TARDBP gene
TAR DNA binding protein

Normal Function
The TARDBP gene provides instructions for making a protein called transactive response DNA binding protein 43 kDa (TDP-43). This protein is found within the cell nucleus in most tissues and is involved in many of the steps of protein production. The TDP-43 protein attaches (binds) to DNA and regulates an activity called transcription, which is the first step in the production of proteins from genes. This protein can also bind to RNA, a chemical cousin of DNA, to ensure the RNA’s stability. The TDP-43 protein is involved in processing molecules called messenger RNA (mRNA), which serve as the genetic blueprints for making proteins. By cutting and rearranging mRNA molecules in different ways, the TDP-43 protein controls the production of different versions of certain proteins. This process is known as alternative splicing. The TDP-43 protein can influence various functions of a cell by regulating protein production.

The TARDBP gene is particularly active (expressed) during early development before birth when new tissues are forming. Many of the proteins whose production is influenced by the TDP-43 protein are involved in nervous system and organ development.

Health Conditions Related to Genetic Changes
Amyotrophic lateral sclerosis
At least 60 mutations in the TARDBP gene have been found to cause amyotrophic lateral sclerosis (ALS), a condition characterized by progressive muscle weakness, a loss of muscle mass, and an inability to control movement. Most mutations change single protein building blocks (amino acids) in the TDP-43 protein. The majority of these changes affect the region of the protein involved in mRNA processing, likely disrupting the production of other proteins. Changes to the TDP-43 protein cause the protein to misfold and form protein clumps (aggregates), which have been found in nerve cells that control muscle movement (motor neurons) in some people with ALS. It is unclear whether TDP-43 protein aggregates causes the nerve cell death that leads to ALS or if they are a byproduct of a dying cell.

Some people with ALS caused by TARDBP gene mutations also develop a condition called frontotemporal dementia (FTD), which is a progressive brain disorder that affects personality, behavior, and language. It is unclear why some people with TARDBP gene mutations develop FTD and others do not. Individuals who develop both conditions are diagnosed as having ALS-FTD.
Other disorders

Mutations in the TARDBP gene have been found to cause frontotemporal dementia (FTD) without features of amyotrophic lateral sclerosis (ALS, described above). FTD caused by TARDBP gene mutations is characterized by a gradual loss of problem-solving skills and language comprehension. Affected individuals often have changes in personality and behavior that may make it difficult to interact with others in a socially appropriate manner. Most TARDBP gene mutations that cause FTD change single amino acids in the TDP-43 protein. These mutations are thought to affect only part of the protein, leaving other parts of the protein functional. Because these TARDBP gene mutations result in a protein with some residual function, the features of the condition tend to appear later in life, in one’s late sixties or early seventies. Some people who inherit the altered TARDBP gene never develop FTD, a situation known as reduced penetrance.

Chromosomal Location

Cytogenetic Location: 1p36.22, which is the short (p) arm of chromosome 1 at position 36.22

Molecular Location: base pairs 11,012,622 to 11,030,528 on chromosome 1 (Homo sapiens Annotation Release 109, GRCh38.p12) (NCBI)

Other Names for This Gene

- ALS10
- TADBP_HUMAN
- TAR DNA-binding protein 43
- TAR DNA-binding protein-43
- TDP-43
Additional Information & Resources

Educational Resources

• Molecular Biology of the Cell (fourth edition, 2002): Alternative RNA Splicing Can Produce Different Forms of a Protein from the Same Gene
  https://www.ncbi.nlm.nih.gov/books/NBK26890/#A1366

• Washington University, St. Louis Neuromuscular Disease Center
  https://neuromuscular.wustl.edu/synmot.html#tdp43als

Clinical Information from GeneReviews

• Amyotrophic Lateral Sclerosis Overview
  https://www.ncbi.nlm.nih.gov/books/NBK1450

• TARDBP-Related Amyotrophic Lateral Sclerosis
  https://www.ncbi.nlm.nih.gov/books/NBK5942

Scientific Articles on PubMed

• PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28TARDBP%5BTI%5D%29+OR+%28TDP-43%5BTI%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+720+days%22+AND+NCBI+Gene

Catalog of Genes and Diseases from OMIM

• TAR DNA-BINDING PROTEIN
  http://omim.org/entry/605078

Research Resources

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

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

• HGNC Gene Symbol Report

• Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:23435

• NCBI Gene

• UniProt
  https://www.uniprot.org/uniprot/Q13148
Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/20645878

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/21222602

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17981595

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/24750229

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/25526708

- OMIM: TAR DNA-BINDING PROTEIN 
  http://omim.org/entry/605078

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/20601083

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