PRDX1 gene

peroxiredoxin 1

Normal Function

The *PRDX1* gene provides instructions for making the peroxiredoxin-1 (PRDX1) protein. This protein is part of a family of peroxiredoxin proteins that are primarily involved in chemical reactions that protect cells from damage caused by unstable oxygen-containing molecules known as reactive oxygen species (ROS).

The PRDX1 protein breaks down hydrogen peroxide. Hydrogen peroxide is produced through chemical reactions within cells. At low levels, it is involved in several chemical signaling pathways that control cell functions like growth, maturation, and survival. By regulating the amount of hydrogen peroxide in cells, the PRDX1 protein appears to help control these chemical signaling pathways, playing a role in important cellular functions.

At high levels hydrogen peroxide, an ROS, is toxic to cells. If hydrogen peroxide is not broken down, it can damage DNA, proteins, and cell membranes. The PRDX1 protein helps protect cells from this damage.

The *PRDX1* gene is close to another gene on chromosome 1 called *MMACHC*. These two genes have unrelated roles in cells. The protein produced from the *MMACHC* gene is involved in processing vitamin B12 (also known as cobalamin).

Health Conditions Related to Genetic Changes

Methylmalonic acidemia with homocystinuria

Variants (also known as mutations) in the *PRDX1* gene are involved in methylmalonic acidemia with homocystinuria, epi-cblC type (shortened to epi-cblC), which is one form of a disorder that causes developmental delay, eye defects, neurological problems, and blood abnormalities.

Variants in the *PRDX1* gene cause epi-cblC by leading to a genetic change called promoter hypermethylation. (This genetic change is also called an epimutation). The promoter is a region of DNA near a gene that controls gene activity (expression). Hypermethylation occurs when too many small molecules called methyl groups are attached to the promoter region. *PRDX1* gene variants involved in epi-cblC alter the DNA in such a way that the promoter of the nearby *MMACHC* gene becomes hypermethylated. The extra methyl groups reduce the expression of the *MMACHC* gene,

which means that less MMACHC protein is produced.

People with epi-cblC with a *PRDX1* gene variant on one copy of the chromosome usually have an *MMACHC* gene variant on the other copy. (Very rarely, an affected individual has a *PRDX1* gene variant on both copies of the chromosome and no *MMACHC* gene variant.) As a result, cells make little to no functional MMACHC protein. A reduction in this protein's function prevents normal processing of vitamin B12. This vitamin is usually converted to two important molecules. A shortage of both molecules leads to the signs and symptoms of methylmalonic acidemia with homocystinuria.

Research suggests that *PRDX1* gene variants may also lead to hypermethylation of other gene promoters. It is unclear if reduced expression of other genes plays a role in the development of epi-cblC. In addition, the effect of *PRDX1* gene variants on the production or function of the peroxiredoxin-1 protein is unclear. More studies are needed to understand if hypermethylation of additional promoters or changes to peroxiredoxin-1 contribute to methylmalonic acidemia with homocystinuria or cause additional signs or symptoms in affected individuals.

Other Names for This Gene

- MSP23
- natural killer-enhancing factor A
- NKEF-A
- NKEFA
- PAG
- PAGA
- PAGB
- proliferation-associated gene A
- PRX1
- PRXI
- TDPX2

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of PRDX1 (https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=5052[geneid])

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=PRDX1%255Btiab%255D&filter=datesearch.y_5&sort=date)

Catalog of Genes and Diseases from OMIM

- PEROXIREDOXIN 1; PRDX1 (https://omim.org/entry/176763)

Gene and Variant Databases

- NCBI Gene (https://www.ncbi.nlm.nih.gov/gene/5052)
- ClinVar (https://www.ncbi.nlm.nih.gov/clinvar?term=PRDX1[gene])

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