



## NGF gene

nerve growth factor

### Normal Function

The *NGF* gene provides instructions for making a protein called nerve growth factor beta (NGF $\beta$ ). 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 NGF $\beta$  protein functions by attaching (binding) to its receptors, which initiates signaling pathways inside the cell. The NGF $\beta$  protein can bind to two different receptors, the NTRK1 receptor or the p75<sup>NTR</sup> receptor. Both receptors are found on the surface of sensory neurons and other types of neurons. The binding of the NGF $\beta$  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, NGF $\beta$  signaling through NTRK1 plays a role in pain sensation. It is less clear what binding with the p75<sup>NTR</sup> receptor signals. Studies suggest that p75<sup>NTR</sup> signaling can help sensory neurons grow and differentiate but can also trigger apoptosis.

### Health Conditions Related to Genetic Changes

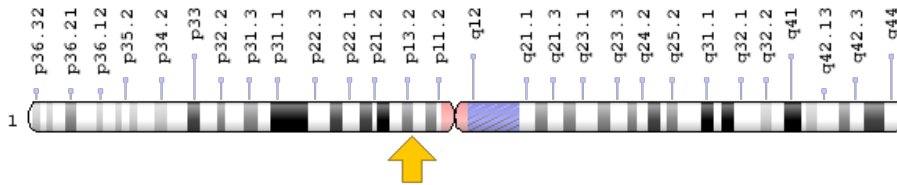
#### hereditary sensory and autonomic neuropathy type V

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 NGF $\beta$  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 NGF $\beta$  protein cannot bind to the p75<sup>NTR</sup> 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 NGF $\beta$  protein is important in many types of neurons, only sensory neurons appear to be affected in people with HSAN5.

## Chromosomal Location

Cytogenetic Location: 1p13.2, which is the short (p) arm of chromosome 1 at position 13.2

Molecular Location: base pairs 115,285,915 to 115,338,253 on chromosome 1 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

## Other Names for This Gene

- beta-nerve growth factor
- beta-nerve growth factor precursor
- Beta-NGF
- HSN5
- nerve growth factor (beta polypeptide)
- nerve growth factor, beta subunit
- NGF\_HUMAN
- NGFB

## Additional Information & Resources

### Educational Resources

- Molecular Cell Biology (Fourth Edition, 2000): Neurotrophins Promote Survival of Neurons  
<https://www.ncbi.nlm.nih.gov/books/NBK21716/#A6893>

### Scientific Articles on PubMed

- PubMed  
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28NGF%5BTI%5D%29+OR+%28nerve+growth+factor%5BTI%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+720+days%22%5Bdp%5D>

## OMIM

- NERVE GROWTH FACTOR  
<http://omim.org/entry/162030>

## Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology  
[http://atlasgeneticsoncology.org/Genes/GC\\_NGF.html](http://atlasgeneticsoncology.org/Genes/GC_NGF.html)
- ClinVar  
<https://www.ncbi.nlm.nih.gov/clinvar?term=NGF%5Bgene%5D>
- HGNC Gene Family: Endogenous ligands  
<http://www.genenames.org/cgi-bin/genefamilies/set/542>
- HGNC Gene Symbol Report  
[http://www.genenames.org/cgi-bin/gene\\_symbol\\_report?q=data/hgnc\\_data.php&hgnc\\_id=7808](http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=7808)
- NCBI Gene  
<https://www.ncbi.nlm.nih.gov/gene/4803>
- UniProt  
<http://www.uniprot.org/uniprot/P01138>

## **Sources for This Summary**

- Capsoni S, Covaceuszach S, Marinelli S, Ceci M, Bernardo A, Minghetti L, Ugolini G, Pavone F, Cattaneo A. Taking pain out of NGF: a "painless" NGF mutant, linked to hereditary sensory autonomic neuropathy type V, with full neurotrophic activity. PLoS One. 2011 Feb 28;6(2):e17321. doi: 10.1371/journal.pone.0017321.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/21387003>  
*Free article on PubMed Central:* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3046150/>
- Einarisdottir E, Carlsson A, Minde J, Toolanen G, Svensson O, Solders G, Holmgren G, Holmberg D, Holmberg M. A mutation in the nerve growth factor beta gene (NGFB) causes loss of pain perception. Hum Mol Genet. 2004 Apr 15;13(8):799-805. Epub 2004 Feb 19.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/14976160>
- Kaplan DR, Miller FD. Neurotrophin signal transduction in the nervous system. Curr Opin Neurobiol. 2000 Jun;10(3):381-91. Review.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/10851172>
- Larsson E, Kuma R, Norberg A, Minde J, Holmberg M. Nerve growth factor R221W responsible for insensitivity to pain is defectively processed and accumulates as proNGF. Neurobiol Dis. 2009 Feb; 33(2):221-8. doi: 10.1016/j.nbd.2008.10.012. Epub 2008 Nov 8.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/19038341>
- Lewin GR, Mendell LM. Nerve growth factor and nociception. Trends Neurosci. 1993 Sep;16(9): 353-9. Review.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/7694405>
- OMIM: NERVE GROWTH FACTOR  
<http://omim.org/entry/162030>

- Ritter AM, Lewin GR, Kremer NE, Mendell LM. Requirement for nerve growth factor in the development of myelinated nociceptors in vivo. *Nature*. 1991 Apr 11;350(6318):500-2.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/2014050>
  - Verpoorten N, De Jonghe P, Timmerman V. Disease mechanisms in hereditary sensory and autonomic neuropathies. *Neurobiol Dis*. 2006 Feb;21(2):247-55. Epub 2005 Sep 23. Review.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/16183296>
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