proceedings

MDPI

Abstract

Therapeutic Strategies for Chromium-Induced Neurotoxicity: Exploiting NPTX2 and Autophagy Pathways in CNS Cells †

Sanjesh Kumar * and Mansi Singh

Institute of Pharmaceutical Research, GLA University, Mathura 281406, India; mansisingh542@gmail.com
* Correspondence: sanjesh534@gmail.com
† Presented at the 3rd International Electronic Conference on Biomolecules, 23–25 April 2024; Available online: https://sciforum.net/event/IECBM2024.

Keywords: chromium toxicity; autophagy dysregulation; NPTX2 mediation; CNS neurotoxicity; peroxiphagy

Introduction: Chromium is the most prevalent metal present on earth in two valence states: hexavalent [Cr(VI)] and trivalent [Cr(III)]. Hexavalent chromium [Cr(VI)] is widely recognized as a teratogen, mutagen, and neurotoxin to humans. Chromium-induced autophagy is a novel avenue which involves a plethora of cellular and molecular intricacies, including the identification of the novel NPTX2 (neuronal pentraxin 2) as a critical mediator of chromium-induced autophagy dysregulation in CNS cells. NPTX2 has a broad expression pattern in the brain, with a principal role in synaptic plasticity and neuronal survival.

Material and Methods: This review compiles the most recent research on the molecular processes of chromium-induced autophagy, with a particular emphasis on NPTX2 as a mediator in the cells of the CNS. Research on NPTX2 expression patterns in different brain areas and its role in autophagy dysregulation in response to chromium exposure was compiled. In addition, we looked at the signaling pathways and processes that were involved in the dysregulation of autophagy caused by chromium, such as the inhibition of mTOR, the activation of ULK1, and the interaction of NPTX2 with Beclin-1.

Results: Abnormal autophagosome synthesis, lysosomal dysfunction, and improper autophagic substrate degradation are symptoms of disturbed autophagy, which is caused by an increase in NPTX2 expression in response to chromium exposure. The inhibition of mTOR, activation of ULK1, and interaction between NPTX2 and Beclin-1 are all components of the intricate signaling pathways that contribute to autophagy dysregulation. Furthermore, non-traditional pathways like peroxiphagy are involved; in this process, chromium-induced oxidative stress harms peroxisomes, which are then selectively engulfed by autophagosomes through PINK1/Parkin signaling, reducing cellular damage.

Conclusions: Targeting peroxiphagy and pharmacological interventions which restore autophagic flux offer the potential to reduce chromium-induced neurotoxicity.

Author Contributions: Validation, S.K. and M.S.; formal analysis, S.K.; investigation, S.K. and M.S.; data curation, S.K.; writing—original draft preparation, S.K.; writing—review and editing, S.K.; supervision, M.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

check for updates

Citation: Kumar, S.; Singh, M. Therapeutic Strategies for Chromium-Induced Neurotoxicity: Exploiting NPTX2 and Autophagy Pathways in CNS Cells. *Proceedings* **2024**, *103*, 22. https://doi.org/10.3390/proceedings2024103022

Academic Editor: Jurg Bahler

Published: 12 April 2024

Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

Data Availability Statement: No new data were created or analyzed in this study.

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

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.