TCN2 gene
transcobalamin 2

Normal Function

The TCN2 gene provides instructions for making a protein called transcobalamin (formerly known as transcobalamin II). This protein transports cobalamin (also known as vitamin B12) from the bloodstream to cells throughout the body. Cobalamin is obtained from the diet; this vitamin is found in animal products such as meat, eggs, and shellfish.

During digestion, cobalamin is transported through intestinal cells into the bloodstream. Transcobalamin attaches (binds) to cobalamin when it is released into the bloodstream and transports the vitamin to cells. The transcobalamin-cobalamin complex binds to a receptor on the cell surface, which allows the complex to enter the cell. Transcobalamin releases cobalamin when the complex enters the cell and transcobalamin is broken down.

Within cells, cobalamin helps certain enzymes carry out chemical reactions. Cobalamin plays a role in the processes that produce the building blocks of DNA (nucleotides) and break down various compounds such as fatty acids; these processes are needed for cell growth and division (proliferation) and cellular energy production. Cobalamin's role in these processes is particularly important in the formation of new blood cells and in the nervous system.

Health Conditions Related to Genetic Changes

Transcobalamin deficiency

More than 20 mutations in the TCN2 gene have been found to cause transcobalamin deficiency. This condition impairs the transport of cobalamin from the bloodstream to cells throughout the body. Affected individuals have difficulty gaining weight and growing at the expected rate (failure to thrive), vomiting, diarrhea, a shortage of all types of blood cells, and neurological problems. Many TCN2 gene mutations lead to a complete or near-complete lack (deficiency) of transcobalamin. Other TCN2 gene mutations result in a transcobalamin protein that cannot bind to cobalamin or a protein that cannot bind to the receptor at the surface of cells. The resulting lack of cobalamin within cells interferes with the functioning of certain enzymes, which impacts many cell activities. As a result, a wide range of signs and symptoms characteristic of transcobalamin deficiency can develop.
Chromosomal Location

Cytogenetic Location: 22q12.2, which is the long (q) arm of chromosome 22 at position 12.2

Molecular Location: base pairs 30,607,083 to 30,627,060 on chromosome 22 (Homo sapiens Annotation Release 109, GRCh38.p12) (NCBI)

Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- D22S676
- D22S750
- TC
- TC-2
- TC II
- TC2
- TCII
- transcobalamin-2
- transcobalamin II

Additional Information & Resources

Educational Resources
- Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline: Vitamin B12
  https://www.ncbi.nlm.nih.gov/books/NBK114302/

Scientific Articles on PubMed
- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28TCN2%5BTI%5D%29%2B%20OR%20%28transcobalamin-II%5BTI%5D%29%29%20AND%28%28Genes%5BMH%5D%29%29%20AND%20english%20AND%20human%20AND%20%22last%203600%20days%22
Catalog of Genes and Diseases from OMIM

• TRANSCOBALAMIN II
  http://omim.org/entry/613441

Research Resources

• Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_TCN2.html

• ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=TCN2%5Bgene%5D

• HGNC Gene Symbol Report

• Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:6948

• NCBI Gene

• UniProt
  https://www.uniprot.org/uniprot/P20062

Sources for This Summary

• Nielsen MJ, Rasmussen MR, Andersen CB, Nexø E, Moestrup SK. Vitamin B12 transport from food
to the body's cells--a sophisticated, multistep pathway. Nat Rev Gastroenterol Hepatol. 2012 May 1;
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/22547309

• Nissen PH, Nordwall M, Hoffmann-Lücke E, Sorensen BS, Nexø E. Transcobalamin deficiency
caused by compound heterozygosity for two novel mutations in the TCN2 gene: a study of two
affected siblings, their brother, and their parents. J Inherit Metab Dis. 2010 Dec;33 Suppl 3:
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/20607612

• Qian L, Quadros EV, Regec A, Zittoun J, Rothenberg SP. Congenital transcobalamin II deficiency
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/12064907

  Review.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/10714245

• OMIM: TRANSCOBALAMIN II
  http://omim.org/entry/613441

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