

# Multi-Tier Assessment of Ecotoxicity of a PEG-Based Pharmaceutical on *Danio rerio* Embryos: Are Additives the Missing Piece?

Giada Caorsi<sup>1\*</sup>, Cristina Cremonesi<sup>1</sup>, Stefano Magni<sup>1</sup>, Camilla Della Torre<sup>1</sup>, Andrea Binelli<sup>1</sup>

<sup>1</sup>Department of Biosciences, University of Milan, Via Celoria 26, Milan 20133, Italy

## INTRODUCTION & AIM

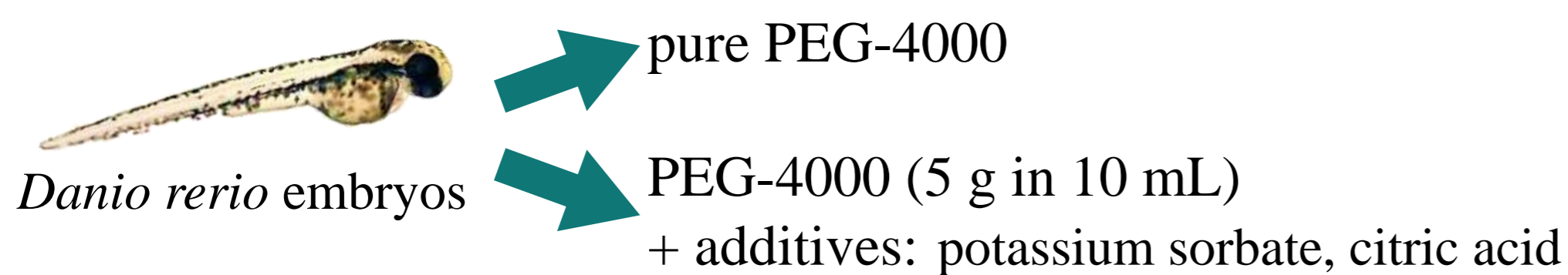
**Background:** water-soluble-polymers (WSPs) are a class of synthetic polymers broadly used in industrial, medical, and consumer applications<sup>[1]</sup>. Due to the lack of specific regulatory frameworks and their large-scale production, WSPs raise concerns about their continuous environmental release and potential related risks to organism health<sup>[2]</sup>.

**Commercial WSP-based products** often contain **additives** that may alter their environmental behaviour and ecotoxicity. Among these WSPs, polyethylene-glycol (PEG) is often used in pharmaceutical products together with additional compounds, but their combined effects remain poorly understood.

**Aim:** evaluate the potential effects of PEG comparing two different **commercial PEG-4000 based laxatives**, with and without additives, on *Danio rerio* embryos exposed for 120 hpf (hours post fertilization) under environmentally relevant concentrations.

## METHOD

*Danio rerio* embryos were exposed for 120 hpf at **equivalent PEG concentration of 0.1 mg/L**



**Ecotoxicological analyses:** a multi-tier approach was used



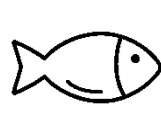
**Molecular level:** gel-free proteomic



**Cellular level:** ethoxyresorufin-O-deethylase (EROD)\*, glutathione S-transferase (GST), reactive oxygen species (ROS)\*, superoxide dismutase (SOD), acetylcholinesterase (AChE), and monoamine oxidase (MAO)



**Physiological level:** cardiac activity\*



**Organism level:** morphometric parameters (eye size, body length), spontaneous coil-tailing activity, and swimming behaviour\* (distance moved, velocity, acceleration, thigmotaxis and turn angle)

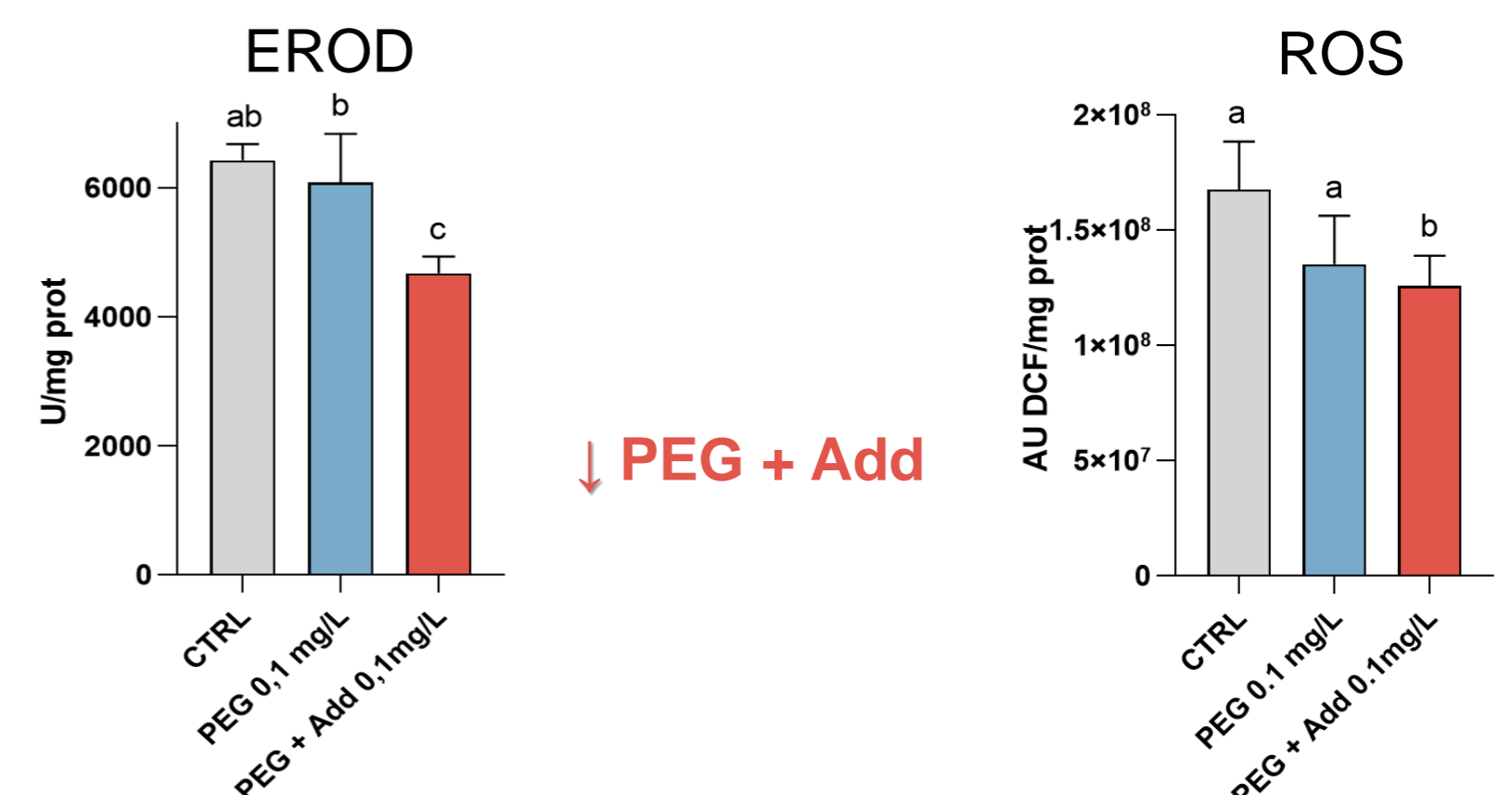
\*statistically significant results ( $p < 0.05$ )

## RESULTS & DISCUSSION

Only statistically significant findings are shown in this section (one way ANOVA, Fisher LSD *post-hoc* test,  $p < 0.05$ )



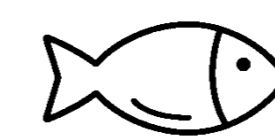
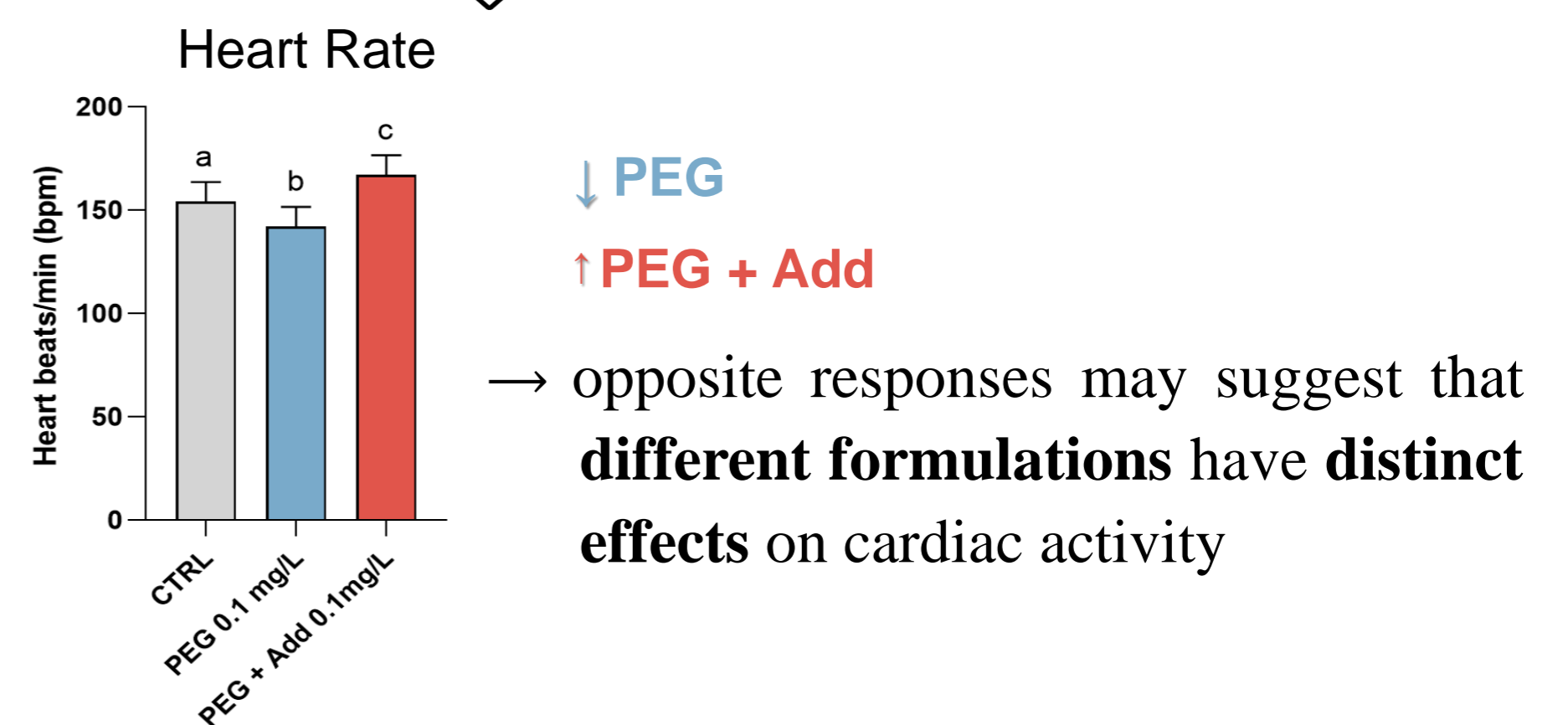
**Cellular level**



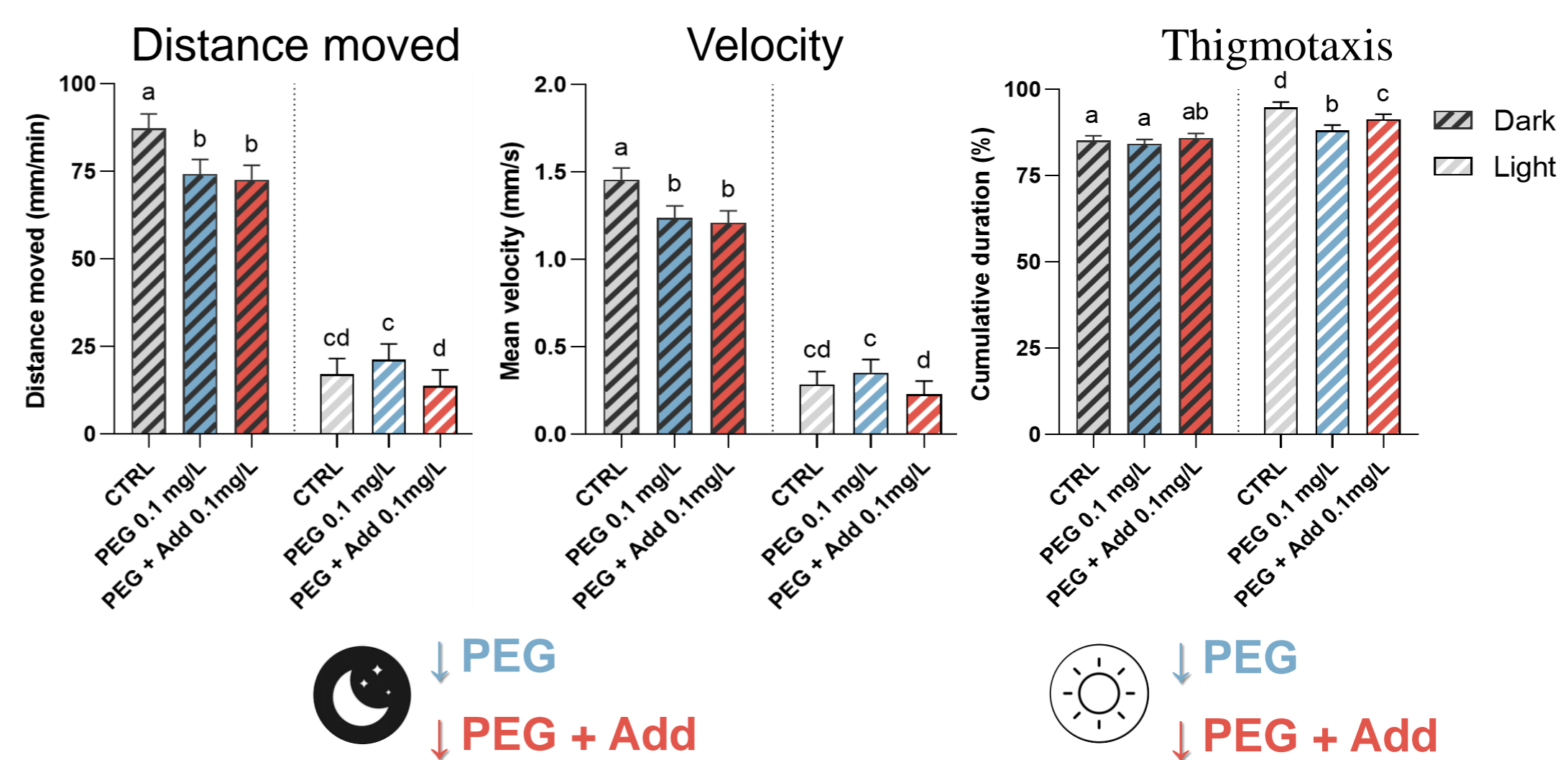
→ possible alteration of **oxidative balance** and **detoxification pathways**



**Physiological level**



**Organism level**



→ Treatments altered **swimming pattern under dark conditions** and **stress-related behaviour under light conditions**

## CONCLUSION

Want to know more?

- **Additives influence the toxicity** of commercial WSP-based products
- **Ecotoxicological assessments should focus on commercial WSPs-based products** rather than polymers alone
- Further studies are needed to assess the **environmental impacts** of WSPs-based products releases **in freshwater ecosystems**



SCAN ME

## REFERENCES

- [1] Nigro L, Magni S, Ortenzi MA, Gazzotti S, Signorini SG, Sbarberi R, Della Torre C, Binelli A. Assessment of behavioural effects of three water-soluble polymers in zebrafish embryos. *Sci.Total.Environ.* 2023;893:16484
- [2] Wang D, Zheng Y, Deng Q, Liu X. Water-Soluble Synthetic Polymers: Their Environmental Emission Relevant Usage, Transport and Transformation, Persistence, and Toxicity. *Environ.Sci.Technol.* 2023;57(16):6387-6402