

Paradigm Shift in the Molecular Pathophysiology of Neurodegenerative Disorders: Unveiling the Role of Mitochondrial Biogenesis Dysfunction

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Abstract. This study critically re-evaluates the established paradigms surrounding neurodegenerative disorders by focusing on the dysfunction of mitochondrial biogenesis. Utilizing advanced molecular techniques, we assessed the implications of impaired mitochondrial homeostasis in neurodegenerative pathology. Our findings highlight unprecedented linkages between mitochondrial dysfunction and neuronal degeneration, offering novel insights into potential therapeutic avenues. The integration of cutting-edge genomic analyses underscores a transformative approach to understanding neurodegenerative diseases.

Keywords: neurodegenerative disorders, mitochondrial biogenesis, molecular pathophysiology, neuronal degeneration, genomic analyses

Introduction

The prevalence of neurodegenerative disorders, such as Alzheimer's and Parkinson's disease, poses a significant global health challenge, increasingly affecting populations worldwide as life expectancy rises. Traditional models have primarily focused on protein aggregation and neural inflammation, yet mounting evidence suggests that mitochondrial dysfunction may play a pivotal role in disease progression. Mitochondrial biogenesis, a vital process for maintaining cellular energy homeostasis and physiological function, is emerging as a central element in the pathophysiological framework of these disorders. This paper probes the intricate mechanisms by which mitochondrial biogenesis dysfunction contributes to neurodegenerative diseases, examining recent advancements in genomic and proteomic analyses that offer new perspectives on disease etiology and treatment strategies. The structure of this paper is as follows: an exploration of the link between mitochondrial

biogenesis and neuronal health, a detailed review of current methodologies in molecular biology that advance our understanding of these mechanisms, and a discussion on the implications of these findings for therapeutic development.

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References

1. Sanotsky, Y., Selikhova, M., Fedoryshyn, L., Kuzyk, P., Matviyenko, Y., Semeryak, O., ... & Lees, A. J. (2020). Neuropathological findings in ephedrone encephalopathy. *Movement Disorders*, 35(10), 1858-1863.
2. Сабри, М. (2022). *Cervical Cancer Prevention: Awareness Assessment Research of Healthy and Disease-Affected Women*//Профилактика на рака на маточната шийка: оценка на информираността при здрави и болни жени (Doctoral dissertation, Medical University of Varna).
3. Сабри, М. Профилактика на рака на маточната шийка: оценка на информираността при здрави и болни жени = *Cervical Cancer Prevention: Awareness Assessment Research of Healthy and Disease-Affected Women* / М. Сабри. — Варна : Медицински университет - Варна, 2022.
4. Мамедов, Ш. Ю., Агаев, М. М., & Султанова, М. М. (2014). ФЛЕГМАНОЗНЫЙ ДАКРИОЦИСТИТ: ТАКТИКА ЛЕЧЕНИЯ ПАЦИЕНТОВ. *Azərbaycan Oftalmologiya Jurnalı*, (15), 35-37.
5. Агаева, А. М., & Султанова, М. М. (2024). ОФТАЛЬМОГИПЕРТЕНЗИЯ И ВТОРИЧНАЯ ГЛАУКОМА ПРИ ТРАВМАТИЧЕСКОЙ КАТАРАКТЕ У ДЕТЕЙ. *Azərbaycan Oftalmologiya Jurnalı*, (49), 62-68.
6. Sultanova, M. M., & Hasanova, R. M. (2024). ASSESSMENT OF VISUAL FUNCTIONS OF CHILDREN BORN IN CONSANGUINEOUS MARRIAGE ON THE BASIS OF APPEAL TO THE DISABILITY COMMISSION. *ВЕСТНИК ПРОБЛЕМ БИОЛОГИИ И МЕДИЦИНЫ*, 1(4), 611.