Zebrafish, Extracellular Vesicle Biology & Safe-by-Design RNA Origami

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What we do

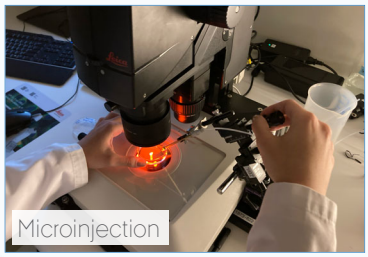
Seeing is believing. We use zebrafish as a model organism to "visualize" unsolved mysteries in biology – such as the role of extracellular vesicles (EVs) – in a way that cannot be achieved by the traditional use of cell cultures or mammalian models.

EVs emerge as a new frontier that has the potential to redefine today's knowledge across many research areas from basic to clinical sciences.

What are EVs really? How can we translate the EV biology into novel therapeutics? With zebrafish as our little partners, we seek answers to these questions by nanoscience approaches, bioinformatics and live imaging of embryos that are genetically modified.

So, what is our goal? We aim to advance the field of nanomedicine by *learning*, *manipulating* and *mimicking* nature's smart biomolecular architecture, EVs.

Project Opportunities



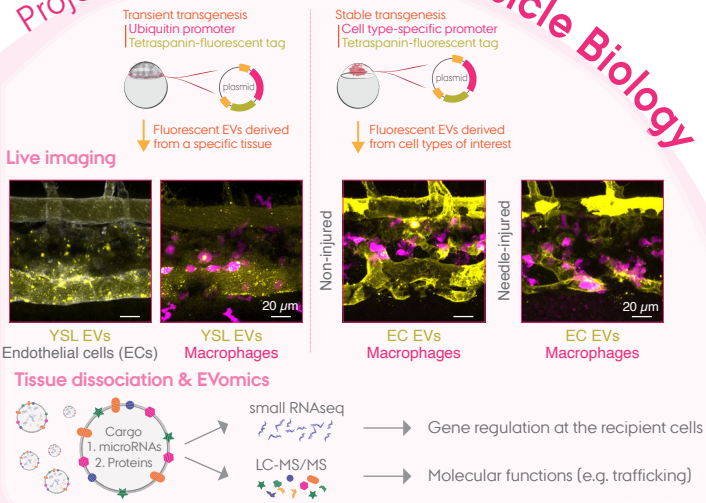
For your project, we offer training in modern molecular & cell biology techniques for experiments using zebrafish embryos or cell cultures.

For example:

- Zebrafish embryo handling and screening
- Microinjection of proteins/cells/nanoparticles
- Culturing of mammalian cell lines
- Plasmid DNA construction for transfection, transgenesis, and overexpression of genes
- Gene/protein expression profiling
- Bioimaging and image analysis

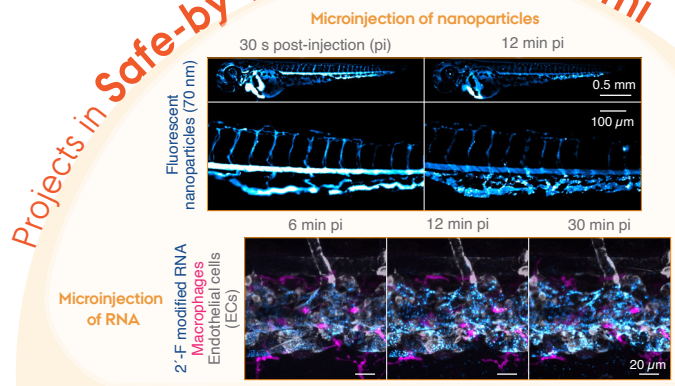
...and also thesis writing skills!

Projects in Extracellular Vesicle Biology



Extracelluler vesicles (EVs) were once believed to be just waste released from cells. Over the past decades we have started to appreciate the many faces of EVs – they are indeed bags filled with secrets. Using zebrafish as an in vivo model, we study EVs of various origins on their dynamic behaviour in the bloodstream and how they are trapped by cells. We have also developed a method to profile the biomolecular cargo of EVs "in transit" from donor cells. Our aim is to capture snapshots of conversation between cells and thus to identify novel therapeutic targets, in particular those involved in tissue injury, inflammation and regeneration.

Projects in Safe-by-Design RNA Origami



RNA origami uses RNA as molecular building blocks that self-assemble into programmable 3D nanostructures. We focus on its biomedical application using zebrafish as a screening model to develop a multi-functional RNA origami without undesired antiviral responses. In particular, we look at key determinants of nucleic acid sensing and inflammation to unravel how life "sees" artificial RNA architectures. Our goal is thus to pave the road for a safe-by-design approach.

Main collaboration partners @ iNANO
Assist. Prof. Julián Valero Moreno
Assoc. Prof. Ebbe Sloth Andersen
Prof. Jørgen Kjems

Other projects in collaboration with Dept. of Biomedicine are also available!

Recent publications from the group

1. "Differential Nanoparticle Sequestration by Macrophages and Scavenger Endothelial Cells Visualized in Vivo in Real-Time and at Ultrastructural Resolution" in ACS Nano (2020) doi: 10.1021/acsnano.9b07233
2. "Tracing the In Vivo Fate of Nanoparticles with a Non-Self Biological Identity" in ACS Nano (2020) doi: 0.1021/acsnano.0c05178

Visit our group webpage (QR on the right) to find more about the student projects and techniques you can learn with us.
You can also watch fancy movies of cells capturing EVs from the bloodstream!