proceedings

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Abstract

Arsenic-Induced Neurotoxicity: A Study on the Brain–Behaviour Circuit †

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† Presented at the 1st International Electronic Conference on Toxics, 20–22 March 2024; Available online: https://sciforum.net/event/IECTO2024.

Keywords: arsenic; neurotoxicity; toxic metalloid

Introduction: Arsenic is a highly toxic metalloid and an environmental contaminant which predominantly affects the aquatic ecosystem. This pollutant is a well-known neurotoxicant and effectively alters neuronal activity by affecting the neurotransmission process. Abnormal neuronal activities manifest as modifications of behavioural biomarkers, which makes them a convenient method of assessing modulations in the neural system of an organism. The aim of this research study is to establish the hypothesis that an environmental toxicant like arsenic can cause repetitive behavioural patterns, which is an index of neurological abnormality.

Methods: Aquatic invertebrates are a reliable model to study ecotoxicity. As a common freshwater prawn species, *Macrobrachium lamarrei* was considered as a model organism to evaluate the critical role of low (non-lethal) concentrations of arsenic trioxide (As_2O_3) as a neurotoxicant in aquatic organisms. Both behavioural and respective gene expression (acetyl cholinesterase, neurexin–neuroligins) data were analysed to corroborate arsenic-induced neurotoxicity.

Results: The effect of arsenic trioxide on *Macrobrachium lamarrei* was robustly manifested in the form of a significant increase in grooming behaviour activity. Grooming is an established marker of neurological stress in several animals. In addition, repetitive behaviour is a marker of Autism Spectrum Disorder (ASD). Here, grooming repetitions were substantiated with neurexin–neuroligin up- and downregulation patterns.

Conclusions: Present-day research on the brain–behaviour circuit is applied for the analysis of psychopathological status in animals and humans. It is also efficiently used in neuropharmaceutical or neurotoxicological examinations of certain neuromodulators and neurotoxic agents (like arsenic) in the ecosystem which can induce transformed neuronal actions and consequently cause behavioural plasticity.

Author Contributions: Conceptualization, writing, formal analysis, C.M.; Methodology, A.M.; Data curation, A.M. and A.B.; Validation, P.M. and A.D.B.; Review and editing, P.S. and S.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Experiments were done according to the guidelines.

Citation: Munshi, C.; Mukhuty, A.; Bandyopadhyay, A.; Mondal, P.; Bhowmik, A.D.; Shaw, P.; Bhattacharya, S. Arsenic-Induced Neurotoxicity: A Study on the Brain–Behaviour Circuit. *Proceedings* **2024**, *102*, 33. https://doi.org/10.3390/proceedings2024102033

Academic Editor: Yankai Xia

Published: 3 April 2024

Informed Consent Statement: Not applicable.

Data Availability Statement: Experimental results can be found in the preprint https://www.biorxiv.org/content/10.1101/2022.08.30.505863v1.

Conflicts of Interest: The authors declare no conflict of interest.