Workshop: Potential Roles of Omics Data in the use of Adverse Outcome Pathways for Environmental Risk Assessment
September 18th, University of Liverpool

Background

The current approach to assessing adverse effects of chemicals in the environment is largely based on a battery of in-vivo study methods and a limited number of accepted in-silico approaches. For most substances the pool of data from which to predict ecosystem effects is limited and often only short term data are available. The EC Scientific Committee Consultation paper ‘Addressing the New Challenges for Risk Assessment’ (2012) highlights some of the main deficiencies of current risk assessment approaches. The report also outlines the potential advantages and challenges of conducting effects assessments using data from lower hierarchical (biological) levels of organization, such as molecular, biochemical and histological responses, to infer impacts at the individual, population and, perhaps, even community levels. The adverse outcome pathway (AOP) framework provides a conceptual basis through which linkages can be explicitly assessed across biological levels of organization. There are substantial international efforts to develop and catalogue AOPs and develop implementation guidance for risk assessment. ‘Omics approaches offer potential for use in environmental risk assessment when applied as part of a systems toxicology or integrative approach, and considered in the context of the AOP framework. For example, omics can provide mechanistic information about the effects of chemicals and have the potential to increase confidence in species extrapolation. These techniques have the potential to be combined with i) mechanistic effect models that can (begin to) account for some of the complexity of populations, communities and ecosystems and ii) provide insights as to toxic mechanisms for both defined and, importantly, defined pathways via which unacceptable effects occur.

Objectives

The workshop aims to bring together experts from the academic, industry and regulatory authority communities to discuss and define the role of ‘omics’ techniques as part of the AOP framework to support environmental risk assessment of chemicals especially those used in consumer products. It is intended that the workshop will help to identify key challenges and propose collaborative research projects for making stepwise change.

Workshop participants will be assigned to a technical group by the workshop Steering Committee, based upon their expertise and will be tasked with addressing specific technical questions.

Workshop output

The aim of the workshop is to provide a short review for publication in <journal under discussion>. Each workgroup will provide text for direct inclusion in the publication.
Workgroups

Group 1: The role of ‘omics in the AOP Framework
Chair: Tom Hutchinson  Rapporteur: Natalia Reyero
Specific topics for consideration by Workgroup 1:

- How can we use functional genomics data to better define components of an AOP (e.g. Discovery of new AOPs versus confirmation of existing AOPs, Application to Lab vs Field (i.e., prospective vs diagnostic assessments etc))?
- How does the AOP framework influence study design to ensure data generation is useful for risk assessment.

Group 2: The role of ‘omics in understanding species sensitivity and the biological domain of applicability of AOPs
Chair: Markus Hecker  Rapporteur: Peter Kille
Specific topics for consideration by workgroup 2:

- Can ‘omics data be used to better understand differential species sensitivity and what are the limitations of current techniques/approaches?

Group 3: The role of data-driven computational learning and its integration with mechanistic approaches in extrapolating from molecular events to population relevant endpoints.
Chair: Francesco Falciani  Rapporteur: Emma Butler
Specific topics for consideration by workgroup 3:

- What are the Computational Biology approaches for inference of biological knowledge that have been demonstrated to be effective in the context of the AOP framework?
- How to integrate mechanistic understanding in the data driven learning process?
- Can predictions of individual (population relevant) effects be made from ‘omics data? (how good are we at predicting apical endpoints using ‘omics data)
Agenda

09:00  Registration, Refreshment and Welcome.

09:30  A view on current challenges in the environmental risk assessment of chemicals.
       Geoff Hodges/ Stuart Marshall, Safety and Environmental Assurance Centre, Unilever Research

09:45  Keynote lecture
       Overview of AOP- and ‘Omics-orientated Research by the Small Fish CompTox team: Progress and Challenges’
       Gerald Ankley, USEPA

10:30  Refreshment to go into workgroup discussions

10:45  Workgroup breakout session. Discussion.

13:00  Lunch

14:00  Workgroup breakout session. Discussion and text preparation.

16:00  Refreshment

16:30  Plenary, Summary of outputs from each Workgroup.
       1) Slide set for discussion covering:
          a. Key outputs
          b. Challenges to address and
          c. Initial research proposals to address the challenges.
       2) Draft text for the publication of 500 words answering the challenges posed to the workgroup.

18:00  Close