CAPN3 gene

Normal Function

The \textit{CAPN3} gene provides instructions for making an enzyme called calpain-3, which is found within muscle cells in structures called sarcomeres. Sarcomeres are the basic unit of muscle contraction. They are made of proteins that generate the mechanical force needed for muscles to contract.

The function of the calpain-3 enzyme is not well understood. Researchers suggest it may help cut (cleave) damaged proteins into shorter segments to facilitate their removal from the sarcomere. Studies have also shown that calpain-3 attaches (binds) to proteins involved in controlling the ability of muscle fibers to stretch (elasticity) and in cell signaling. However, its specific roles in these processes are unknown.

Health Conditions Related to Genetic Changes

Limb-girdle muscular dystrophy

More than 300 mutations in the \textit{CAPN3} gene have been identified in people with limb-girdle muscular dystrophy type 2A. This form of limb-girdle muscular dystrophy is also called calpainopathy.

Limb-girdle muscular dystrophy is a group of related disorders characterized by muscle weakness and wasting, particularly in the shoulders, hips, and limbs. \textit{CAPN3} gene mutations are the most common cause of limb-girdle muscular dystrophy. These mutations account for approximately 30 percent of limb-girdle muscular dystrophy cases overall, although the percentage varies by specific population.

Most \textit{CAPN3} gene mutations change one protein building block (amino acid) in the calpain-3 enzyme. These mutations result in a calpain-3 enzyme that is abnormally short or unstable. Disruption of the enzyme’s ability to properly cleave proteins for removal from the sarcomere may allow these waste proteins to accumulate in muscle tissue and become toxic. Other mechanisms have also been suggested to account for the muscle damage that underlies limb-girdle muscular dystrophy in people with \textit{CAPN3} gene mutations.
Chromosomal Location

Cytogenetic Location: 15q15.1, which is the long (q) arm of chromosome 15 at position 15.1

Molecular Location: base pairs 42,359,500 to 42,412,317 on chromosome 15 (Homo sapiens Annotation Release 109, GRCh38.p12) (NCBI)

Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- calcium-activated neutral proteinase 3
- calpain-3
- calpain-3 isoform c
- calpain 3, (p94)
- calpain L3
- calpain p94, large [catalytic] subunit
- calpain, large polypeptide L3
- CAN3_HUMAN
- CANP3
- CANPL3
- LGMD2A
- muscle-specific calcium-activated neutral protease 3 large subunit
- nCL-1
- new calpain 1
- p94

Additional Information & Resources

Educational Resources

- University of Washington Neuromuscular Disease Center
  https://neuromuscular.wustl.edu/musdist/lg.html#2a
Clinical Information from GeneReviews

- Calpainopathy
  https://www.ncbi.nlm.nih.gov/books/NBK1313

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28CAPN3%5BTIAB%5D%29+OR+%28calpain+3%5BTIAB%5D%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22+AND+5Bdp%5D

Catalog of Genes and Diseases from OMIM

- CALPAIN 3
  http://omim.org/entry/114240

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_CAPN3.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=CAPN3%5Bgene%5D
- HGNC Gene Symbol Report
- Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:825
- NCBI Gene
- UniProt
  https://www.uniprot.org/uniprot/P20807

Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/18974005
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2614824/
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/21150381
- OMIM: CALPAIN 3
  http://omim.org/entry/114240
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16884488

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16002060

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/18769252

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16934440

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/15043707

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17027860

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