



# THE OECD QSAR TOOLBOX: MORE THAN QSAR PREDICTIONS

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30 November, 2021



- ECHA and OECD co-own and co-develop the Toolbox
  - Work executed by LMC
- Activities under the OECD umbrella, core developments contracted by ECHA
  - Coordination group: OECD, ECHA, IT developer
  - Toolbox management group: Coordination group + experts from industry, authorities, NGOs
- Other partners also invest in the development
  - e.g. EPA contracted the link with their tool ONCOLOGIC and Japan developed a plug-in for their QSAR tool KATE
- Now third parties can make their own extensions (e.g. profilers, QSAR models) available through the TB repository.

The screenshot shows the 'Toolbox Repository' website. At the top right is a 'Login' link. On the left is a 'Categories' sidebar with links for 'Calculators', 'Profilers', 'Metabolism Simulators', 'QSARs', and 'System Extensions'. The main area is titled 'Tools' and features a search bar with the placeholder text 'Tool name, description, developer'. Below the search bar is a grid of tool cards. Each card displays a logo (e.g., PBT ECHA, VEGA, KATE), the tool name, the developer (e.g., ECHA, NIES\_JAPAN, LMC), and a star rating. The tools shown include: ECHA P screening (BETA), ECHA B screening (BETA), ECHA T (ENV) screening (BETA), KATE Addin, VEGA addin, ECHA REACH Unlock Plugin, Oral absorption, and Blood brain barrier.



# Global Use by Regulators

 Environment and Climate Change Canada  
 Health Canada

 NIH  
NIEHS



 Agência Nacional de Vigilância Sanitária

 ECHA  
EUROPEAN CHEMICALS AGENCY

 anses  
French agency for food, environmental and occupational health & safety  
*Investigate, evaluate, protect*

 BfR  
Bundesinstitut für Risikobewertung



 Ministry of Environment and Food of Denmark  
Environmental Protection Agency

 Cefas

 経済産業省  
Ministry of Economy, Trade and Industry

 環境省  
Ministry of the Environment

 Australian Government  
Department of Health  
National Industrial Chemicals Notification and Assessment Scheme



# QSAR TOOLBOX



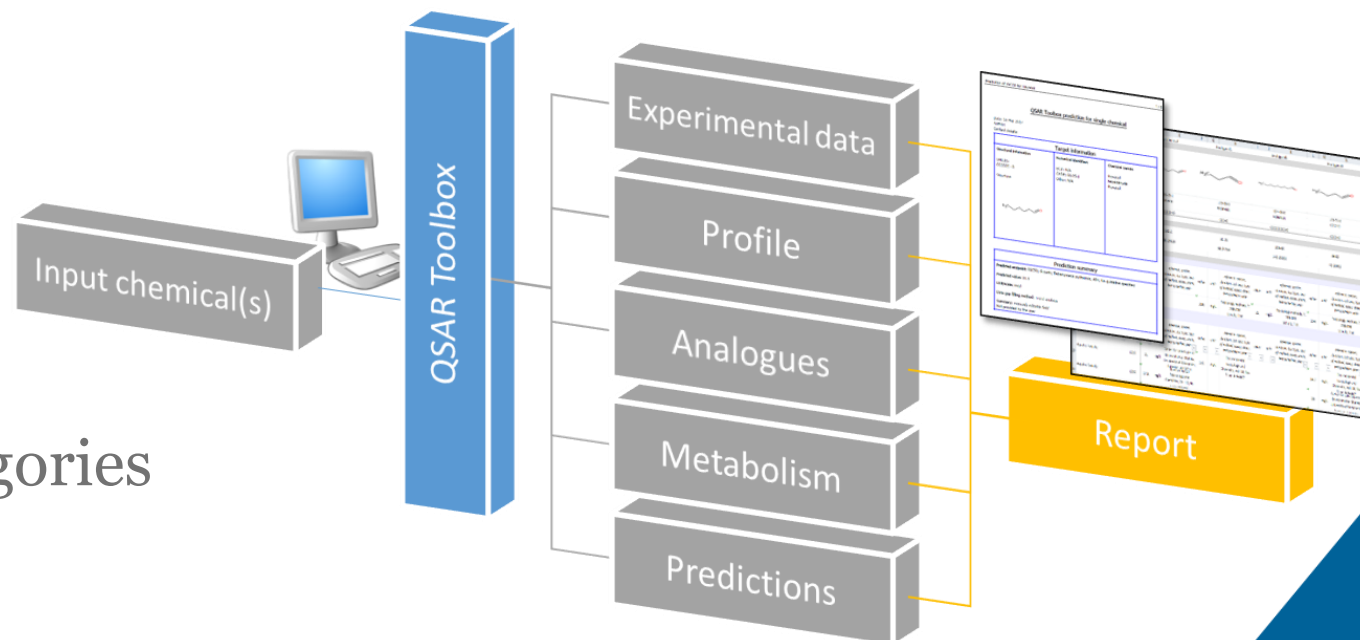
More than QSAR predictions

QSAR TOOLBOX

The QSAR Toolbox is a free software application that supports (eco)toxicologists in performing reproducible and transparent chemical hazard assessment using **non-animal methods**.

Key functionalities:

- retrieve experimental data
- profiling properties of chemical
- simulate metabolism
- identify analogues and build categories
- predict properties





## Experimental data

## QSAR TOOLBOX

No need to perform new experimental studies if the information is already (publicly) available.

Toolbox searches **experimental data** on chemicals from 59 databases, including 100 000 chemicals and over 3 million data points.

Experimental data from analogues can also be used for read-across predictions.





**Structural profilers** support the identification of structurally similar substances.

**Mechanistic profilers** provide an understanding of the mode of action, which is key to predict the activity of substances or to form mechanistically sound categories.

The results of the profilers in the Toolbox, include descriptions and references to scientific papers to explain the outcome.

The screenshot displays the QSAR Toolbox interface. On the left, a 'Filter endpoint tree' lists categories like 'Structure', 'Structure info', 'Profile', 'Predefined', 'US-EPA New Chemical Categories', 'General Mechanistic', 'Protein binding by OASIS', 'Endpoint Specific', 'Protein binding alerts for skin sensitization by OASIS', and 'Empiric'. The 'Organic functional groups' section is expanded, showing 'Acyl halide', 'Alkyl halide', 'Alkyl', and 'Carboxylic acid ester'. The central panel shows a chemical structure of a chlorinated aromatic compound with a carboxylic acid group. Below the structure, a list of mechanistic alerts is shown, including 'Acid Chlorides', 'Esters (Acute toxicity)', and several 'Acylation' alerts. One alert is highlighted: 'Acylation >> Direct acylation involving a leaving group >> (Thio)acyl and (thio)carbamoyl halides'. To the right, a detailed window for this alert is open, showing the reaction mechanism: a nucleophile (Nu) attacks the carbonyl carbon of an acyl halide (R-CO-X), displacing the leaving group (X). The window also includes a reference to a scientific paper by Dr. D. Asher.

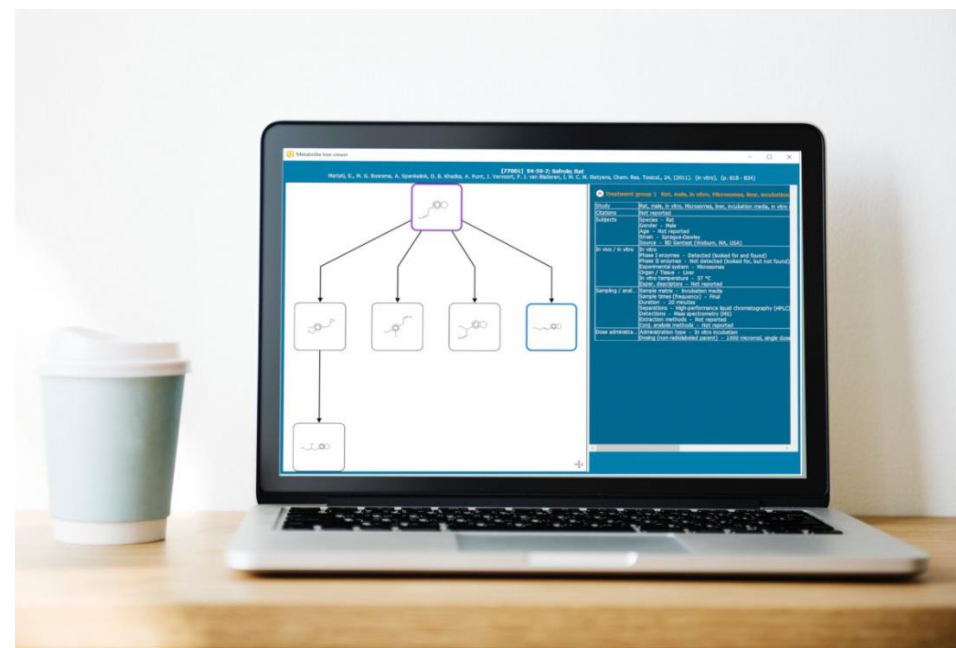


# Metabolism

# QSAR TOOLBOX

Metabolism influences the activity of substances in many cases. It is important to take it into account when making predictions of forming categories.

Results from 5 experimental metabolic databases and 11 metabolic simulators can be taken into account when assessing a single substance or categories.

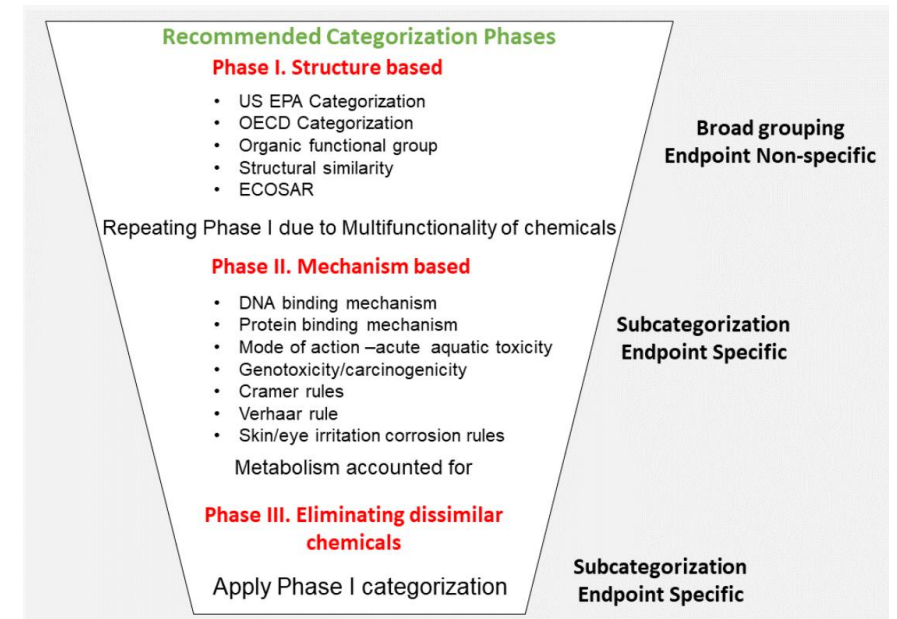




# Analogues and categories

Data from analogues can be used to predict the property of a target substance using read-across or trend-analysis.

Toolbox can take into account structural, mechanistic and metabolic aspects to find toxicologically relevant analogues with data on the property of interest.







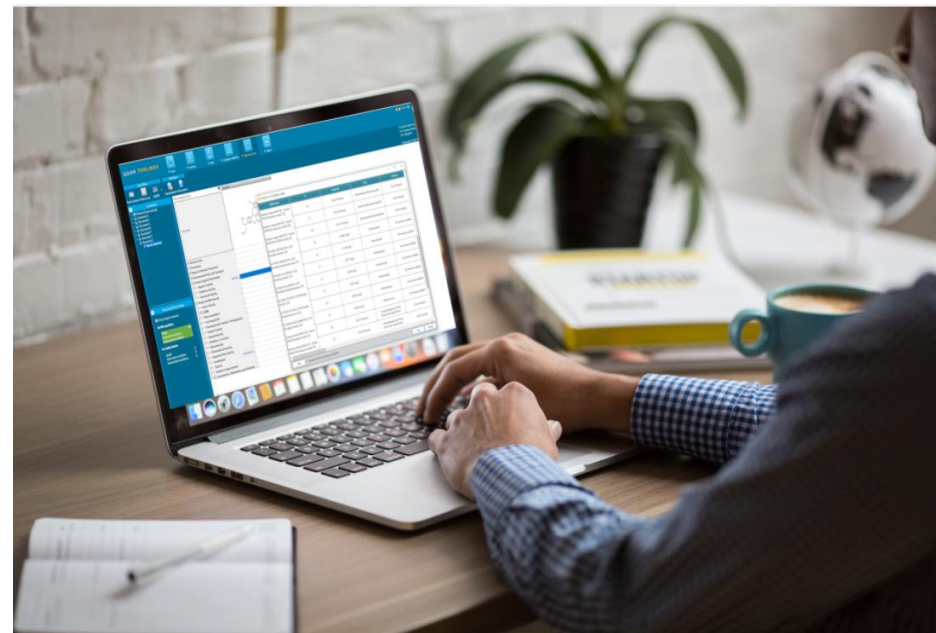
## Predict properties

## QSAR TOOLBOX

Toolbox can also predict properties by using existing QSAR models, which do not require the (manual) identification of analogues.

Examples of external QSARs included in the Toolbox are:

- EPISuite models by US EPA
- Danish QSAR Database predictions





- The QSAR Toolbox offers many possibilities to assess chemical properties with non-animal methods.
- In addition to QSAR models, existing data, metabolic and mechanistic information can be used to fill data gaps.
- The Toolbox development is a group effort! The project is managed by ECHA and OECD and implemented by LMC, but also 3<sup>rd</sup> parties contribute to its success, with e.g.:
  - The donation of data, profilers and models.
  - Feedback and suggestions, especially by the QSAR Toolbox management group.
  - The financing of tutorials and other developments.