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# A Comprehensive Approach to Saxitoxin Effects in Daphnia magna

**Albano Pinto**<sup>1,2</sup> <sup>™</sup> albanopinto@ua.pt</sup>, Inês P. E. Macário<sup>1,2</sup>, Sérgio M. Marques<sup>1,2</sup>, Joana Lourenço<sup>1,2</sup>, Inês Domingues<sup>1,2</sup>, Jana Asselman<sup>3</sup>, Patrícia Pereira<sup>1,2</sup> and Joana Luísa Pereira<sup>1,2</sup>

- <sup>1</sup> CESAM Centre for Environmental and Marine Studies, Department of Biology, University of Aveiro, Portugal
- <sup>2</sup> Department of Biology, University of Aveiro, Aveiro, Portugal
- <sup>3</sup> Blue Growth Research Lab, Ghent University, Bluebridge Building, Ostend Science Park 1, 8400, Ostend, Belgium

## Background

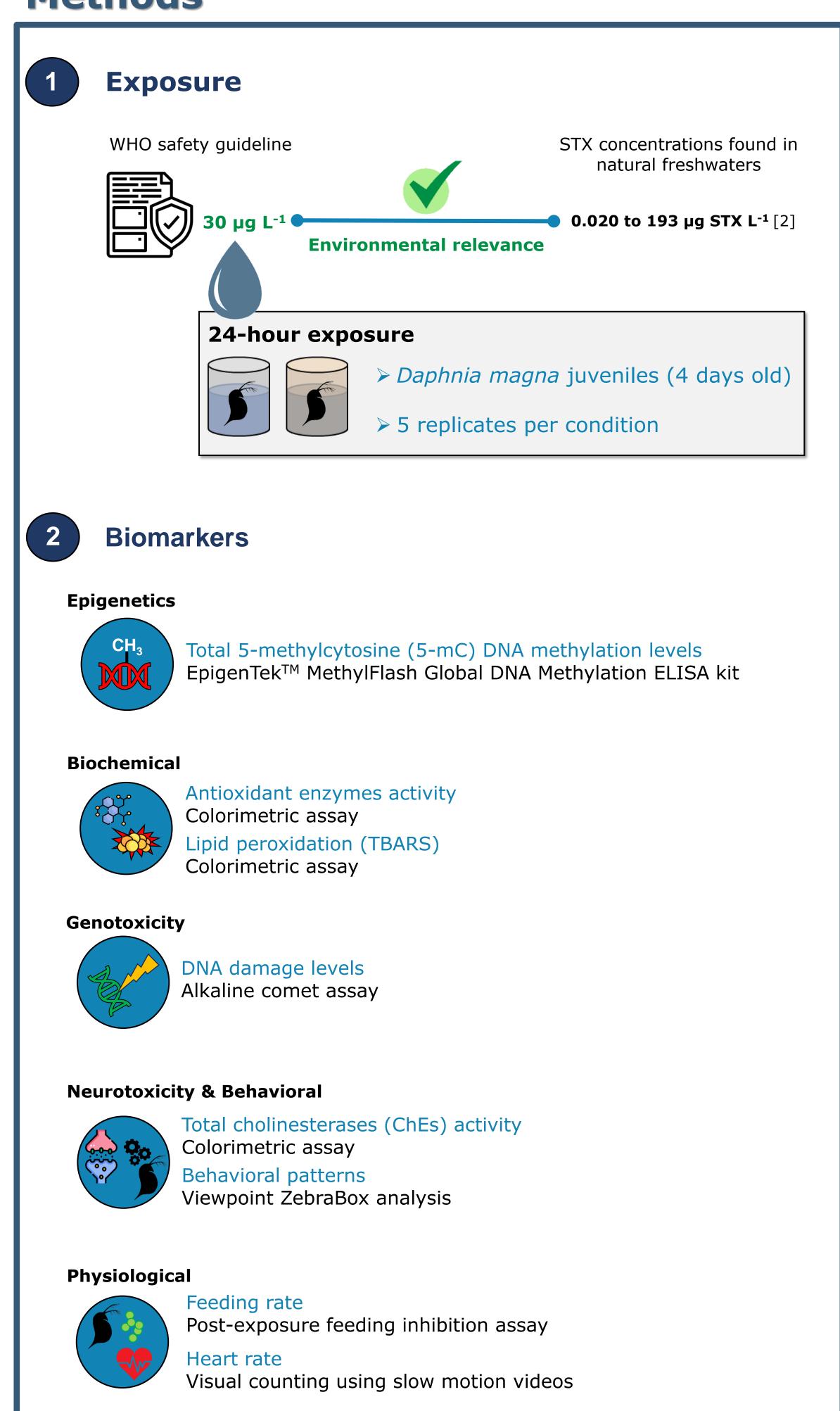
Saxitoxin (STX) and its derivatives are dangerous naturally occurring aquatic neurotoxins produced by freshwater and marine phytoplankton species during harmful algal blooms (HABs).

STX high toxicity and adverse impacts towards humans are well known, however its effects on the aquatic biota are less unexplored.

## **Aim**

To fill some of the existent gaps, this work aims at assessing the effects of a pulse acute 24 h exposure to the safety guideline established by the World Health Organization for STX in recreational freshwaters (30  $\mu$ g L<sup>-1</sup>) [1], thus simulating a possible exposure that may occur in a freshwater ecosystem.

## Methods



References [1] World Health Organization (2020) Cyanobacterial toxins: saxitoxins. World Health Organization. Available at: https://iris.who.int/bitstream/handle/10665/338069/WHO-HEP-ECH-WSH-2020.8-eng.pdf [2] Trainer, V. & Hardy, F. (2015) Integrative monitoring of marine and freshwater harmful algae in Washington State for public health protection. Toxins, 7(4), pp. 1206-1234. Available at:

https://doi.org/10.3390/toxins7041206 [3] Roncalli, V., et al. (2016) Transcriptomic responses of the calanoid copepod Calanus finmarchicus to the saxitoxin producing dinoflagellate *Alexandrium fundyense*. Scientific Reports, 6(1), 25708. Available at: https://doi.org/10.1038/srep25708

### **Acknowledgements**

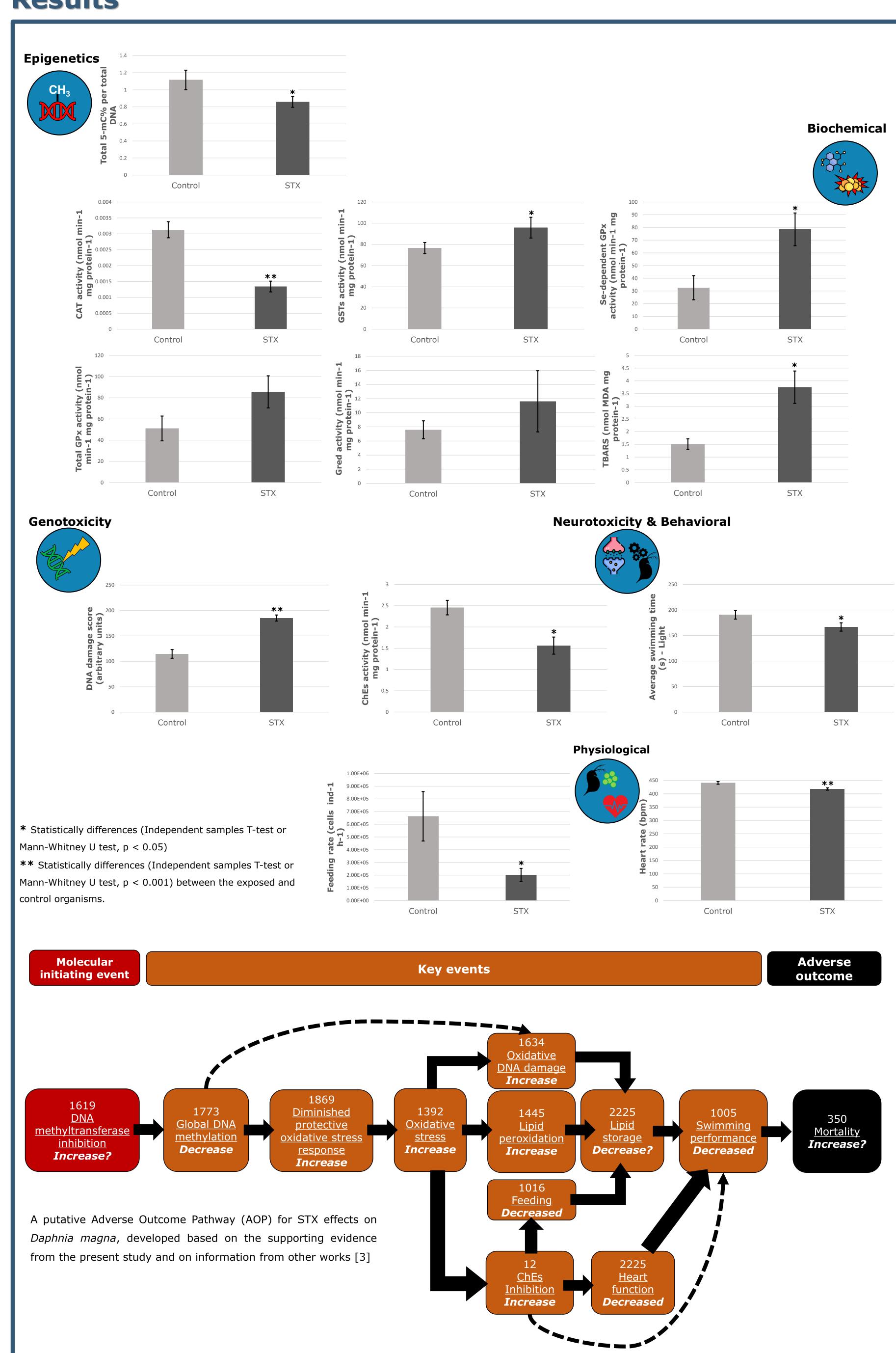
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## Results



- > STX exposure led to global genome hypomethylation, possibly due to altered activity of key epigenetic machinery
- > The altered DNA methylation landscape likely elicits alterations at the transcriptomic level, probably resulting in an impaired antioxidant metabolism (inhibited <u>CAT</u> activity) and then oxidative stress onset (increased <u>TBARS</u> levels)
- > Oxidative stress-related changes on ChEs activity can explain the reduced heart rate and feeding rate
- > STX impairs *D. magna* physiological function and behavioral patterns, potentially compromising organisms' overall fitness

### **Takeaway**

- A STX concentration deemed safe for humans by the WHO induces extensive deleterious effects on *D. magna*.
- Changes in the epigenetic landscape could serve as the initiating events in a putative STX AOP.
- HABs and aquatic toxins occurrence in ecosystems are predicted to rise, reinforcing the need for further work.