NGF Gene

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1. Introduction

The *NGF* gene provides instructions for making a protein called nerve growth factor beta (NGFβ). This protein is important in the development and survival of nerve cells (neurons), especially those that transmit pain, temperature, and touch sensations (sensory neurons). The NGFβ protein functions by attaching (binding) to its receptors, which initiates signaling pathways inside the cell. The NGFβ protein can bind to two different receptors, the NTRK1 receptor or the $p75^{NTR}$ receptor. Both receptors are found on the surface of sensory neurons and other types of neurons. The binding of the NGFβ protein to the NTRK1 receptor signals these neurons to grow and to mature and take on specialized functions (differentiate). This binding also blocks signals that initiate the process of self-destruction (apoptosis). Additionally, NGFβ signaling through NTRK1 plays a role in pain sensation. It is less clear what binding with the $p75^{NTR}$ receptor signals. Studies suggest that $p75^{NTR}$ signaling can help sensory neurons grow and differentiate but can also trigger apoptosis.

2. Health Conditions Related to Genetic Changes

2.1. Hereditary sensory and autonomic neuropathy type V

At least one mutation in the *NGF* gene has been reported to cause hereditary sensory and autonomic neuropathy type V (HSAN5), a condition characterized by the inability to feel pain and sense hot and cold. This mutation changes a single protein building block (amino acid) in the NGFβ protein. The amino acid arginine is replaced with the amino acid tryptophan at position 100 (written as Arg100Trp or R100W). Studies show that the mutated NGFβ protein cannot bind to the $p75^{NTR}$ receptor and that it alters the signaling through the NTRK1 receptor. In addition, people with HSAN5 have a reduced number of sensory neurons. However, the mechanism by which mutation of the *NGF* gene leads to the inability to feel pain and temperature sensations is unclear. Although the NGFβ protein is important in many types of neurons, only sensory neurons appear to be affected in people with HSAN5.

3. Other Names for This Gene

- beta-nerve growth factor
- beta-nerve growth factor precursor
- Beta-NGF
- HSAN5
- nerve growth factor (beta polypeptide)
- nerve growth factor, beta subunit
- NGF_HUMAN
- NGFB

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