INS gene

insulin

Normal Function

The *INS* gene provides instructions for producing the hormone insulin, which is necessary for the control of glucose levels in the blood. Glucose is a simple sugar and the primary energy source for most cells in the body.

Insulin is produced in a precursor form called proinsulin, which consists of a single chain of protein building blocks (amino acids). The proinsulin chain is cut (cleaved) to form individual pieces called the A and B chains, which are joined together by connections called disulfide bonds to form insulin.

Health Conditions Related to Genetic Changes

Permanent neonatal diabetes mellitus

At least 10 mutations in the *INS* gene have been identified in people with permanent neonatal diabetes mellitus. Individuals with this condition often have a low birth weight and develop increased blood glucose (hyperglycemia) within the first 6 months of life.

INS gene mutations that cause permanent neonatal diabetes mellitus change single protein building blocks (amino acids) in the protein sequence. These mutations are believed to disrupt the cleavage of the proinsulin chain or the binding of the A and B chains to form insulin, leading to impaired blood glucose control.

Maturity-onset diabetes of the young

MedlinePlus Genetics provides information about Maturity-onset diabetes of the young

Type 1 diabetes

MedlinePlus Genetics provides information about Type 1 diabetes

Other disorders

Mutations in the *INS* gene can also cause other disorders involving insulin production and blood glucose control. Some individuals with *INS* gene mutations have increased levels of proinsulin in their blood (hyperproinsulinemia) and may also have impaired

blood glucose control. *INS* gene mutations are also associated with a disorder called maturity-onset diabetes of the young (MODY). This term refers to hereditary forms of relatively mild diabetes mellitus caused by changes in single genes.

Other Names for This Gene

- IDDM2
- ILPR
- INS_HUMAN
- insulin preproprotein
- IRDN
- MODY10
- proinsulin

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of INS (https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=3630[geneid])

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28%28INS%5BTI%5D%29+OR+%28insulin%5BTI%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+review%5Bpt%5D+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+720+days%22%5Bdp%5D)

Catalog of Genes and Diseases from OMIM

- INSULIN; INS (https://omim.org/entry/176730)
- MATURITY-ONSET DIABETES OF THE YOUNG, TYPE 10; MODY10 (https://omim.org/entry/613370)

Gene and Variant Databases

- NCBI Gene (https://www.ncbi.nlm.nih.gov/gene/3630)
- ClinVar (https://www.ncbi.nlm.nih.gov/clinvar?term=INS[gene])

References

- Boesgaard TW, Pruhova S, Andersson EA, Cinek O, Obermannova B, Lauenborg J,

Damm P, Bergholdt R, Pociot F, Pisinger C, Barbetti F, Lebl J, Pedersen O, HansenT. Further evidence that mutations in INS can be a rare cause of Maturity-OnsetDiabetes of the Young (MODY). BMC Med Genet. 2010 Mar 12;11:42. doi:10.1186/1471-2350-11-42. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/20226046) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2848224/)

- Edghill EL, Flanagan SE, Patch AM, Boustred C, Parrish A, Shields B, ShepherdMH, Hussain K, Kapoor RR, Malecki M, MacDonald MJ, Stoy J, Steiner DF, PhilipsonLH, Bell GI; Neonatal Diabetes International Collaborative Group; Hattersley AT,Ellard S. Insulin mutation screening in 1,044 patients with diabetes: mutationsin the INS gene are a common cause of neonatal diabetes but a rare cause ofdiabetes diagnosed in childhood or adulthood. Diabetes. 2008 Apr;57(4):1034-42.doi: 10.2337/db07-1405. Epub 2007 Dec 27. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/18162506)
- Liu M, Haataja L, Wright J, Wickramasinghe NP, Hua QX, Phillips NF, BarbettiF, Weiss MA, Arvan P. Mutant INS-gene induced diabetes of youth: proinsulincysteine residues impose dominant-negative inhibition on wild-type proinsulintransport. PLoS One. 2010 Oct 11;5(10):e13333. doi: 10.1371/journal.pone.0013333.Erratum In: PLoS One. 2010;5(10) doi:10.1371/annotation/6d5e12f2-defc-48b5-84f6-43253f593a2a. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/20948967) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2952628/)
- Liu M, Hodish I, Haataja L, Lara-Lemus R, Rajpal G, Wright J, Arvan P.Proinsulin misfolding and diabetes: mutant INS gene-induced diabetes of youth.Trends Endocrinol Metab. 2010 Nov;21(11):652-9. doi: 10.1016/j.tem.2010.07.001.Epub 2010 Aug 18. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/20724178) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2967602/)
- Molven A, Ringdal M, Nordbo AM, Raeder H, Stoy J, Lipkind GM, Steiner DF, Philipson LH, Bergmann I, Aarskog D, Undlien DE, Joner G, Sovik O; NorwegianChildhood Diabetes Study Group; Bell GI, Njolstad PR. Mutations in the insulingene can cause MODY and autoantibody-negative type 1 diabetes. Diabetes. 2008Apr;57(4):1131-5. doi: 10.2337/db07-1467. Epub 2008 Jan 11. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/18192540)
- Polak M, Dechaume A, Cave H, Nimri R, Crosnier H, Sulmont V, de Kerdanet M, Scharfmann R, Lebenthal Y, Froguel P, Vaxillaire M; French ND (Neonatal Diabetes) Study Group. Heterozygous missense mutations in the insulin gene are linked topermanent diabetes appearing in the neonatal period or in early infancy: a reportfrom the French ND (Neonatal Diabetes) Study Group. Diabetes. 2008Apr;57(4):1115-9. doi: 10.2337/db07-1358. Epub 2008 Jan 2. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/18171712)
- Rubio-Cabezas O, Klupa T, Malecki MT; CEED3 Consortium. Permanent neonataldiabetes mellitus--the importance of diabetes differential diagnosis in neonatesand infants. Eur J Clin Invest. 2011 Mar;41(3):323-33. doi:10.1111/j.1365-2362.2010.02409.x. Epub 2010 Nov 4. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/21054355)

- Stoy J, Edghill EL, Flanagan SE, Ye H, Paz VP, Pluzhnikov A, Below JE, HayesMG, Cox NJ, Lipkind GM, Lipton RB, Greeley SA, Patch AM, Ellard S, Steiner DF, Hattersley AT, Philipson LH, Bell GI; Neonatal Diabetes InternationalCollaborative Group. Insulin gene mutations as a cause of permanent neonataldiabetes. Proc Natl Acad Sci U S A. 2007 Sep 18;104(38):15040-4. doi:10.1073/pnas.0707291104. Epub 2007 Sep 12. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/17855560) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1986609/)
- Stoy J, Steiner DF, Park SY, Ye H, Philipson LH, Bell GI. Clinical andmolecular genetics of neonatal diabetes due to mutations in the insulin gene. RevEndocr Metab Disord. 2010 Sep;11(3):205-15. doi: 10.1007/s11154-010-9151-3.Erratum In: Rev Endocr Metab Disord. 2012 Mar;13(1):79-81. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/20938745) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2974937/)
- Weiss MA. Proinsulin and the genetics of diabetes mellitus. J Biol Chem. 2009Jul 17;284(29):19159-63. doi: 10.1074/jbc.R109.009936. Epub 2009 Apr 24. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/19395706) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2740536/)

Genomic Location

The *INS* gene is found on chromosome 11 (https://medlineplus.gov/genetics/chromosome/11/).

Last updated March 1, 2013