

---

# Neurotoxicity of polystyrene nanoplastics and their ingestion in the marine mussel *Mytilus galloprovincialis*

Joanna Gonçalves<sup>\*1</sup> and Maria João Bebianno<sup>†1</sup>

<sup>1</sup>Centre for Marine and Environmental Research – Universidade do Algarve - FCT — Edifício 7 - Piso 1  
Campus Universitário de Gambelas — 8005-139 FARO, Portugal

## Abstract

Increasing plastic pollution and its toxic effects towards living organisms is concerning not only the scientific community, but the whole world. With the increase of marine plastic debris, the impact of nano-sized plastic particles towards marine organisms is still not fully understood. The class size of nanoplastics (NPs) (1 – 100 nm) facilitates the entry through biological barriers, and accumulation of these NPs in marine organisms is crucial to understand, as NPs may serve as vectors for other contaminants. Acetylcholinesterase (AChE) is a well-known biomarker used in marine organisms to understand the neurotoxic effects of contaminants, as the downregulation of this enzyme may cause changes to synaptic networks controlling heartbeats or muscle contraction. Furthermore, the ingestion of nanoplastics by mussels remains challenging to this date, therefore, the present study determined to assess the neurotoxic effects of polystyrene nanoplastics (nPS; 50 nm), at a concentration of 10 mg/L, on the marine mussel *Mytilus galloprovincialis* by evaluating the activity of AChE in the gills, and ingestion of nPS was evaluated in the gonads of mussels after a 28-day *in vivo* exposure. Neurotoxicity occurred in the gills of mussels, with a downregulation of AChE observable after 3 and 7 days of exposure to nPS compared to unexposed mussels. However, prior to 14-days, statistical differences are noteworthy between unexposed mussels, making it challenging to arrive at a sound conclusion. The ingestion of nPS in the gonadal tissues of mussels decreases along the time of exposure. Whether this pattern is tissue-specific, or nano-size specific, or plastic-specific remains a mystery and further investigation is necessary to understand if mussels ingest, and if they do, do they egest and therefore explain results observed.

**Keywords:** Neurotoxicity, Nanoplastic, Polystyrene, Mussel, Ingestion

---

<sup>\*</sup>Speaker

<sup>†</sup>Corresponding author: mbebian@ualg.pt