BCKDHB gene

branched chain keto acid dehydrogenase E1 subunit beta

Normal Function

The *BCKDHB* gene provides instructions for making one part, the beta subunit, of a group of enzymes called the branched-chain alpha-keto acid dehydrogenase (BCKD) enzyme complex. Two beta subunits connect with two alpha subunits, which are produced from the *BCKDHA* gene, to form a critical piece of the enzyme complex called the E1 component.

The BCKD enzyme complex is responsible for one step in the normal breakdown of three protein building blocks (amino acids). These amino acids—leucine, isoleucine, and valine—are obtained from the diet. They are present in many kinds of food, particularly protein-rich foods such as milk, meat, and eggs. The BCKD enzyme complex is active in mitochondria, which are specialized structures inside cells that serve as energy-producing centers. The breakdown of leucine, isoleucine, and valine produces molecules that can be used for energy.

Health Conditions Related to Genetic Changes

Maple syrup urine disease

More than 90 mutations in the *BCKDHB* gene have been identified in people with maple syrup urine disease. These mutations most often cause the severe, classic form of the disorder, which becomes apparent soon after birth. Maple syrup urine disease gets its name from the distinctive sweet odor of affected infants' urine. It is also characterized by poor feeding, vomiting, lack of energy (lethargy), abnormal movements, and delayed development.

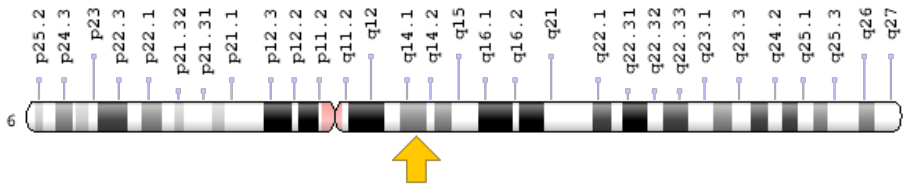
Most *BCKDHB* gene mutations change single amino acids in the beta subunit of the BCKD enzyme complex. Other mutations insert or delete small amounts of DNA in the gene. A particular mutation is most common in people of Ashkenazi (eastern and central European) Jewish descent; this mutation replaces the amino acid arginine with the amino acid proline at position 183 in the beta subunit (written as Arg183Pro or R183P).

Mutations in the *BCKDHB* gene disrupt the normal function of the BCKD enzyme complex, preventing it from effectively breaking down leucine, isoleucine, and valine. As a result, these amino acids and their byproducts build up in the body. This accumulation is toxic to cells and tissues, particularly in the nervous system. The buildup of these substances can lead to seizures, developmental delay, and the other health problems associated with maple syrup urine disease.

Chromosomal Location

Cytogenetic Location: 6q14.1, which is the long (q) arm of chromosome 6 at position 14.1

Molecular Location: base pairs 80,106,610 to 80,469,088 on chromosome 6 (Homo sapiens Annotation Release 109, GRCh38.p12) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- 2-oxoisovalerate dehydrogenase beta subunit
- BCKDH E1-beta
- branched chain keto acid dehydrogenase E1, beta polypeptide
- branched chain keto acid dehydrogenase E1, beta polypeptide (maple syrup urine disease)
- ODBB_HUMAN

Additional Information & Resources

Educational Resources

- Basic Neurochemistry (sixth edition, 1998): Major pathways of branched-chain amino acid metabolism (figure) https://www.ncbi.nlm.nih.gov/books/NBK20436/figure/A3097/
- Basic Neurochemistry (sixth edition, 1998): Maple syrup urine disease was the first congenital defect of branched-chain amino acid catabolism to be described https://www.ncbi.nlm.nih.gov/books/NBK28225/#A3107

Clinical Information from GeneReviews

- Maple Syrup Urine Disease https://www.ncbi.nlm.nih.gov/books/NBK1319

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28BCKDHB%5BTIAB%5D%29+OR+%28branched+chain+keto+acid+dehydrogenase+AND+E1+AND+beta%5BTIAB%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D

Catalog of Genes and Diseases from OMIM

- BRANCHED-CHAIN KETO ACID DEHYDROGENASE E1, BETA POLYPEPTIDE
  http://omim.org/entry/248611

Research Resources

- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=BCKDHB%5Bgene%5D
- HGNC Gene Symbol Report
  https://www.genenames.org/data/gene-symbol-report/#!/hgnc_id/HGNC:987
- Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:594
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/594
- UniProt
  https://www.uniprot.org/uniprot/P21953

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