STXBP1 Gene

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Syntaxin binding protein 1: The STXBP1 gene provides instructions for making syntaxin-binding protein 1.

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1. Normal Function

The *STXBP1* gene provides instructions for making syntaxin-binding protein 1. In nerve cells (neurons), this protein helps regulate the release of chemical messengers called neurotransmitters from compartments known as synaptic vesicles. The release of neurotransmitters relays signals between neurons and is critical for normal brain function.

To release its neurotransmitters, a synaptic vesicle must join (fuse) with the outer membrane of the neuron. The syntaxin-binding protein 1 regulates the formation of a group (complex) of proteins that allows vesicle fusion.

Syntaxin-binding protein 1 may also have a role in the positioning and growth of neurons during brain development. Proper localization of neurons is important for normal brain formation and function.

2. Health Conditions Related to Genetic Changes

2.1. STXBP1 encephalopathy

More than 150 mutations in the *STXBP1* gene have been found to cause *STXBP1* encephalopathy. This condition is characterized by abnormal brain function (encephalopathy) and intellectual disability. Most affected individuals also have recurrent seizures (epilepsy) that begin in infancy. The *STXBP1* gene mutations can alter the structure of syntaxin-binding protein 1, result in an abnormally short protein, or add or delete small sections of the protein.

The gene mutations that cause *STXBP1* encephalopathy reduce the amount of functional syntaxin-binding protein 1 produced from the gene. A shortage of this protein impairs the formation of the protein complex that allows vesicle fusion and the release of neurotransmitters from neurons. A change in neurotransmitter levels can lead to uncontrolled activation (excitation) of neurons, which causes seizures. Researchers suspect that a shortage of syntaxin-binding protein 1 also impairs neuron development in certain regions of the brain, which could underlie abnormal brain function and other neurological problems in people with *STXBP1* encephalopathy.

Lennox-Gastaut syndrome

Other Names for This Gene

- hUNC18
- MUNC18-1
- N-Sec1
- neuronal SEC1
- NSEC1
- RBSEC1
- unc-18A
- UNC18

- unc18-1

References

1. Abramov D, Guiberson NGL, Burré J. STXBP1 encephalopathies: Clinical spectrum,disease mechanisms, and therape utic strategies. J Neurochem. 2020 Jul 8. doi:10.1111/jnc.15120. [Epub ahead of print] Review.
2. Di Meglio C, Lesca G, Villeneuve N, Lacoste C, Abidi A, Cacciagli P, AltuzarraC, Roubertie A, Afenjar A, Renaldo-Robin F, Isidor B, Gautier A, Husson M, CancesC, Metreau J, Laroche C, Chouchane M, Ville D, Marignier S, Rougeot C, Leb run M, de Saint Martin A, Perez A, Riquet A, Badens C, Missirian C, Philip N, Chabrol B,Villard L, Milh M. Epileptic patie nts with de novo STXBP1 mutations: Key clinicalfeatures based on 24 cases. Epilepsia. 2015 Dec;56(12):1931-40. doi: 10.1111/epi.13214.
3. Gburek-Augustat J, Beck-Woedl S, Tzschach A, Bauer P, Schoening M, Riess A.Epilepsy is not a mandatory feature of STXBP1 associatedataxia-tremor-retardation syndrome. Eur J Paediatr Neurol. 2016 Jul;20(4):661-5. doi: 10.1016/j.ejp n.2016.04.005.
4. Hamada N, Iwamoto I, Tabata H, Nagata KI. MUNC18-1 gene abnormalities areinvolved in neurodevelopmental disord ers through defective cortical architecture during brain development. Acta Neuropathol Commun. 2017 Nov 30;5(1):92. doi:10.1186/s40478-017-0498-5.
5. Patzke C, Han Y, Covy J, Yi F, Maxeiner S, Wernig M, Südhof TC. Analysis ofconditional heterozygous STXBP1 mutati ons in human neurons. J Clin Invest. 2015Sep;125(9):3560-71. doi: 10.1172/JCI78612.
6. Rizo J, Rosenmund C. Synaptic vesicle fusion. Nat Struct Mol Biol. 2008Jul;15(7):665-74. Review.
7. Stamberger H, Nikanorova M, Willemsen MH, Accorsi P, Angriman M, Baier H,Benkel-Herrenbrueck I, Benoit V, Budett a M, Caliebe A, Cantalupo G, Capovilla G, Casara G, Courage C, Deprez M, Destrée A, Dilena R, Erasmus CE, Fanne mel M, Fjær R, Giordano L, Helbig KL, Heyne HO, Klepper J, Kluger GJ, Lederer D, Lodi M,Maier O, Merkenschlager A, Michelberger N, Minetti C, Muhle H, Phalin J, RamseyK, Romeo A, Schallner J, Schanze I, Shinawi M, Sleegers K, Sterbova K, Syrbe S,Traverso M, Tzschach A, Uldall P, Van Coster R, Verhelst H, Viri M, Winter S,Wolff M, Zenker M, Z occante L, De Jonghe P, Helbig I, Striano P, Lemke JR, MøllerRS, Weckhuysen S. STXBP1 encephalopathy: A neurod evelopmental disorder including epilepsy. Neurology. 2016 Mar 8;86(10):954-62. doi: 10.1212/WNL.000000000000245 7.
8. Yamamoto T, Shimojima K, Yano T, Ueda Y, Takayama R, Ikeda H, Imai K.Loss-of-function mutations of STXBP1 in pati ents with epileptic encephalopathy.Brain Dev. 2016 Mar;38(3):280-4. doi: 10.1016/j.braindev.2015.09.004.
9. Yamashita S, Chiyonobu T, Yoshida M, Maeda H, Zuiki M, Kidowaki S, Isoda K,Morimoto M, Kato M, Saitsu H, Matsum oto N, Nakahata T, Saito MK, Hosoi H.Mislocalization of syntaxin-1 and impaired neurite growth observed in a humaniP SC model for STXBP1-related epileptic encephalopathy. Epilepsia. 2016Apr;57(4):e81-6. doi: 10.1111/epi.13338.