HARS2 gene

histidyl-tRNA synthetase 2, mitochondrial

Normal Function

The *HARS2* gene provides instructions for making an enzyme called mitochondrial histidyl-tRNA synthetase. This enzyme is important in the production (synthesis) of proteins in cellular structures called mitochondria, the energy-producing centers in cells. While most protein synthesis occurs in the fluid surrounding the nucleus (cytoplasm), some proteins are synthesized in the mitochondria.

During protein synthesis, in either the mitochondria or the cytoplasm, a type of RNA called transfer RNA (tRNA) helps assemble protein building blocks (amino acids) into a chain that forms the protein. Each tRNA carries a specific amino acid to the growing chain. Enzymes called aminoacyl-tRNA synthetases, including mitochondrial histidyl-tRNA synthetase, attach a particular amino acid to a specific tRNA. Mitochondrial histidyl-tRNA synthetase attaches the amino acid histidine to the correct tRNA, which helps ensure that histidine is added at the proper place in the mitochondrial protein.

Health Conditions Related to Genetic Changes

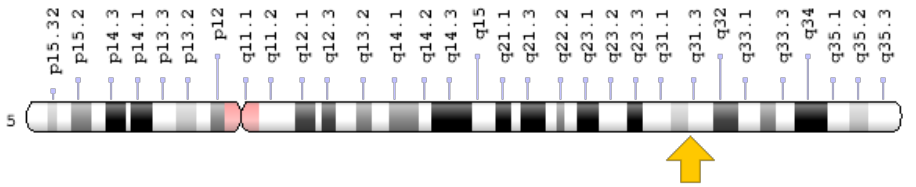
Perrault syndrome

At least two mutations in the *HARS2* gene have been found to cause Perrault syndrome. This rare condition is characterized by hearing loss in males and females with the disorder and abnormalities of the ovaries in affected females. The *HARS2* gene mutations involved in Perrault syndrome reduce the activity of mitochondrial histidyl-tRNA synthetase. A shortage of functional mitochondrial histidyl-tRNA synthetase prevents the normal assembly of new proteins within mitochondria. Researchers speculate that impaired protein assembly disrupts mitochondrial energy production. However, it is unclear exactly how *HARS2* gene mutations lead to hearing problems and ovarian abnormalities in affected individuals.

Chromosomal Location

Cytogenetic Location: 5q31.3, which is the long (q) arm of chromosome 5 at position 31.3

Molecular Location: base pairs 140,691,444 to 140,699,308 on chromosome 5 (Homo sapiens Updated Annotation Release 109.20190607, GRCh38.p13) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- HARS-related
- HARSL
- HARSR
- hisRS
- histidine translase
- histidine tRNA ligase 2, mitochondrial (putative)
- histidine-tRNA ligase homolog
- histidyl-tRNA synthetase 2
- histidyl-tRNA synthetase 2, mitochondrial (putative)
- HO3
- PRLTS2
- probable histidine--tRNA ligase, mitochondrial
- probable histidine--tRNA ligase, mitochondrial isoform 2
- probable histidine--tRNA ligase, mitochondrial isoform 3
- probable histidyl-tRNA synthetase, mitochondrial

Additional Information & Resources

Educational Resources

- Genomes (second edition, 2002): The Role of tRNA in Protein Synthesis
  https://www.ncbi.nlm.nih.gov/books/NBK21111/#_A7603_
- Madam Curie Biosciences Database (2000): Mitochondrial Aminoacyl tRNA Synthetases
  https://www.ncbi.nlm.nih.gov/books/NBK6033/

Clinical Information from GeneReviews

- Perrault Syndrome
  https://www.ncbi.nlm.nih.gov/books/NBK242617

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28HARS2%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%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

- HISTIDYL-tRNA SYNTHETASE 2
  http://omim.org/entry/600783

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_HARS2.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=HARS2%5Bgene%5D
- HGNC Gene Symbol Report
  https://www.genenames.org/data/gene-symbol-report/#!/hgnc_id/HGNC:4817
- Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:23438
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/23438
- UniProt
  https://www.uniprot.org/uniprot/P49590

Sources for This Summary

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