Advanced Engineering Days

aed.mersin.edu.tr

The role of Notch and Wnt signaling pathways in neurodevelopment

Ece Tümkaya [*1], **Furkan Ayaz** [2]

[1]*Mersin Univercity, Biotechnology Department, Türkiye, ece_tumkaya@hotmail.com*
[2]*Mersin Univercity, Research and Application Center, Türkiye, furkanayaz@mersin.edu.tr*

Cite this study: Tümkaya, E., & Ayaz, F. (2023). The role of Notch and Wnt signaling pathways in neurodevelopment. Advanced Engineering Days, 6, 22-23

Keywords
Signaling pathway
Neuron
Neurodevelopment
Diseases
Cancer

Abstract

Notch is a protein that decides the path that cells should take by interacting with its ligands. The Notch signaling pathway is involved in performing functions that ensure cell survival.Notch activity mediates the formation of new structures from certain cells with its effect on differentiation, proliferation and apoptosis of cell. Similarly, Wnt signaling pathway sare involved in versatile signal transduction pathways that start with proteins that transmit signals to a cell via cell surface receptors and have many functions, including the control of neurogenesis. In this review proceeding, we will address the role of Notch and Wnt signaling pathways on neuronal development.

Introduction

John S. Dexter noticed that a notch appeared on the wings of the fruit fly Drosophila melanogaster in 1914. The alleles of this gene were described by Thomas Hunt Morgan in 1917, and in this way the notch signaling pathway was discovered [1]. The Notch pathway controls the continuity of stem cells, which undertake numerous tasks in our body, and is also a human cancer pathway known to have great activity in cancer. WNT, on the other hand, has two members that made it possible to get its name. The name Wnt was created by combining the first discovered Int-1 and later the Wingless gene, which was found to be homologous to this gene and discovered in Drosophila [2]. 19 proteins in the Wnt family are stimulants that contribute to the stimulation of the signaling pathway. These signaling pathways control neural stem cell activation, cell division and migration. Among its most important functions are being the main regulator of neurogenesis in the CNS and controlling brain plasticity. The brain sometimes undergoes changes due to different reasons. These can be structural or physiological. Some of these changes are the result of the neuron production mechanism. This production is of vital importance in the whole body as well as in the brain [3]. The control of a certain part of the changes and production mechanism in the brain is in the hands of the signaling pathways. With this explanation, we emphasize the importance of Notch and Wnt signaling pathways. Studies have revealed that Notch and Wnt signaling pathway sinteract in Drosophila and prevent early neuro-competence in ectodermal cells. In another study, it has been proven that a defect in these signaling pathways creates major deficits in learning and memory abilities [4]. Considering the effect of these signaling pathways on neurodevelopment, any dysregulation of the sepathways can be very serious, including T-cell leukemia, spondylocostal dysostosis, schizophrenia, Alzheimer's, Parkinson's, CADASIL syndrome and Alagille syndrome, ADHD, learning and communication disorder, and intellectual disabilities [1,5]. It is becoming clear that it can pave the way for a large number of neurodevelopmental and neurodegenerative diseases.

Results

The indicated signal transduction pathways enable many reactions required for cell survival. They are cancer pathways, however, due to their important roles in the body, they can cause various neurodevelopmental and neurodegenerative problems, developmental delay and many diseases such as cancer.

Discussion

Contrary to the general belief that nerve cells in the brain end with the moment of birth and that there is no new formation, scientists have revealed that new nerve cells can be produced thanks to their discovery. It is known that newly formed neurons increase memory capacity and improve learning power [4]. As mentioned above, it has been discovered that the role of Notch and Wnt signaling pathways is quite large in these developments.

Conclusion

While significant progress has been made in understanding the molecular mechanisms behind the neurodevelopment, there is still much to explore [5]. The hundreds of interconnected signaling pathways probably lie behind the simplest phenomena. Elucidation of these mechanisms will be through further analysis of animal models, biochemistry analysis, and human diseases. We should not be hopeless within the scope of the treatment of neurodevelopmental disorders, we should concentrate on where and how the treatment should be found. The ability of the brain to renew itself is much stronger than we think, and we can direct this ability with the right steps [6]. Extensive studies on the indicated signaling pathways will lead to the discovery of new and promising treatments.

References

1. Xiao, M. J., Han, Z., Shao, B., & Jin, K. (2009). Notch signaling and neurogenesis in normal and stroke brain. *International journal of physiology, pathophysiology and pharmacology*, *1*(2), 192-202
2. Altinok, B., & Sunguroğlu, A. (2016). Wnt sinyal yolağı ve kanser. *Ankara Sağlık Hizmetleri Dergisi*, *15*(2), 27-38.
3. https://bilimfili.com/beyin-plastisitesi-nedir-ve-neden-cok-onemlidir
4. Chen, M., & Do, H. (2012). Wnt signaling in neurogenesis during aging and physical activity. *Brain Sciences*, *2*(4), 745-768.
5. Lasky, J. L., & Wu, H. (2005). Notch signaling, brain development, and human disease. *Pediatric research*, *57*(7), 104-109.
6. https://abapsikoloji.com/norogelisimsel-bozukluklar-icin-tedavi-ve-terapi-yontemi/