemidler

"Chip-based technology aims to reduce animal testing and improve medicines."

Article in Titan.no featuring HTH PI Steven Wilson and HTH alumni Frøydis Skottvold.

<https://www.titan.uio.no/livsvitenskap/2025/minibrikken-skal-redde-dyr-bedre-legemidler.html>

Rektorteam sikter mot verdens-toppen — om 30 år

"The rector team is aiming for the top of the world — in 30 years."

Article in Khrono.no highlighting the rector election candidate team, with Giske Ursin as rector candidate, HTH Director Stefan Krauss as pro-rector, and HTH PI Heidi Beate Bentzen as vice-rector.

<https://www.khrono.no/rektorteam-sikter-mot-verdenstoppen-om-30-ar/933746>

Education

TNNN – Research School for Training the Next Generation of Micro- and Nanotechnology Researchers in Norway

About the project

The Hybrid Technology Hub CoE participates in the Research School for Training the Next Generation of Micro- and Nanotechnology Researchers in Norway (TNNN). Micro and Nano Science and Technology is a highly cross disciplinary field that covers many areas of science including physics, chemistry, material technology, biology and medicine. It is the driving force behind a large part of modern science and technology, with numerous applications that span photovoltaics, batteries, fuel cells, opto-electronics, sensors, medical diagnostics, biomedical research, quantum computing and many others.

The Research School for Training the Next Generation of Micro- and Nanotechnology Researchers in Norway (TNNN) will address current gaps in PhD-level education in this field. In particular, it will establish a vibrant national network of junior scientists working in this area of science and technology development, provide training in transferable skills and facilitate collaboration with industry.

The Research School focuses on:

- 1. National Junior Scientist Research Conference: This conference will be organized every year and will include plenary and invited talks from leaders in various areas of nanotechnology, contributed talks from PhD candidates and postdoctoral researchers, presentations from industry, workshops and networking events
- 2. Workshops in generic/transferable skills
- 3. Problem solving workshops organized together with partners from the Norwegian industry
- 4. Innovation, entrepreneurship and commercialization courses and workshops

The TNNN Conference 2025 (11–13 June, University of Tromsø) featured invited speakers, contributed talks, and sessions on scientific integrity, publishing, and research in today’s geopolitical context. Highlights included a poster session at Mack Brewery, the Conference Dinner at Maskinverkstedet, and networking with colleagues. The conference concluded with a Scientific Writing Workshop on 13 June, where Claus Roll and Muhammad Nadeem Akram shared guidance on manuscript preparation, journal selection, ethical considerations, and the peer review process.

HTH contact point

Dr. Hanne Scholz, Hybrid Technology Hub – Centre of Excellence, Institute of Basic Medical Sciences, University of Oslo (UiO) and Oslo University Hospital.

Further information

Research School for Training the Next Generation of Micro- and Nanotechnology Researchers in Norway (TNNN) – NTNU.
<https://www.ntnu.edu/tnnn>

The NoOC networking event



Education

NOR-MPS 2025 convention - microphysiological systems, organoids and organ-on-chip technology

HTH organized the 2025 NOR-MPS convention, featuring a practical workshop on February 13th and the main symposium on February 14th.



The NOR-MPS symposium brought together Norwegian and international experts to present their research and discuss the latest advancements in microphysiological systems, organoids, and organ-on-chip technologies.

Held as a side event to the Norway Life Science Conference, the NOR-MPS symposium included keynote presentations by Reyk Horland (CEO, TissUse), Peter Loskill (University of Tübingen), Magdalena Lorenowicz (BPRC/UMC Utrecht), Susanna Narkilahti (CoE BoC, Tampere University), Sina Bartfeld (TU Berlin), and Stephan Krieg (Merck Healthcare).

The program also featured short project presentations from principal investigators, postdocs, and PhD students, a poster session, roundtable discussions on cutting-edge developments, an industry session with InSphero, BiomimX, Cherrybioteck, and Oncosyne, and an ethics panel that examined emerging challenges in the field.

The event was highly successful and fully booked, with 30 participants attending the workshop and 140 attending the symposium.





Image credit: Stefan Krauss



Modelling Ageing in Microphysiological Systems and Organoids

HTH, together with partners, organised the AIMS 2025 conference on 9 June in Brussels, as a satellite event of the MPS World Summit. The meeting brought together leading researchers, innovators, and stakeholders to

explore advances in modelling ageing using microphysiological systems (MPS) and organoid technologies.

The scientific programme featured invited keynote lectures,

presentations selected from submitted abstracts, and interactive roundtable discussions. The event provided a platform for interdisciplinary exchange and highlighted recent progress in understanding ageing mechanisms

and age-related diseases through advanced in vitro models.

Programme Overview

The conference programme was structured into thematic sessions, each chaired by an expert in the field:

- Hallmarks and Measures of Ageing (Chair: Lynne Cox, University of Oxford)
- Building Physiologically Relevant MPS – Short Talks (Chair: Andrea Dalmao Fernandez, UiO)
- Cell-Extrinsic Ageing Features in MPS (Chair: Andreas Stahl, University of California, Berkeley)
- Modelling Ageing and Age-Related Diseases I (Chair: Alexandra Stolzing, Loughborough University)
- Modelling Ageing and Age-Related Diseases II (Chair: George Truskey, Duke University)
- Modelling Ageing and Age-Related Diseases III (Chair: Simon Jones, University of Birmingham)
- Modelling Ageing and Age-Related Diseases – Short Talks (Chair: Andrea Dalmao, UiO)

The conference concluded with a roundtable discussion entitled “Modelling Ageing and Investigating Strategies for Interventions”, chaired by Lynne Cox. This session fostered dialogue on future directions, translational opportunities, and collaborative strategies to accelerate the development of effective interventions targeting ageing and age-associated conditions.

AIMS 2025 welcomed approximately 250 participants from across the international research community.

Graduated PhD students

On March 14th, 2025, M.Sc. Ingrid Wilhelmsen successfully defended her PhD thesis, “Characterization of Human Pluripotent Stem Cell-Derived Hepatic Stellate Cells for In Vitro Disease Modeling.” The trial lecture was titled “Advanced In Vitro Models for Precision Medicine: Challenges and Opportunities.”

Adjudication Committee:

First opponent: Associate Professor Pau Sancho Bru, University of Barcelona.

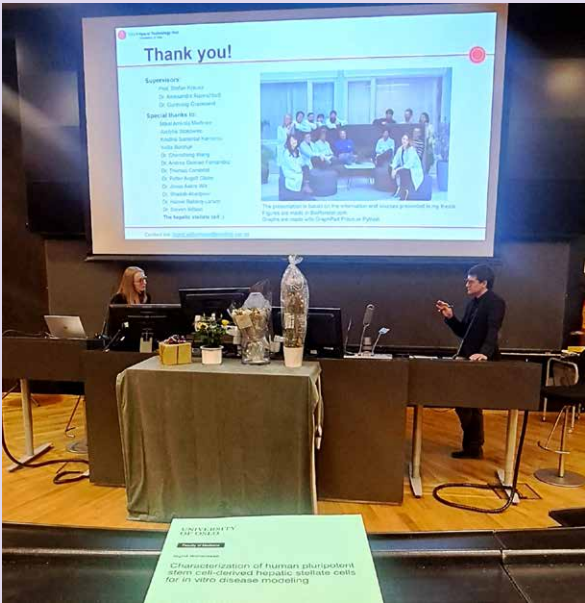
Second opponent: Professor Mathieu Hautefeuille, Sorbonne Université, Paris.

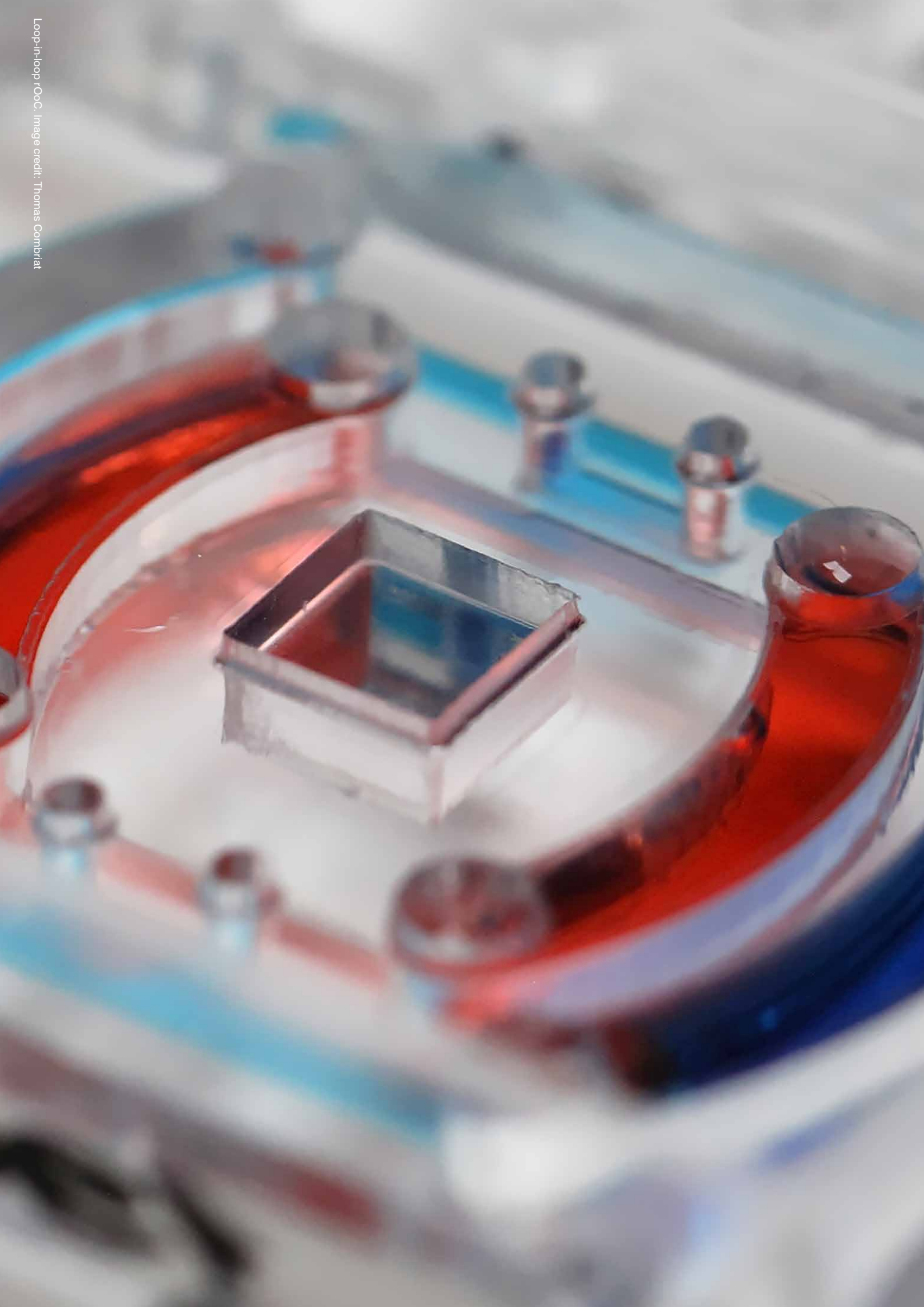
Third member and Chair of the a Committee: Professor Marit Inngjerdingen, University of Oslo.

Chair of the Defence: Professor Bjørn Steen Skålhegg, University of Oslo.

Principal Supervisor: Professor Stefan Krauss, University of Oslo.

Co-supervisors: Aleksandra Aizenshtadt and Gunnveig Grødeland, both University of Oslo.





About the Centre

Organizational chart

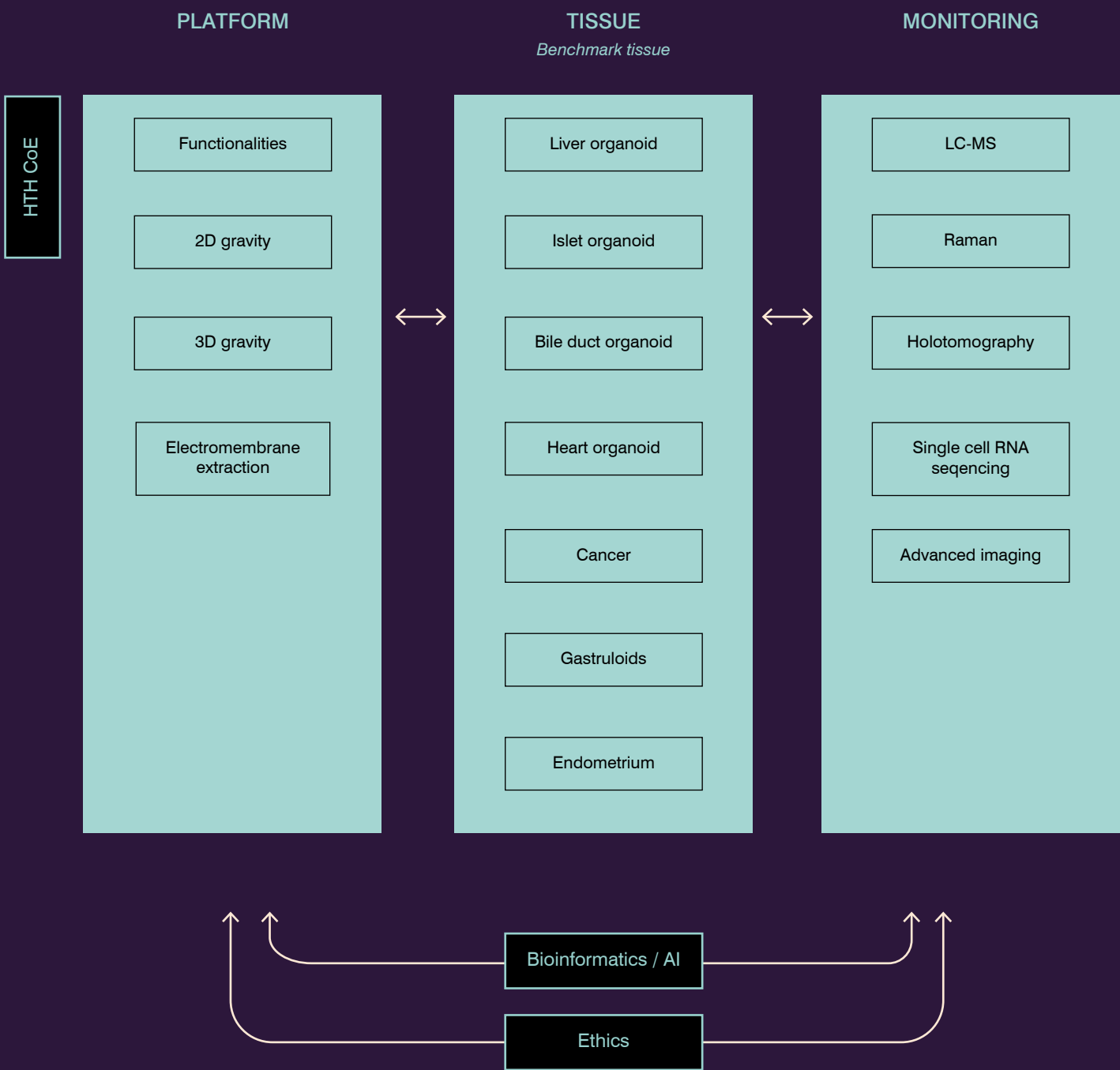
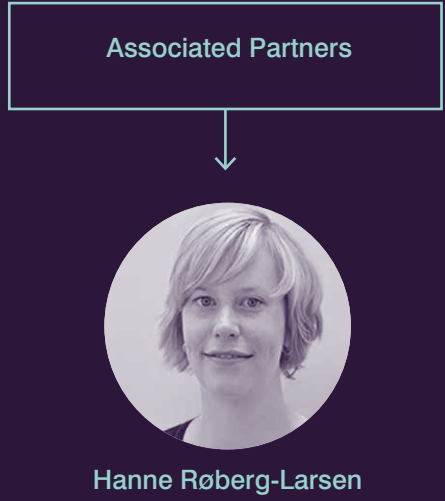
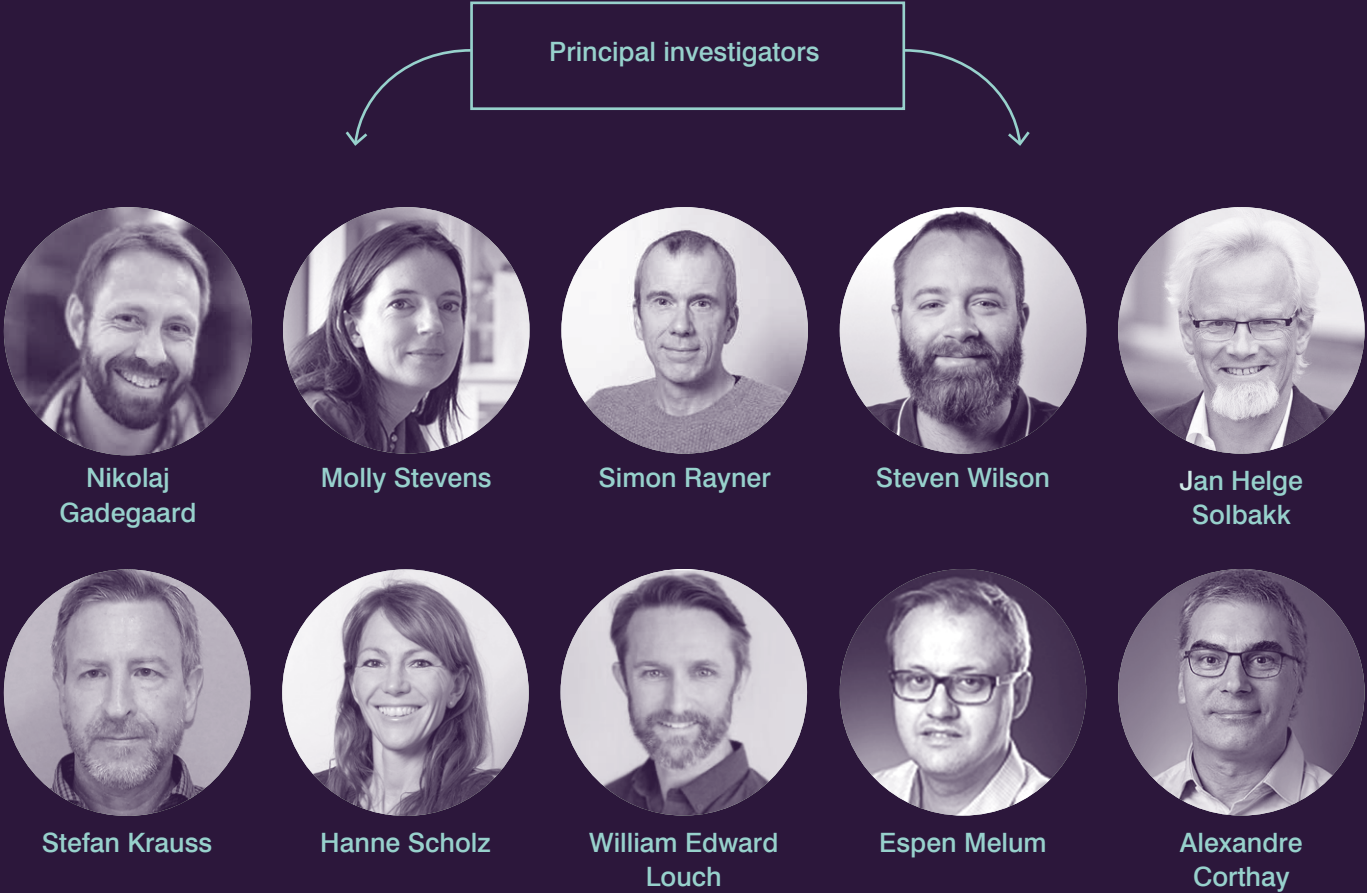
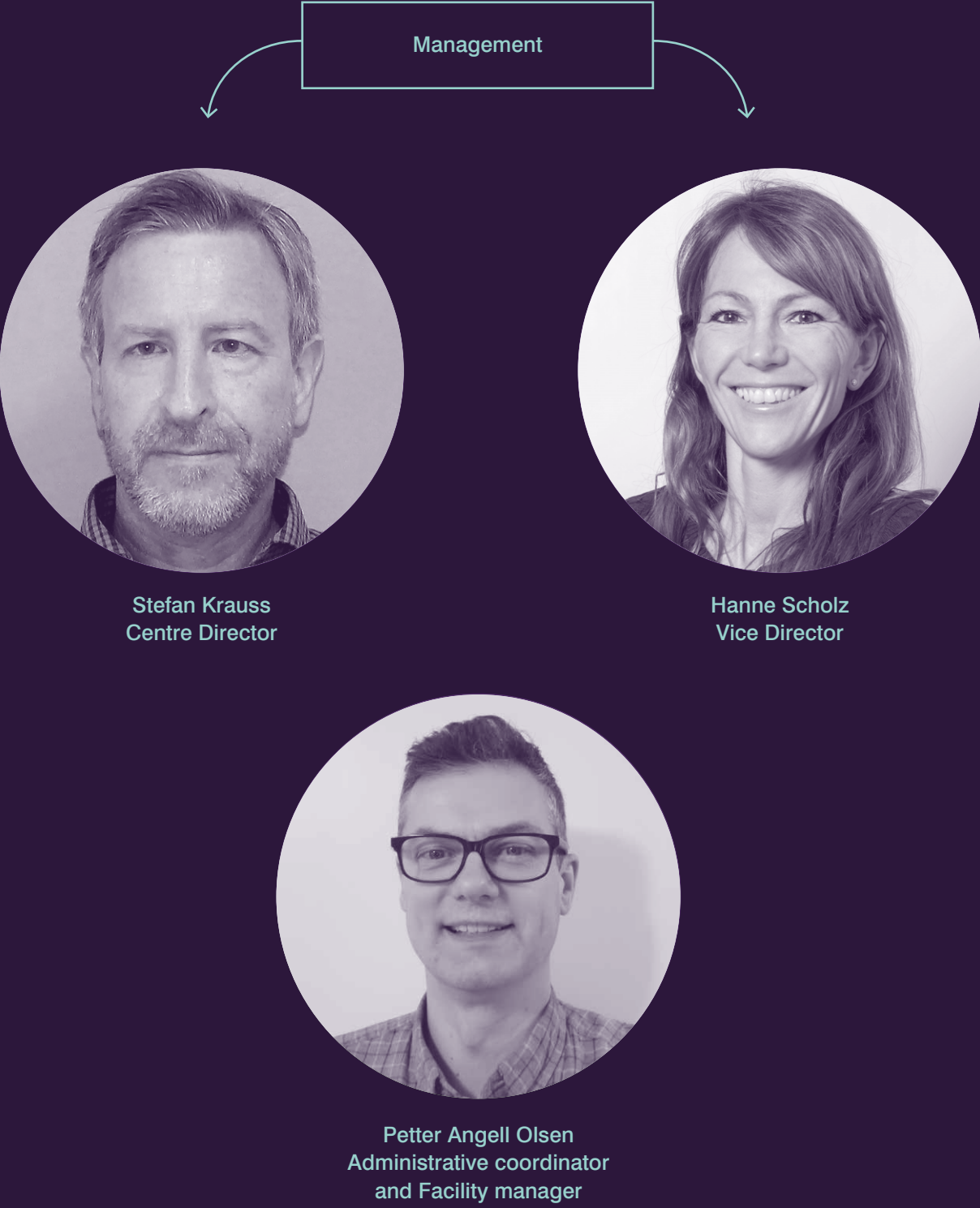


Image credit: Thomas Cornblat

Team members

2025



Team member 2025

Postdoctoral fellows
and researchers



Alexandra Aizenshtadt
Lab. manager



Anna Frank



Shadab Abadpour



Mathias Busek



Thomas Combriat



Ludivine Delon



Sergei Ponomartcev



Igor Meszka



Inger Øybråten



Yuchuan Li



Andrea Dalmao-
Fernandez



Jonas Aakre Wik



Henry Hoyle



Jia Li



Wen Jie (Jeremy)
Yeoh



Endalkachew
Alemu



Helena Hruskova



Heidi Beate
Bentzen



Sara Peisl



Khadija El Jellas



Carl Eskildsen



Max Lycke



Justyna Stokowiec

Head
engineer

PhD candidates



Almira Ibragimova



Malgorzata
Elzbieta Zawadzka



Shoshy Alam Brinch



Mughilan
Selvarajah



Ingrid Wilhelmsen



Franziska
Schoeb



Natalia Smirnova



Magnhild Sekse

Technicians



Dilara Lal, Lal



Niamh-OHeneghan-
Yates



Lydia Busek



Alexey Golovin



Yuliia Boichuk



Karen Irion



Enya
Amundsen-Isaksen



Oline Hovland



Thea Josefine
Christensen



Katharina
Ferencevic

Board 2025



Professor Jan G. Bjålie
Pro-Dean for Research and Innovation
Faculty of Medicine, University of Oslo

Chairman of the board

Board members



Professor Lene Frost Andersen
Head of department, Institute of Basic Medical Sciences, University of Oslo



Professor Lars Eide
Institute of Clinical Medicine, University of Oslo



Professor Steve Beaumont
University of Glasgow



Professor Raoul Charles Coombes
Imperial College, London



Professor Stefan Krauss
Centre Director, Hybrid Technology Hub, University of Oslo

Scientific Advisory Board (SAB) 2025



Professor Bengt Norden
Chalmers University of Technology, Sweden



Professor Anna Herland
KTH Royal Institute of Technology, Sweden



Professor Peter Loskill
Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB, Germany



Professor Thomas Laurell
Department of Biomedical Engineering, Lund University

International collaborations

ACADEMIC COLLABORATIONS

- Aarhus University
- Armauer Hansen Research Institute
- Chalmers University of Technology
- Chinese Academy of Sciences-Max Planck Gesellschaft Partner Institute for Computational Biology
- Forschungsverbund Berlin
- Harvard Medical School
- Institut Cochin
- Italian National Research Council
- Juntendo University School of Medicine
- Karolinska Institutet
- KTH Royal Institute of Technology
- Leiden University Medical Center
- Maastricht University
- Max-Planck-Gesellschaft zur Förderung der Wissenschaften
- RMIT University
- Tampere University (Finland)
- Technical University of Denmark
- Tel Aviv University
- The University of Texas Medical Branch
- Université d'Artois
- University of Arizona
- University of Bergen
- University of California
- University of Cambridge
- University of Biobío (Chile)
- University of Copenhagen
- University of Glasgow
- University of Helsinki
- University of Illinois at Urbana-Champaign
- University of Natural Resources and Life Sciences
- University of Oulu
- University of Turku
- Univesity of Oslo / Oslo university hospital
- University of Oxford
- Uppsala University (Sweden)
- Wuhan Institute of Virology
- Wyss Institute at Harvard University
- Yale School of Medicine / Yale Stem Cell Center

● ACADEMIC
● INDUSTRIAL

INDUSTRIAL COLLABORATIONS

- AstraZeneca R&D
- BiomimX S.r.l.
- NOVARTIS
- Symeres Inc
- TPP plc



Image credit: Paul Høgshon / visitoskarsborg.no

Retreats

2025 HTH Annual Retreat – Oscarsborg festning

The 2025 HTH Annual Retreat was held on 23–24 October at Oscarsborg festning. The retreat brought together HTH Principal Investigators, researchers, and invited speakers for two days of scientific exchange, skills development, and community building.

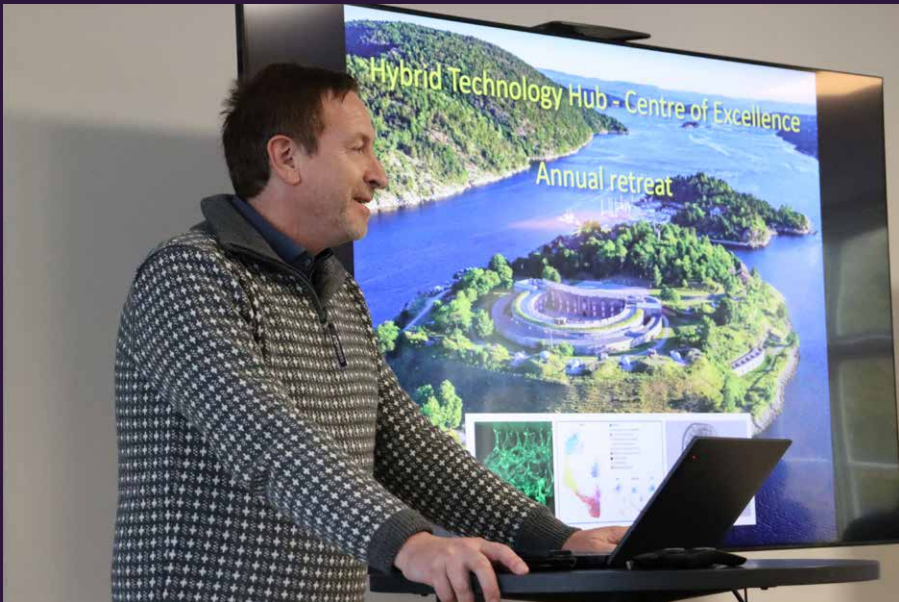
The programme opened with “State of the Art” presentations by HTH PIs, highlighting recent achievements, ongoing projects, and strategic priorities for the coming year.

The Technical Session featured invited presentations by Katja Elgstøen (OUS), Coen Campsteijn (UiO), and Jonas Øgaard (OUS), addressing current methodological and technological advances. The session concluded with an interactive technical workshop, enabling participants to explore applications and collaborative opportunities.

The Skill Session focused on professional and transferable skills, with contributions from Hanne Bjerknes (UiO), Nicolay Berard-Andersen (UiO), and Beate Rygg Johnsen (UiO) and Veslemøy Ramsfjell (UiO). Workshops encouraged active participation and reflection on communication, teamwork, and commercialization.

The retreat concluded with a forward-looking “SciFi Session,” featuring invited presentations from the ITOM convergence environment and Vaibhav Pai (Tufts University, US), stimulating discussion on emerging directions and innovative perspectives.

A festive dinner, followed by a lively music bingo event, created a relaxed atmosphere for informal networking and further strengthened the sense of community within HTH.



Publications 2025



Alexander H Clowsley, Anna Meletiou, Radoslav Janicek, Alexandre F E Bokhobza, Evelina Lučinskaitė, Gabriela Bleuer, Isabelle Jansen, Peter P Jones, William E Louch, Christian Soeller.

MINFLUX microscopy resolves subunits of the cardiac ryanodine receptor and its 3D orientation in cells.

Nature Communications. 2025 Dec 21;17(1):1044.
<https://doi.org/10.1038/s41467-025-67801-6>



Anna Bergan-Dahl, Cathrine R Carlson, Martin Laasmaa, Hariharan Subramanian, Adelle Basson, Jia Li, Almira Hasic, Marianne Lunde, Hege Ugland, Ornella Manfra, Enno Klussmann, Julie Bossuyt, Donald M Bers, Viacheslav O Nikolaev, William E Louch, Xin Shen.

Activated CaMKIIδ translocates to the RyR nanodomain in cardiomyocytes

Cardiovascular Research. 2025 Nov 22;121(14):2177-2188.
<https://doi.org/10.1093/cvr/cvaf187>



Anna Katharina Frank, Brian K Chung, Miguel Larraz Lopez De Novales, Lise Katrine Engesæter, Henry William Hoyle, Jonas Øgaard, James Heslop, Tom H Karlsen, Olivia Tysoe, Teresa Brevini, Jan S Tchorz, Ludovic Vallier, Irina Mohorianu, Fotios Sampaziotis, Espen Melum.

Single-Cell Transcriptomic Profiling of Cholangiocyte Organoids Derived from Bile Ducts of Primary Sclerosing Cholangitis Patients.

Digestive Diseases and Sciences. 2024 Oct;69(10):3810-3823.
<https://doi.org/10.1007/s10620-024-08570-y>



Brian K Chung, Markus S Jördens, Jonas Øgaard, Henrik Mikael Reims, Benedicte Flateland, Tom Luedde, Xiaojun Jiang, Tom H Karlsen, Espen Melum.

Multimodal transcriptomics identifies metallothionein as a novel pathway in primary sclerosing cholangitis.

Hepatology. 2025 Jun 25.
<https://doi.org/10.1097/hep.0000000000001432>



Eleni Skourti, Kotryna Seip, Nadia Mensali, Shakila Jabeen, Siri Juell, Inger Øynebråten, Solveig Pettersen, Olav Engebraaten, Alexandre Corthay, Else Marit Inderberg, Helmut Dolznig, Gunhild Mari Mælandsmo, Eivind Valen Egeland, Lina Prasmickaite.

Chemoresistant tumor cell secretome potentiates immune suppression in triple negative breast cancer.

Breast Cancer Research. 2025 Jul 14;27(1):131.
<https://doi.org/10.1186/s13058-025-02082-x>



Hanne Scholz, Valeria Sordi, Lorenzo Piemonti.

Cautious Optimism Warranted for Stem Cell-Derived Islet Transplantation in Type 2 Diabetes.

Transplant International. 2024 Jul 26;37:13358
<https://doi.org/10.3389/ti.2024.13358>



Ingrid Wilhelmsen, Thomas Combriat, Andrea Dalmao-Fernandez, Justyna Stokowiec, Chencheng Wang, Petter Angell Olsen, Jonas Aakre Wik, Yuliia Boichuk, Aleksandra Aizenshtadt, Stefan Krauss.

The effects of TGF-β-induced activation and starvation of vitamin A and palmitic acid on human stem cell-derived hepatic stellate cells.

Stem Cell Research & Therapy. 2024 Jul 23;15(1):223.
<https://doi.org/10.1186/s13287-024-03852-8>



Jelena Branovets, Martin Laasmaa, Jekaterina Stolova, Xin Shen, Triinu Rätsepso, Romain Bernasconi, Kârol Soodla, Mihkel Jaan Balodis, Cärolin Grahv, Eliise Hendrikson, William Edward Louch, Rikke Birkedal, Marko Vendelin.

Lifelong creatine deficiency leads to augmented sarcoplasmic reticulum calcium release but not heart failure.

American Journal of Physiology-Heart and Circulatory Physiology. 2025 Aug 1;329(2):H471-H489.
<https://doi.org/10.1152/ajpheart.00106.2025>



Jun-Ya Shoji, Richard P Davis, Christine L Mummery, Stefan Krauss.

Global Literature Analysis of Tumor Organoid and Tumor-on-Chip Research.

Cancers (Basel). 2025 Jan 1;17(1):108.
<https://doi.org/10.3390/cancers17010108>



Karoline Horgmo Jæger, William E Louch, Aslak Tveit.

Reduced gap junction coupling amplifies the effects of cardiomyocyte variability and destabilizes the heartbeat.

Physiological Reports. 2025 Jul;13(13):e70461.
<https://doi.org/10.14814/phy2.70461>



Ludivine Delon, Mathias Busek, Pedro Duarte Menezes, Nikolaj Gadegaard, Justyna Stokowiec, Alexey Golovin, Yuliia Boichuk, Thomas Combriat, Aleksandra Aizenshtadt, Stefan Krauss.

Placental Syncytium-on-Chip (PSoC)-Comparison of Forskolin or Mechanical Induced-Syncytialization.

Advanced Healthcare Materials. 2025 Aug;14(21):e2404462.
<https://doi.org/10.1002/adhm.202404462>



Luis A Gonano, Alycia M Kinns, Anna Bergan-Dahl, William E Louch, Peter P Jones.

Interplay Between Ryanodine Receptor Arrangement and Function: Implications for (Patho)physiological Control of Calcium Release.

Circulation Research. 2025 Aug 29;137(6):902-923.
<https://doi.org/10.1161/circresa-ha.125.325387>



Maya W Haaker, Jung-Chin Chang, Brian K Chung, Tobias S Pieper, Falko Noé, Tongtong Wang, Niels Geijssen, Martin Houweling, Christian Wolfrum, Arie B Vaandrager, Espen Melum, Bart Spee, J Bernd Helms.

Cellular Crosstalk Promotes Hepatic Progenitor Cell Proliferation and Stellate Cell Activation in 3D Co-culture.

Cellular and Molecular Gastroenterology and Hepatology. 2025;19(5):101472.
<https://doi.org/10.1016/j.jcmgh.2025.101472>



Mikel Amirola-Martinez, Thomas Combriat, Katharina Ferencevic, Ingrid Wilhelmsen, Andrea Dalmao-Fernandez, Petter Angell Olsen, Justyna Stokowiec, Aleksandra Aizenshtadt, Stefan Krauss.

Aspects of zone-like identity and holotomographic tracking of human stem cell-derived liver sinusoidal endothelial cells.

Frontiers in Cell and Developmental Biology. 2025 Oct 17;13:1528991.
<https://doi.org/10.3389/fcell.2025.1528991>



Mohamed M Benimam, Vannary Meas-Ye-did, Suvadip Mukherjee, Astri Frafjord, Alexandre Corthay, Thibault Lagache, Jean-Christophe Olivo-Marin.

Statistical analysis of spatial patterns in tumor microenvironment images.

Nature Communications. 2025 Mar 31;16(1):3090.
<https://doi.org/10.1038/s41467-025-57943-y>



Natalia P. Smirnova, Sergey V. Ponomartsev, Tharvesh M. Liyakat Ali, Max Lycke, Brian K. Chung, Jonas Øgaard, Espen Melum, Jesse Veenfliet, Stefan Krauss.

Reconstituting epiblast–extraembryonic endoderm interactions restores anterior–ventral patterning in stem cell–based embryo models.

bioRxiv. 2025.
<https://doi.org/10.1101/2025.11.09.687163>



Natasha Josifovska, Essi M Niemi, Murugan Ramalingam, Geetha Manivasagam, Hanne Scholz, Goran Petrovski.

A pilot study for decellularizing porcine cornea for future use in corneal regeneration.

PLoS One. 2025 Dec 31;20(12):e0339462
<https://doi.org/10.1371/journal.pone.0339462>



Oliver Pabst, Christin Schülke, Ilanko Balasingham, Stefan Krauss, Joel Clinton Glover, Ørjan Grøttem Martinsen.

Recording and modeling of pinched hysteresis loops, the fingerprint of a memristor, in neurons.

Scientific Reports. 2025 Oct 24;15(1):37212.
<https://doi.org/10.1038/s41598-025-21035-0>

Publications 2025



Orsolya Vincze, Piotr Minias, Alexandre Corthay, Fernando Colchero, Jean-François Lemaître, Louise Maille, Tamás Malkócs, Justus Hagemann, Dalia A Conde, Samuel Pavard, Antoine M Dujon, Beata Ujvari, Frédéric Thomas, Amy M Boddy, Carlo C Maley, Damien Chevallier, Tuul Sepp, Thomas Pradeu, Mathieu Giraudeau.

Immunological surveillance against cancer across mammals

Nature Communications. 2025 Nov 24;16(1):10333.

<https://doi.org/10.1038/s41467-025-65286-x>



Per-Ola Carlsson, Xiaomeng Hu, Hanne Scholz, Sofie Ingvast, Torbjörn Lundgren, Tim Scholz, Olof Eriksson, Per Liss, Di Yu, Tobias Deuse, Olle Korsgren, Sonja Schrepfer.

Survival of Transplanted Allogeneic Beta Cells with No Immunosuppression.

The New England Journal of Medicine. 2025 Sep 4;393(9):887-894.

<https://doi.org/10.1056/nejmoa2503822>



Reza Parvan, Victoria Becker, Milad Hosseinpour, Yousef Moradi, William E Louch, Alessandro Cataliotti, Yvan Devaux 5, Michael Frisk, Gustavo Jose Justo Silva.

Prognostic and predictive microRNA panels for heart failure patients with reduced or preserved ejection fraction: a meta-analysis of Kaplan-Meier-based individual patient data.

BMC Medicine. 2025 Jul 7;23(1):409.

<https://doi.org/10.1186/s12916-025-04238-0>



Sarah Dobner, Lisa Kleissl, Fanni Tóth, Robert Paxton, Irena Yordanova, Kveta Brazdilova, Cedric Vanluyten, Aleksandra Aizenshtadt, Hanna Toth, Jake Burton, Aglaja Kopf, Vera Belyaeva, Katharina Ferencevic, Dunja A. Al-Nuaimi, André F. Rendeiro, View ORCID ProfileChristoph Bock, Joanna Kalucka, Stefan Krauss, Selma Osmanagic-Myers, Laurens J. Ceulemans, Georg Stary, Abdel Rahman Abdel Fattah, P.M.H. de Rooij.

Uncovering the transcriptional hallmarks of endothelial cell aging via integrated single-cell analysis.

bioRxiv. 2025.

<https://doi.org/10.1101/2025.08.18.669055>



Shoshy Alam Brinch, Ida Johnsen, Lena Willmer, Ole Vidhammer Bjornstad, Teresa Lucifora, Karl Martin Forbord, Maria Candamo-Lourido, Maureen Tania Meling, Ingrid Lofthus Morken, Martin Frank Strand, Danny Jonigk, Patrick Zardo, Hans Gerd Fieguth, Christina Hesse, Mark Alexander Skarsfeldt, Morten Asser Karsdal, Erika Ferrari, Paola Occhetta, Roberta Visone, Stephen Jordan, Joseph Lee, Harry Holton, Simon Rayner, Anita Wegert, Simon Cruwys, Stefan Krauss, Jo Waaler.

Tankyrase inhibition demonstrates anti-fibrotic effects in preclinical pulmonary fibrosis models.

bioRxiv. 2025.

<https://doi.org/10.1101/2025.11.13.688191>



Sabrina Bech Mathiesen, Thea Parsberg Støle, Andreas Romaine, Marianne Lunde, Marita Martinsen, Jan Magnus Aronsen, Ivar Sjaastad, William E Louch, Geir Christensen, Cathrine Rein Carlson.

Syndecan-4 interacts directly with β -parvin and regulates the ILK-PINCH- β -parvin complex, the β -parvin- β -PIX-Rac1 axis, and cardiomyocyte geometry in a sex-dependent manner.

Frontiers in Cell and Developmental Biology. 2025 Aug 29;13:1569185.

<https://doi.org/10.3389/fcell.2025.1569185>



Steffen Nøvik, Kayoko Hirayama-Shoji, Thomas Combriat, Domantas Sakalys, Erik Aashamar, William E Louch, Philipp Dominik Häfliger, Stefan Johannes Karl Krauss, Ørjan Grottem Martinsen.

Bioimpedance and electrophysiology measurements of engineered heart tissues outside the culture medium.

Biosensors and Bioelectronics. 2025 Nov 1;287:117634.

<https://doi.org/10.1016/j.bios.2025.117634>



Stian Kogler, Frøydis Sved Skottvoll, Helena Hrušková, Frode Rise, Aleksandra Aizenshtadt, Stefan Krauss, Hanne Ro Berg-Larsen, Frederik André Hansen, Steven Ray Wilson.

Electromembrane Extraction Provides Unprecedented Selectivity for Drugs in Cell Culture Media Used in Organoid and Organ-on-Chip Systems.

Analytical Chemistry. 2025 Mar 11;97(9):4923-4931.

<https://doi.org/10.1021/acs.anal-chem.4c04994>



Sven T Sowa, Murat Küçükdisli, Yelena Mostinski, David A Schaller, Carolina S Vinagreiro, Davide Cirillo, Chiara Bosetti, Shoshy Alam Brinch, Kirsten van Laar, Anita Wegert, Ruben G G Leenders, Stefan Krauss, Jo Waaler, Andrea Volkamer, Lari Lehtiö, Marc Nazaré.

Deconstruction of Dual-Site Tankyrase Inhibitors Provides Insights into Binding Energetics and Suggests Critical Hotspots for Ligand Optimization.

Journal of Medicinal Chemistry. 2025 Apr 10;68(7):7263-7279.

<https://doi.org/10.1021/acs.jmed-chem.4c02845>



Richard D.J.G. Ho, Endre J. L. Mossige, Sergei Ponomartcev, Natalia Smirnova, Xian Hu, Keqing Sunny Dai, Stefan Krauss, Dag Kristian Dysthe, Luiza Angheluta.

Spontaneous elongation of 3D gastruloids from local cell polarity alignment.

arXiv 2025. 2509.08929

<https://doi.org/10.48550/arXiv.2509.08929>

Funding

Project name	Funding scheme	Project leader	Sum	Period
NATIONAL				
Tankyrase Inhibition in Cancer Immunotherapy	HSØ – Forskerstipend	Jo Waaler	4.4 M NOK	2019–2022
Scalable directional pump-less perfusion (dpp) organ-on-a-chip platform	FORNY20–2020	Stefan Krauss	0.5 M NOK	2021–2022
Scientia Fellows II	H2020-MSCA-COFUND	Stefan Krauss and Espen Melum	1.6 M NOK	2021–2022
Virus induced Acute Respiratory Distress Syndrome (ARDS): testing WNT inhibition as a novel therapeutic principle on a Lung-on-a-Chip platform	HSØ – Åpen prosjektstøtte	Stefan Krauss	9 M NOK	2021–2023
Tankyrase Inhibition in Cancer Immunotherapy	HSØ – Karrierestipend	Jo Waaler	9 M NOK	2021–2024
DUCT chip – Immune studies using a bile duct on a chip	NFR – FRIMED2-FRIPRO	Espen Melum	12 M NOK	2021–2027
Tankyrase inhibition as a therapeutic principle in idiopathic lung fibrosis	NFR – FORNY20	Stefan Krauss	5 M NOK	2022–2023
Unleashing the full antitumor potential of macrophages for next-generation cancer immunotherapy	HSØ – Åpen prosjektstøtte	Alexandre Corthay	9 M NOK	2022–2025
Integrated technologies for tracking organoid morphogenesis (ITOM)	UiO:Lifescience-Convergence	Stefan Krauss	16.9 M NOK	2022–2026
Pharmacokinetics-on-chip	NFR – FORNY20	Steven Wilson	0.5 M NOK	2023–2024
KVAL: A neural network-based image denoising software	NFR – FORNY20	Hao Wu (Louch Group)	0.5 M NOK	2023
New hope for heart failure with preserved ejection fraction (HFpEF)	HSØ – Postdoktorstipend	William E. Louch	2.6 M NOK	2023–2025
Pump-less recirculation Organ-on-Chip platform	NFR – FORNY20	Mathias Busek (Krauss group)	5.0 M NOK	2023 - 2025
TumorChip – development of a tumor-on-a-chip platform for testing WNT signaling inhibition as an enabling factor in melanoma immune oncology”	DNK	Stefan Krauss	8.0 M NOK	2023–2025
Total analytical solution for enabling robust mass spectrometric analysis of organoids and organ-on-chip samples.	FORNY20-FORNY2020	Steven Ray Wilson (Aina H. Rengmark)	0.5 M NOK	2024
Pump-less recirculation Organ-on-Chip platform	FORNY20-FORNY2020	Mathias Busek	3.9 M NOK	2023-2025

Project name	Funding scheme	Project leader	Sum	Period
“PharmaChip”: Robust, automated, and sustainable chemical analysis of organoids and organ-on-chip systems.	NFR - Kommersialiseringsprosjekt / Verifisering	Steven Wilson (Aina H. Rengmark)	5.0 M NOK	2025-2027
DUCT chip – Artificial bile-duct-on-a-chip-platform for assessing bile duct function.	NFR - Kommersialiseringsprosjekt / Verifisering	Project leader: Espen Melum	0.5 M NOK	2025-2026
Nanoscale Control of the Heartbeat (NANOBEAT).	Funding scheme: Nasjonalforeningen for folkehelsen	Project leader: William Louch	3.9 M NOK	2025-2027
Clinical feasibility of in vitro diagnostic drug testing for pancreatic cancer.	BIA-Brukerstyrt innovasjonsarena	Jarle Bruun (CEO Oncosyne)	3.2 M NOK	2024-2028
PRIVATE				
PSC Studies using a Bile-Duct-on-a-Chip	PSC partners	Tom H. Karlsen/Anna Frank/Stefan Krauss	0.6 M NOK	2021–2022
Generation of insulin-producing cells from bile duct cells (cholangiocyte organoids)	Novo Nordisk Foundation	Hanne Scholz	1.3 M NOK	2021–2023
Endocrinology & Metabolism 2022	Novo Nordisk Foundation	Hanne Scholz	1.3 M NOK	2022–2023
EMGUT: Energy Materials for the Gut	Novo Nordisk Foundation	Anja Boisen DTU/Nikolaj Gadegaard	5.5 M NOK	2022–2027
Testing av legemidler med lab-dyrkede organer, som alternativ til dyreforsøk	Dyrevernsalliansen	Steven Wilson and Stian Kogler	0.1 M NOK	2023
Wellcome LEAP: Female resilience on-chip: Monitoring dynamic resilience using Multi-Organ-Chips linking metabolic state and immune response in pre- and post-menopausal women.	Wellcome Trust	Peter Loskill (Co-PI: Stefan Krauss)	9.6 M NOK	2023–2027
Pharmacokinetics-on-chip.	Novo Nordisk Foundation	Steven Ray Wilson	1.6 M NOK	2024
INTERNATIONAL				
Hybrida – Ethics of Organoids	EU H2020 – SwafS	Søren Holm (HTH participants: Jan H. Solbakk, Stefan Krauss, Heidi B. Bentzen)	26.5 M NOK	2021–2024
Moral residue – epistemological ramifications, ethical implications, and didactic opportunities (MORE)	ERC Advanced Grants	Jan Helge Solbakk	27.4 M NOK	2022–2027
Supervised morphogenesis in gastruloids (SUMO)	EIC Pathfinder	Stefan Krauss	51.3 M NOK	2022–2027
EUropean network to tackle METAbolic alterations in HEART failure” (EU-METAHEART)	EU COST action	Christoph Maack (HTH participant: William E. Louch)	5.6 M NOK	2023–2027
Human avatar on chip for advancing personalized cancer therapies by integrating vascular and immune components in a Tumor-on-Chip model (HAVOC)	TRANSCAN-3	Laura de Rooij (Participant: Stefan Krauss)	2.8 M NOK	2025-2027
ctuating nanostructured polymer microcarriers for pluripotent stem-cell derived cardiomyocyte expansion and maturation (CellBeat)	ERA4Health	Roxanne Kieltyka (Participant: William Louch)	3.0 M NOK	2025-2027



Hybrid Technology Hub

– Centre for Organ-on-chip Technology

» Funded by the Research Council of Norway's Centres of Excellence scheme (project number: 262613).

Visiting adress

Domus Medica, Gaustad
Sognsvannsveien 9
0372 OSLO
Norway

Mail adress

Institute of Basic Medical Sciences
P.O. Box 1110 Blindern
0317 OSLO
Norway

www

<https://www.med.uio.no/hth/english/>

Email

contact@hth.uio.no

Grafisk produksjon

XIDE AS

Cover image

Spontaneously formed vascular network on the recirculating Organ-on-Chip (rOoC) platform. Human Umbilical Vein Endothelial Cells (HUVECs; green phalloidin staining, blue DAPI-stained nuclei), seeded within the PMMA matrix (blue autofluorescence) of the rOoC platform together with extracellular matrix, self-organized into endothelial vessels in response to interstitial flow through the gel from one channel to the other. Outside the chamber, the cells formed an endothelial barrier, confirmed by CD31 endothelial marker staining (red). Image credit: Andrea Dalmao Fernandez and Ludivine Delon.