

## Abstract

The quality and utility of literature based chemical assessments has been improved by leveraging the power of systematic review (SR) and systematic mapping (SM, also referred to as evidence mapping) approaches to aggregating and evaluating evidence of health risks posed by exposure to environmental chemicals. Taking maximal advantage of SRs and SMs is currently impeded by linguistic inconsistencies resulting from different communities using different vocabularies to describe common study characteristics, requiring the systematic reviewer to anticipate all the concepts, relationships, and words related to a science question when developing a search string sensitive enough to locate all potentially relevant studies. The state-of-the-art approach, to use dictionaries and thesauruses are useful for ensuring all semantically related terms are included in a search, but they do not offer the context necessary to capture relationships between concepts, e.g. according to biological organization such as gene expression. We are therefore exploring the use of ontologies and semantic mapping as a part of evidence integration in literature based chemical assessments. An ontology is a controlled vocabulary of precisely-defined terms and the specified relationships between them, interpretable by both humans and machines. Here we give an example of how literature prioritized for thyroid and neurological health outcome data extracted from human and animal literature studies can be matched to ontology concepts that serve as a point of integration in a semantic framework bounded by a structured Adverse Outcome Pathway (AOP) framework. When implemented, this ontological approach may solve the problem of a researcher needing perfect *a priori* knowledge of all relevant terms and relationships in order to query a database for comprehensive information about mechanisms of thyroid toxicity: this information is already provided in the database ontology.

## Background

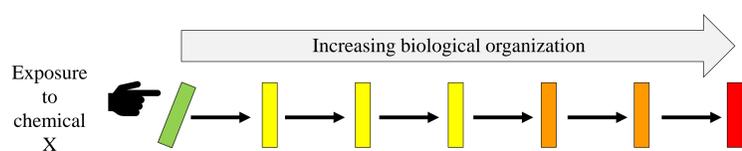
**Systematic Review (SR, Figure 1)** is a formal method used in literature based assessments meant to insure rigor and transparency.

**Systematic Mapping (SM, also referred to as evidence mapping)** is a technique borrowing from SR principles and can be applied during the scoping, planning and problem formulation phase of a chemical assessment to summarize the characteristics of the evidence base. In chemical assessments, these characteristics are usually broad data categories such as evidence type, chemical, type of animal model or human population, outcome, etc. which are important to know before making decisions on how to approach the assessment, staffing needs, and to identify key data gaps.

**Semantics** is the study of linguistics, their meaning, relationship, and structure.

**Ontologies** are "A kind of controlled vocabulary of well-defined terms with specified relationships between those terms, capable of interpretation by both humans and computers" (whetzel et. Al, 2011).

**Adverse Outcome Pathways (AOPs, Figure 2 below)** are meant to describe how perturbation of a biological system leads to a particular adverse health outcome using components called molecular initiating events (MIEs, green bar below), Key Events (KEs, yellow and orange bars below), Key Event Relationships (KERs, arrows below), and Adverse Outcomes (AOs, red bar below) that are supported by scientific information.



## Approach: Evidence Mapping and literature-based information integration into an Adverse Outcome Pathway

