Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences

Biomedicine and Veterinary Public Health
Toxicology Group

Communication

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Degree projects and internships in aquatic toxicology for 2019

We at the Department of Biomedicine and Veterinary Public Health (BVF), toxicology group (https://www.slu.se/institutioner/biomedicin-veterinar-folkhalsovetenskap/forskning/toxikologi/), SLU Uppsala, are offering degree projects and internships to interested students. Our research activities are focused on investigations of toxic compounds from the food chain to the environment, for hazard identification and mechanistic understanding of effects. We have an extensive experience in general toxicology, risk assessment, and cellular and molecular toxicology methods. Individual projects may comprise all types of degree projects (*Examensarbete;* 15/30/45 hp), bibliographic projects (*Bibliografiskt project*), and internships (*Forskningspraktik, Projektarbete)* within the following scientific backgrounds:

Bioanalytical evaluation of the presence of toxic chemicals in water

Tens of thousands of anthropogenic chemicals are produced and spread into the environment, with very limited information on the potential effects on human health and the environment at large. This has challenged the field of environmental toxicology, since it is impossible to monitor such large number of compounds by classical chemical analysis. Further, it has been reported that known chemicals explain as little as 0.1% of the observed bioactivity for some specific toxicity endpoints, highlighting the difficulties in selecting the chemicals to monitor. Therefore it is highly prioritized to develop methodologies that can evaluate water quality without information about the chemicals that cause toxicity.

In this project we will use *in vitro* bioassays for a broad panel of toxicity mechanisms to perform an effect-based assessment of the water quality in critical steps throughout the water chain (waste water treatment, drinking water treatment, water reuse etcetera) to gain understanding of the potential toxic effects of environmental pollutants. The long-term goal is to apply the strategy of effect-directed analysis, by combining bioassays with chemical characterization and fractionation to identify the chemicals that are causing the bioactivity. This research will provide much needed information on novel environmental pollutants of toxicological concern and the developed methods will be very valuable for future environmental monitoring efforts.

This research program addresses questions and challenges relating to the United Nations Global Goals and the Swedish national environmental quality objectives.

Keywords: toxicology, ecotoxicology, toxicity pathways, aquatic toxicity, cell cultures, cell transfection, alternative methods, waste water treatment

Methods: cell culturing and maintenance, reporter-gene assays, bioanalytical *in vitro* methods

The use of toxicity pathways to reduce and replace in vivo studies in fish

This project aims to develop an animal-free testing system for aquatic toxicity, based on the principle of toxicity pathways. European regulations (REACH) require that a large number of chemicals should undergo assessment of aquatic toxicity, which often include animal experiments. In 2005, a total of more than 1.7 million fishes were used for experimental purposes in the European Union.

Assessment of aquatic toxicity in toxicity pathway-based cell culture models instead of an animal experiment, will allow analysis of a large number of chemicals to a moderate cost and will significantly reduce the number of animals used for aquatic toxicity assessment of chemicals. The European Union Reference Laboratory for Alternatives to Animal Testing (EURL ECVAM) has recently proposed development of cell culture-based assays as a key strategy to reduce and replace the use of fish in toxicity testing.

The test system will be based on cultured zebrafish (*D. rerio*) cell lines (ZF4, ZFL, Pac2). The cells will be transfected in reporter-gene assays with DNA-constructs that are designed to respond to molecular key events in different toxicity pathways (ARE-Nrf2-Keap1; Ahr-Arnt; ER; AR; PPARα; AChE). These assays will allow us to investigate the effects of chemicals on a wide range of toxicity mechanisms. The main deliverables from this project will be increased knowledge on the toxicity pathway *in vitro* assays that are needed for initial screening of fish toxicity and a publicly accessible panel of *in vitro* assays that can be used to assess the aquatic toxicity in a wide range of biological systems.

Keywords: toxicology, ecotoxicology, toxicity pathways, aquatic toxicity, cell cultures, cell transfection, alternative methods

Methods: cell culturing and maintenance, reporter-gene assays, cell line design, fish breeding and husbandry

If interested in conducting a thesis work or an internship, please feel free to contact us. We are eager to find a suiting workload/project for undergrad and graduated students.

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