Integrative chemometric strategies for enhanced multi-omic understanding of long-term effects of endocrine disruptors in ecotoxicological studies

The role

Endocrine Disruption Chemicals (EDCs) pose a risk for human and environmental health, altering the normal function of the endocrine system. Moreover, persistent adverse outcomes have been observed after cessation of exposure to EDCs later in life and even in subsequent generations, which is mediated through epigenetic mechanisms. Many questions remain to be answered to integrate epigenetics into risk assessment since no clear associations can be established between epigenetic and other omic level changes. Several factors cause this lack of correlation, including the experimental design focused on a single epigenomic mechanism or only considered a single EDC dose and time point.

A major challenge in multi-omic analysis is the data integration since it implies some processing issues like different scaling, size and patterns of coupled responses. The simplest data fusion approach is the high-level where each omic block is independently analyzed, and the derived results are interpreted together. However, this approach misses the possibility of focusing on common biological processes between different omic levels. Several chemometric tools have been proposed to carry out this data fusion at low-level (i.e. raw data) based on the separation of contributions from the different omic blocks in common processes (present in all levels) and individual contributions (only in one of the biological levels).

The main goal of this PhD project is to better understand the modes of action of EDCs that cause long-term effects in exposed animals. To do so, zebrafish embryos exposed to EDCs in a time- and dose-response manner will be used. The student will perform multi-omic analysis (including epigenomics, transcriptomics, metabolomics and spatial omics) using high-throughput techniques, such as whole genome bisulfite sequencing, Chip-sequencing, RNA-sequencing or untargeted LC-HRMS among others. During the project novel chemometric data fusion strategies based on non-linear machine learning approaches (i.e. neural networks or or support vector machines) will be also developed for the joint analysis of multiomics experiments.

Institute of Environmental Assessments and Water Research (IDAEA-CSIC)
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What do we look for?

- **Qualifications**
  M.Sc. completed in Biology, Bioinformatics, Environmental Sciences, Chemistry, or related fields.
- **Professional experience**
  No previous experience is required.
- **Competences**
  The candidate should demonstrate a solid background in one or some of the following fields: molecular biology, analytical chemistry, bioinformatics or similar.

Preference will be given to candidates with the following skills:

- Motivated, self-starting able to work independently
- Team-working ability
- Good communication skills; fluent in the English language
- Ability to work in a molecular biology and/or analytical chemistry laboratory
- Good computer skills and coding in R/Python/Matlab

Working conditions

- **PhD position offer related to the 2020 call of "Aid for pre-doc contracts for the training of doctors" from the Spanish Ministry of Science and Innovation. Check the call for additional details.**
- **Contract duration**: 48 months
- **Estimated annual gross salary:** Approximately 22.000€ with additional research-related benefits (PhD tuition fees, international research stages).

The group

This FPI PhD proposal is a joint effort by researchers from the "Environmental Toxicology" and "Chemometrics" IDÆA groups.

Laia Navarro-Martín is animal physiologist and endocrinologist working at the Environmental Toxicology group. The main goal of her research is to elucidate molecular mechanisms involved in the modulation of the endocrine system by environmental factors. In the present she is studying gene-environment interactions and environmental omics to understand long-term implications of endocrine disruption by environmental chemicals.

Joaquim Jaumot is member of the "Chemometrics" group which research is focused on the development and application of chemometric (data analysis) tools for the study of problems of environmental interest. For instance, the study of metabolomic effects of environmental stressors on target organisms or the evaluation of environmental data coming from monitoring campaigns. More details at www.ch4eo.info.

The institute

The **Institute of Environmental Assessment and Water Research (IDAEA)** is an environmental science institute devoted to the study of the human footprint on the biosphere. Much of the research work at this institute is centred on two of the great environmental challenges of our time: cleanliness and availability of water and quality of air.

Founded in 2008 as a member of the **Spanish National Research Council (CSIC)**, the Institute brings together a wide range of expertise in environmental science. It is organized under two Departments (Environmental Chemistry and Geosciences), established with a strong record of publication in top scientific journals, leading international projects, membership on international committees, and adopting a high-profile contribution to the identification and remediation of environmental problems.

IDÆA has demonstrated strengths in the analysis of organic pollutants and their impact on ecosystems, the study and management of water resources, the development of multivariate resolution algorithms in chemometrics, and in the study of inhalable particulate matter and toxic gases.

IDÆA has been recently awarded with the distinctive **Centre of Excellence "Severo Ochoa"** (2020-2023), distinction that indicates the high-quality scientific leadership and global impact of the work developed at the centre.

We offer a diverse and inclusive environment where no discrimination against disability, gender, nationality, religion or sexual orientation will occur during the selection process.

How to apply?

Those interested may email their **CV, academic records** and **motivation letter** to **Dr Laia Navarro-Martin** at laia.navarro@idaea.csic.es and **Dr Joaquim Jaumot** at jjsqam@idaea.csic.es, adding "**FPI PhD position**" to the email subject.

Deadline: October 25th 2020