

## **Turning toxins into treatment: The therapeutic potential of animal venoms in neurodegeneration**

**Ines ELBINI**

Institut Pasteur de Tunis, Tunisia

**Background and Objectives:** Neurodegenerative diseases pose significant health and societal challenges due to their progressive nature and the lack of curative treatments. Recent studies have highlighted animal venom as a unique source of bioactive compounds that can specifically target membrane receptors, such as ion channels and integrins, which play critical roles in cellular signaling and neuroprotection. This lecture aims to explore the therapeutic potential of purified biomolecules from animal venoms, focusing on their high affinity and specificity for neuronal receptors and their capacity to modulate neuroinflammatory pathways, protect neurons, and influence disease progression. **Methods:** Purified biomolecules derived from animal venoms were studied for their interactions with key molecular targets, including voltage-gated potassium channels and integrins. Experimental evidence was gathered from *in vitro* and *in vivo* models of Parkinson's disease to evaluate their effects on neural communication, oxidative stress, and neuroinflammation. **Results:** Venom-derived biomolecules demonstrated high specificity and affinity for ion channels and integrins, effectively modulating neuroinflammatory pathways and providing neuroprotection. In experimental models of Parkinson's disease, these compounds were found to stabilize neural communication, reduce oxidative stress, and inhibit neuroinflammation, offering promising evidence for their therapeutic potential. **Discussion:** The findings underscore the translational potential of venom-derived biomolecules in neurodegenerative disease treatment. These natural compounds leverage precise mechanisms of action, such as targeting voltage-gated potassium channels and regulating immune responses through integrins, to address critical aspects of disease pathology. Despite their promise, challenges remain in advancing these compounds from experimental models to clinical applications, including issues of safety, delivery, and scalability. Embracing venom-based therapeutics could open new avenues for innovative treatments, utilizing nature's molecular toolkit to meet the pressing needs of patients with neurodegenerative diseases.

**Keywords:** Neurodegenerative diseases, animal venom, bioactive compounds, Parkinson's disease.