University of Antwerp
Faculty of Science

ECOSPHERE

The ECOSPHERE research group aims to study aquatic and valley ecosystems that are continuously challenged by natural and anthropogenic stressors. The research focuses on acquiring fundamental and applied knowledge at different levels of structural and functional organisation in order to underpin environmental management decisions.

MASTER THESIS SUBJECT 2024

Understanding the endocrine disruptive effects of PFAS, present in complex environmental mixtures, on zebrafish embryos

Research group: ECOSPHERE

Hosting laboratory: Zebrafishlab CDE D.UC1

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Daily supervision: Lucia Vergauwen and PhD student

Effects of endocrine disrupting chemicals in zebrafish embryos exposed to singles and mixtures of PFAS will be studied at the morphological, biochemical and physiological level.

- **This topic mostly contains ☒ literature study, ☒ lab work, ☒ field work, ☒ experimental work, ☐ GIS, ☐ numerical modelling, ☐ other: ……**
- **Possession of driver's license B is ☐ needed, ☐ recommended, ☒ not needed**
- **Possession of certificates needed: ☐ FELASA C, ☐ other: ……**

Summary

There is growing concern about the presence of endocrine disrupting chemicals in the environment. Endocrine disrupting chemicals are able to interfere with normal endocrine processes leading to adverse health effects. Recent advances in EU legislation on the evaluation of endocrine disruptive properties of chemicals in the environment both for humans and wildlife are now demanding the development of innovative approaches to screen chemicals for their potential to disrupt the endocrine system. Methods using zebrafish embryos are being put forward based on (1) the presence of functional hormonal axes in this in vivo whole organism model and (2) the fact that zebrafish embryos are not protected under the EU legislation on the use of laboratory animals and are therefore considered alternatives to animal testing.

When developing innovative approaches to identify endocrine disrupting chemicals, it is important to consider that endocrine axes in vertebrates are highly conserved. Therefore, effects observed in a zebrafish embryo on the one hand inform on consequences for environmental health and on the other hand may also inform on potential effects in mammals, including humans. In a One Health approach, assessment of chemicals is not conducted from either a human or an environmental health perspective but rather in one harmonised approach. Second, while assessments mostly focus on effects of single compounds, there should be an important focus on environmental realism taking into account that organisms are exposed to mixtures of compounds in real life. A third important aspect is the development of innovative methods and approaches that move away from mainly measuring apical effects such as mortality in animal studies and rather focus on providing information on the underlying mechanisms of endocrine disruption.

This thesis will be conducted within the framework of developing methods for identifying endocrine disruptors and understanding the underlying mechanisms including those of mixtures of endocrine disrupting chemicals. The zebrafish embryo will be used as the model organism and experiments with exposure to endocrine disrupting chemicals will be conducted in the lab. Morphological observations are combined with measurements at the biochemical level (e.g., gene expression, oxidative stress, enzyme activities) and the physiological level (e.g., swimming behaviour analysis) as well as fluorescence signals in transgenic reporter lines (e.g., zebrafish transgenic line with fluorescent thyroid follicles). In this thesis, effects of per- and polyfluoroalkyl substances (PFAS) will be studied in zebrafish embryos. In a One Health approach, adverse health effects shown to be associated to PFAS exposure in humans will be investigated in zebrafish embryos exposed to singles and mixtures of PFAS present in samples taken in the Port of Antwerp, a known historical PFAS polluted site, to study the effects of such complex environmental samples.

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