

Effect-based methods to evaluate the presence of toxic compounds in drinking water – our most important food item

Johan Lundqvist, Associate Professor of Molecular Toxicology



Drinking water – our most important food item

- Taken for granted
- The only food item that we cannot live without
- High consumption and life-long exposure



Hazardous chemicals in drinking water

- Tens of thousands of potential contaminants
- Only a very limited number of contaminants are monitored today
- Looking under the streetlight

Looking under the streetlight – is it really a problem?

Example:

- Water samples from streams impacted by wastewater effluents
- Chemically characterized for 400 pollutants
- Effect-based assessment of bioactivities
- The 400 pollutants could only explain 0.2-1.6% of the observed effects on ER, AR and oxidative stress response
- 99% of the observed biological effects was caused by unknown chemicals

Neale et al, Science of the Total Environment, 2017, 576:785-795



Effect-based *in vitro* methods

- Cultured mammalian cells
- Modified to respond to the presence of hazardous chemicals
- Integrate the effects of both **known** and **unknown** chemicals as well as potential **cocktail effects**



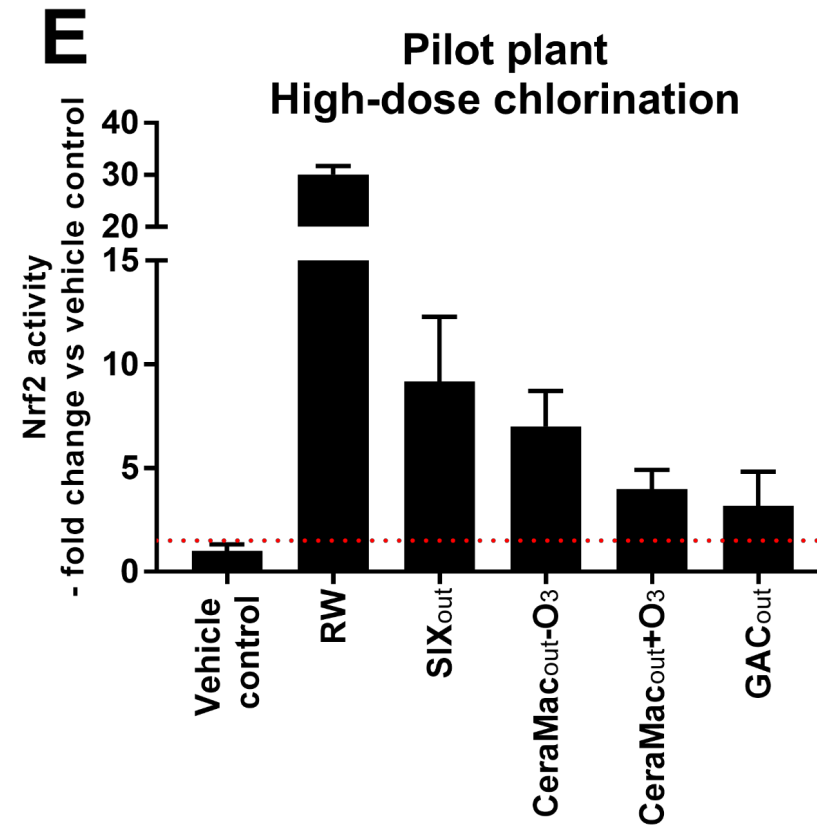
Effect-based *in vitro* methods

- Suitable for high-throughput applications (384 well plates)
- Endocrine disruption, metabolic activity, oxidative stress, genotoxicity etc

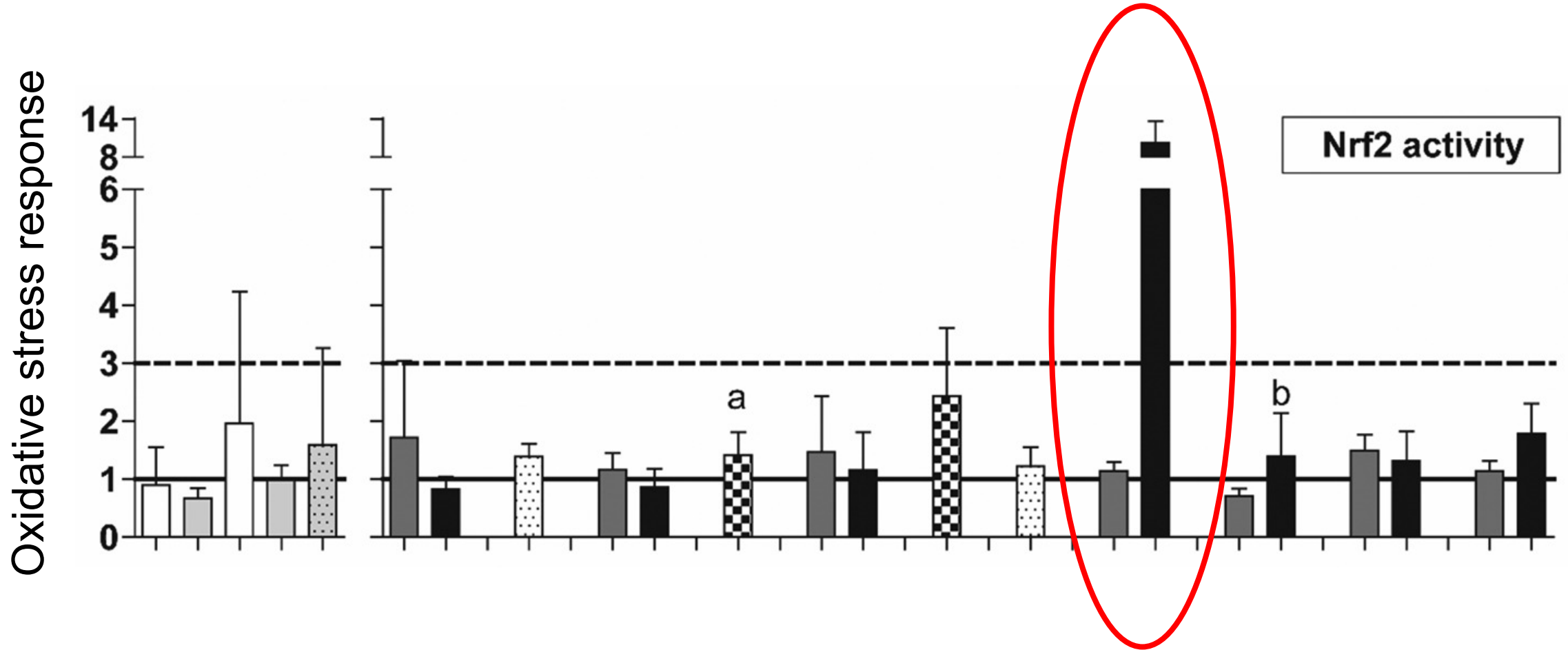


A few examples - effect-based testing

To evaluate new drinking water treatment technologies



Evaluate drinking water safety



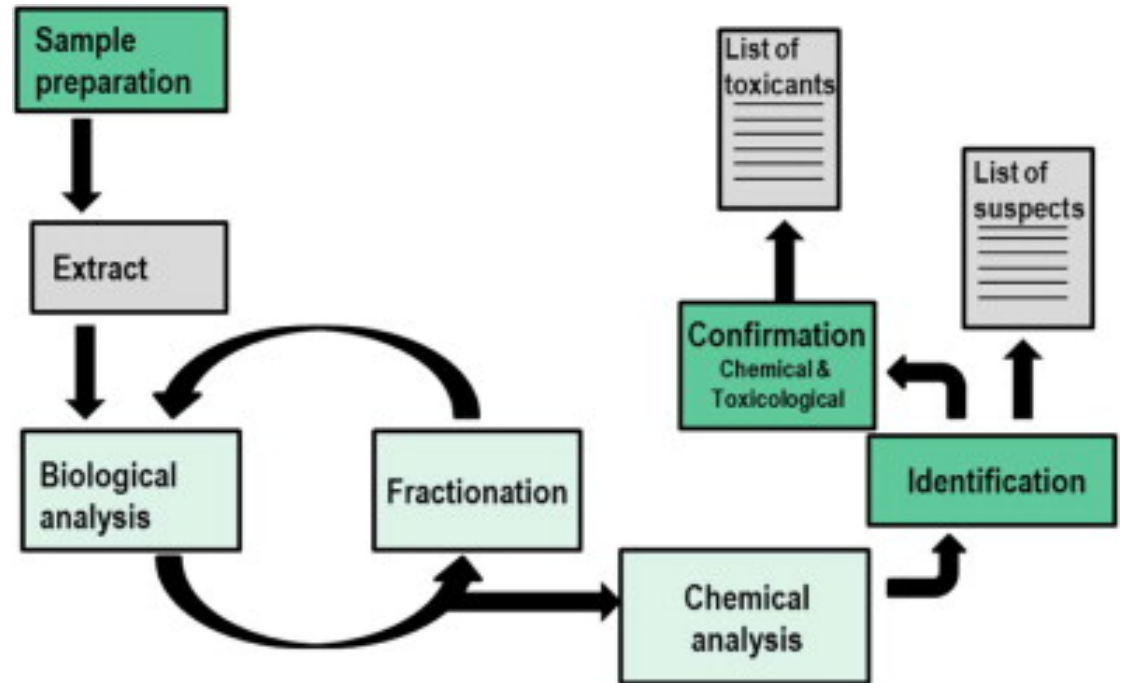
Unpublished data

Effect-directed analysis

Effect-directed analysis (EDA) platform

Effect-directed analysis:

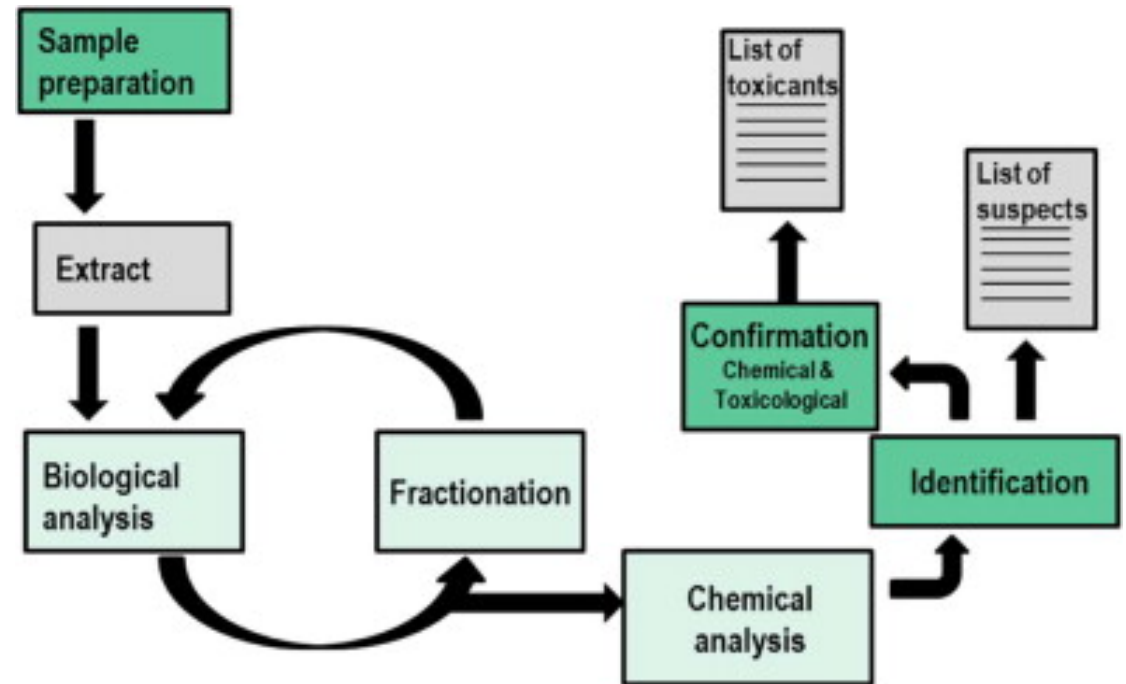
- Combining effect-based testing, fractionation and chemical screening
- Fractionation to reduce chemical complexity in a sample
- Aiming to identify the compounds causing toxicity



Effect-directed analysis (EDA) platform

Funded by an SLU
Infrastructure grant

- Bioassays
- Advanced chemical screening
- Fractionation
- PI: Karin Wiberg



Summary

Panel of cell-based in vitro bioassays:

Endocrine disruption

AhR

Oxidative stress

Genotoxicity

Etcetera...

Overall aim:

- Perform effect-based assessment of hazardous chemicals in the environment
- Use effect-directed analysis to identify new toxic pollutants

An iceberg graphic with a small green peak above a dark green water line. The large, dark green submerged part of the iceberg contains the text '95-99%' in white. The background is a light green gradient.

95-99%

Complex environmental samples

- Surface water
- Waste water
- **Drinking water**
- **Food**
- **Food contact materials**