

## PNP gene

purine nucleoside phosphorylase

### Normal Function

The *PNP* gene provides instructions for making an enzyme called purine nucleoside phosphorylase. This enzyme is found throughout the body but is most active in certain white blood cells called lymphocytes. These cells protect the body against potentially harmful invaders, such as bacteria or viruses. Lymphocytes are produced in specialized lymphoid tissues including the thymus and lymph nodes, and then released into the blood. The thymus is a gland located behind the breastbone; lymph nodes are found throughout the body. Lymphocytes in the blood and in lymphoid tissues are a major component of the immune system.

Purine nucleoside phosphorylase is known as a housekeeping enzyme because it clears away waste molecules called deoxyinosine and deoxyguanosine, which are generated when DNA is broken down. Specifically, purine nucleoside phosphorylase converts deoxyinosine to another molecule called hypoxanthine, and converts deoxyguanosine to another molecule called guanine.

### Health Conditions Related to Genetic Changes

#### Purine nucleoside phosphorylase deficiency

More than 35 *PNP* gene mutations have been identified in individuals with purine nucleoside phosphorylase deficiency, which is an immune system disorder in which the body is unable to fight foreign invaders such as bacteria and viruses. Affected individuals have repeated infections that can be life-threatening. Some people with purine nucleoside phosphorylase deficiency also have neurological problems, such as intellectual disability or difficulty coordinating movements (ataxia).

Most of the *PNP* gene mutations change single protein building blocks (amino acids) in the purine nucleoside phosphorylase enzyme. The mutations reduce or eliminate the activity of purine nucleoside phosphorylase. The resulting excess of waste molecules and further reactions involving them lead to the buildup of a substance called deoxyguanosine triphosphate (dGTP) to levels that are toxic to lymphocytes.

A type of lymphocytes known as T cells are particularly vulnerable to a toxic buildup of dGTP, particularly immature T cells in the thymus. The dGTP damages these cells and

triggers their self-destruction (apoptosis). Lymphocytes in other lymphoid tissues can also be damaged. The shortage of lymphocytes results in the immune problems that cause vulnerability to severe infections. Damage to brain cells caused by buildup of dGTP is thought to underlie the neurological problems that occur in some people with purine nucleoside phosphorylase deficiency.

## Other Names for This Gene

- inosine phosphorylase
- NP
- PNPH\_HUMAN
- PRO1837
- PUNP
- purine-nucleoside:orthophosphate ribosyltransferase

## Additional Information & Resources

### Tests Listed in the Genetic Testing Registry

- Tests of PNP ([https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=4860\[geneid\]](https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=4860[geneid]))

### Scientific Articles on PubMed

- PubMed (<https://pubmed.ncbi.nlm.nih.gov/?term=%28purine+nucleoside+phosphorylase%5BTIAB%5D%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1440+days%22%5Bdp%5D%29>)

### Catalog of Genes and Diseases from OMIM

- PURINE NUCLEOSIDE PHOSPHORYLASE; PNP (<https://omim.org/entry/164050>)

### Gene and Variant Databases

- NCBI Gene (<https://www.ncbi.nlm.nih.gov/gene/4860>)
- ClinVar ([https://www.ncbi.nlm.nih.gov/clinvar?term=PNP\[gene\]](https://www.ncbi.nlm.nih.gov/clinvar?term=PNP[gene]))

## References

- Al-Saud B, Alsmadi O, Al-Muhsen S, Al-Ghonaïm A, Al-Dhekri H, Arnaout R, Hershfield MS, Al-Mousa H. A novel mutation in purine nucleoside phosphorylase in a child with normal uric acid levels. Clin Biochem. 2009 Nov;42(16-17):1725-7.doi:

10.1016/j.clinbiochem.2009.08.017. Epub 2009 Sep 3. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/19733163>)

- Aytekin C, Dogu F, Tanir G, Guloglu D, Santisteban I, Hershfield MS, Ikinçioğullari A. Purine nucleoside phosphorylase deficiency with fatal course in two sisters. *Eur J Pediatr*. 2010 Mar;169(3):311-4. doi:10.1007/s00431-009-1029-6. Epub 2009 Aug 6. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/19657670>)
- Fekrvand S, Yazdani R, Abolhassani H, Ghaffari J, Aghamohammadi A. The First Purine Nucleoside Phosphorylase Deficiency Patient Resembling IgA Deficiency and a Review of the Literature. *Immunol Invest*. 2019 May;48(4):410-430. doi:10.1080/08820139.2019.1570249. Epub 2019 Mar 19. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/30885031>)
- Grunebaum E, Zhang J, Roifman CM. Novel mutations and hot-spots in patients with purine nucleoside phosphorylase deficiency. *Nucleosides Nucleotides Nucleic Acids*. 2004 Oct;23(8-9):1411-5. doi: 10.1081/NCN-200027647. Erratum In: *Nucleosides Nucleotides Nucleic Acids*. 2005;24(4):303. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/15571269>)
- Nyhan WL. Disorders of purine and pyrimidine metabolism. *Mol Genet Metab*. 2005 Sep-Oct;86(1-2):25-33. doi: 10.1016/j.ymgme.2005.07.027. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/16176880>)
- Ozkinay F, Pehlivan S, Onay H, van den Berg P, Vardar F, Koturoglu G, Aksu G, Unal D, Tekgul H, Can S, Ozkinay C. Purine nucleoside phosphorylase deficiency in a patient with spastic paraplegia and recurrent infections. *J Child Neurol*. 2007 Jun;22(6):741-3. doi: 10.1177/0883073807302617. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/17641261>)
- Somech R, Lev A, Grisaru-Soen G, Shiran SI, Simon AJ, Grunebaum E. Purine nucleoside phosphorylase deficiency presenting as severe combined immunodeficiency. *Immunol Res*. 2013 May;56(1):150-4. doi: 10.1007/s12026-012-8380-9. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/23371835>)
- Walker PL, Corrigan A, Arenas M, Escuredo E, Fairbanks L, Marinaki A. Purine nucleoside phosphorylase deficiency: a mutation update. *Nucleosides Nucleotides Nucleic Acids*. 2011 Dec;30(12):1243-7. doi: 10.1080/15257770.2011.630852. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/22132981>)

## Genomic Location

The *PNP* gene is found on chromosome 14 (<https://medlineplus.gov/genetics/chromosome/14/>).

**Last updated April 1, 2019**