PROS1 gene

protein S

Normal Function

The *PROS1* gene provides instructions for making a protein called protein S that is important for controlling blood clotting. By itself, protein S cannot carry out the chemical reactions necessary for regulating the formation of blood clots. Instead, protein S attaches to certain enzymes and enhances their function. On the basis of this action, protein S is called a cofactor.

Protein S is made chiefly by cells in the liver. The protein circulates in the bloodstream in two forms; it is either attached (bound) to a specific protein or occurs by itself in a free form. Both forms of proteins S can act as cofactors; however, bound protein S is less effective than the free form. Protein S is a cofactor for an enzyme called activated protein C (APC). APC turns off (inactivates) the blood clotting proteins known as factor Va and factor VIIIa. Protein S also helps an enzyme known as tissue factor pathway inhibitor (TFPI) block the activity of another clotting protein, factor Xa.

Health Conditions Related to Genetic Changes

Protein S deficiency

More than 220 mutations in the *PROS1* gene have been found to cause protein S deficiency. Most of these mutations change single protein building blocks (amino acids) in protein S, which disrupts its ability to act as a cofactor. Protein S deficiency can be divided into three types based on the mutation in the *PROS1* gene.

Protein S deficiency type I is caused by *PROS1* gene mutations that result in reduced levels of protein S. Affected individuals do not have enough protein S to control blood clotting, which causes the increased risk for abnormal blood clots in protein S deficiency.

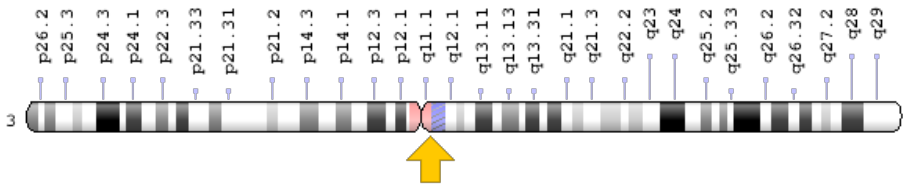
Mutations that cause protein S deficiency type II result in the production of an altered protein S with reduced activity. Individuals with this form of the condition have normal levels of protein S, but the protein is not able to interact with other molecules involved in blood clotting. If protein S does not function properly, abnormal blood clots may form.

Protein S deficiency type III occurs when there is a low amount of free protein S, but the overall amount of protein S is normal. Because free protein S is a more effective cofactor than bound protein S, reduced levels of free protein S can disrupt the inactivation of blood clotting proteins.

Chromosomal Location

Cytogenetic Location: 3q11.1, which is the long (q) arm of chromosome 3 at position 11.1

Molecular Location: base pairs 93,873,037 to 93,974,090 on chromosome 3 (Homo sapiens Annotation Release 109, GRCh38.p12) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- PROS
- PROS_HUMAN
- protein S (alpha)
- protein S, alpha
- protein S, alpha preproprotein
- protein Sa
- PS21
- PS22
- PS23
- PS24
- PS25
- PSA
- vitamin K-dependent plasma protein S

Additional Information & Resources

Educational Resources

- Madam Curie Bioscience Database: Protein S Deficiencies https://www.ncbi.nlm.nih.gov/books/NBK6069/#A2909

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28PROS1%5BTI%5D%29+OR+%28protein+S%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%5Bdp%5D

Catalog of Genes and Diseases from OMIM

- PROTEIN S
  http://omim.org/entry/176880

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_PROS1.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=PROS1%5Bgene%5D
- HGNC Gene Symbol Report
  https://www.genenames.org/data/gene-symbol-report/#!/hgnc_id/HGNC:9456
- Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:5627
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/5627
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