

# **Arsenic induced neurotoxicity: a study on brain-behaviour circuit**

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## **Abstract**

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

**Methods:** Aquatic invertebrates are reliable model to study eco-toxicity. A highly occurring freshwater prawn species, *Macrobrachium lamarrei* was considered as a model organism to evaluate the critical role of low concentration (non-lethal) of arsenic trioxide (As<sub>2</sub>O<sub>3</sub>) as a neurotoxicant in aquatic organisms. Both behavioural and respective gene expression (acetyl cholinesterase, neurexin-neuroligins) data were analyzed to corroborate arsenic induced neurotoxicity.

**Results:** The effect of arsenic trioxide on *Macrobrachium lamarrei*, robustly manifested significant increase in the 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 gene up and downregulation patterns.

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

**Keywords:** Arsenic; neurotoxicity; toxic metalloid