1. Introduction
Organisms are living in multi-stressed environments involving both chemical and environmental stressors. It is worth understanding how this environment affects the organisms. Mechanistic effects models are gaining interest in the scientific and regulatory communities for use in risk assessment. They can facilitate accounting for the complexities and multiple stressors of various environmental scenarios.

We report here a case study on a Cladoceran, *Ceriodaphnia dubia*, exposed to various chemicals under different environmental conditions.

2. Ceriodaphnia dubia
Found globally, *C. dubia* inhabits freshwater lakes and ponds. Length ranges from 0.2 to 1.0 mm.

Used in EPA test for 7 days 3 broods chronic experiments at 25°C. *C. dubia* is tolerant to a wide range of temperatures.

In our study, length, reproduction, and survival were monitored daily using a microscope.

3. Environmental conditions
Capability of an organism to grow and reproduce will be impacted by factors such as temperature, food availability, predation or chemical exposure.

In our study, we assessed the effect of a chemical under optimal conditions (25°C, ad libitum) and under a scenario with non optimal temperature and food availability.

Organisms were exposed to a range of concentrations of phenol or 1-octanol.

4. DEBkiss model
Mechanistic model based on the Dynamic Energy Budget theory, it accounts for mass balance and treats all biomass as structure.

Physiological parameters calibrated on a control dataset with several temperature and food levels

Toxic parameters calibrated under optimal conditions only.

5. Effect of environment on *C. dubia* response
Fits are accurate under both optimal and non optimal conditions. Calibration of physiological parameters only required once on a control dataset. Calibration of the toxic parameters only required once and used to infer response on non-optimal condition.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Phenol</th>
<th>Octanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiological mode of action</td>
<td>N/A</td>
<td>Cost for growth + reproduction</td>
<td>Cost for growth + reproduction</td>
</tr>
<tr>
<td>Dominant rate (ke)</td>
<td>d⁻¹</td>
<td>10 (3.4-10)</td>
<td>10 (3.4-10)</td>
</tr>
<tr>
<td>NEC sub-lethal</td>
<td>mg.L⁻¹</td>
<td>0.14 (0.09-0.18)</td>
<td>0.14 (0.09-0.18)</td>
</tr>
<tr>
<td>Tolerance concentration sub-lethal</td>
<td>mg.L⁻¹</td>
<td>1.53 (1.33-1.75)</td>
<td>1.53 (1.33-1.75)</td>
</tr>
<tr>
<td>Arrhenius temperature</td>
<td>K</td>
<td>6400</td>
<td>0.57 (0.09-0.95)</td>
</tr>
</tbody>
</table>

6. Conclusion
Chronic toxicity data were produced using a semi high-throughput 7 day experimental design. A bioenergetics model was calibrated under optimal conditions and used to assess the effect under non-optimal conditions.

*Ceriodaphnia dubia* is a suitable organism for high-throughput chronic experiments that can be analysed by DEB based models allowing further extrapolation to non tested conditions and levels of biological organisation.

References: