



CYBA gene

cytochrome b-245 alpha chain

Normal Function

The *CYBA* gene provides instructions for making a protein called the cytochrome b-245 alpha chain (also known as p22-phox). This protein is one part (subunit) of a group of proteins that forms an enzyme complex called NADPH oxidase, which plays an essential role in the immune system. Within this complex, the cytochrome b-245 alpha chain has a beta chain partner (produced from the *CYBB* gene). Both alpha and beta chains are required for either to function, and the NADPH oxidase complex requires both chains in order to be functional. NADPH oxidase is primarily active in immune system cells called phagocytes. These cells catch and destroy foreign invaders such as bacteria and fungi. NADPH oxidase is also thought to regulate the activity of immune cells called neutrophils. These cells play a role in adjusting the inflammatory response to optimize healing and reduce injury to the body.

The presence of foreign invaders stimulates phagocytes and triggers the assembly of NADPH oxidase. This enzyme participates in a chemical reaction that converts oxygen to a toxic molecule called superoxide. Superoxide is used to generate several other compounds, including hydrogen peroxide (a strong disinfectant) and hypochlorous acid (the active ingredient in bleach). These highly reactive, toxic substances are known as reactive oxygen species. Phagocytes use these substances to kill foreign invaders, preventing them from reproducing in the body and causing illness.

Health Conditions Related to Genetic Changes

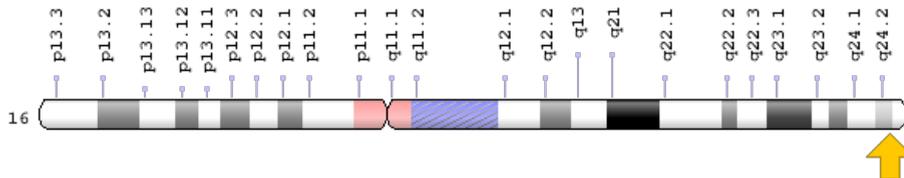
Chronic granulomatous disease

More than 40 mutations in the *CYBA* gene have been found to cause chronic granulomatous disease. People with this disorder are at increased risk of developing recurrent episodes of infection and inflammation due to a weakened immune system. Mutations in the *CYBA* gene cause less than 5 percent of all cases of this condition. Most of these mutations change single building blocks of protein (amino acids) in the cytochrome b-245 alpha chain or cause it to be abnormally short and nonfunctional. An altered protein not only diminishes the function of the alpha chain, but the function of its beta chain partner as well. Without these subunits, NADPH oxidase cannot assemble or function properly. As a result, phagocytes are unable to produce reactive oxygen species to kill foreign invaders, and neutrophil activity is not regulated. A lack of NADPH oxidase leaves affected individuals vulnerable to many types of infection and excessive inflammation.

Chromosomal Location

Cytogenetic Location: 16q24.2, which is the long (q) arm of chromosome 16 at position 24.2

Molecular Location: base pairs 88,643,289 to 88,651,079 on chromosome 16 (Homo sapiens Updated Annotation Release 109.20200522, GRCh38.p13) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- CY24A_HUMAN
- cytochrome b-245 light chain
- cytochrome b-245, alpha polypeptide
- cytochrome b light chain
- cytochrome b(558) alpha chain
- cytochrome b, alpha polypeptide
- cytochrome b558 subunit alpha
- flavocytochrome b-558 alpha polypeptide
- neutrophil cytochrome b 22 kDa polypeptide
- p22phox
- superoxide-generating NADPH oxidase light chain subunit

Additional Information & Resources

Educational Resources

- Immunobiology: The Immune System in Health and Disease (2001, fifth edition): After entering tissues, many pathogens are recognized, ingested, and killed by phagocytes
<https://www.ncbi.nlm.nih.gov/books/NBK27105/#A156>
- Immunobiology: The Immune System in Health and Disease (2001, fifth edition): Defects in phagocytic cells permit widespread bacterial infections
<https://www.ncbi.nlm.nih.gov/books/NBK27109/#A1507>

Clinical Information from GeneReviews

- Chronic Granulomatous Disease
<https://www.ncbi.nlm.nih.gov/books/NBK99496>

Scientific Articles on PubMed

- PubMed
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28CYBA%5BTIAB%5D%29+OR+%28p22phox%5BTIAB%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+1800+days%22%5Bdp%5D>

Catalog of Genes and Diseases from OMIM

- CYTOCHROME b(-245), ALPHA SUBUNIT
<http://omim.org/entry/608508>

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
http://atlasgeneticsoncology.org/Genes/GC_CYBA.html
- ClinVar
<https://www.ncbi.nlm.nih.gov/clinvar?term=CYBA%5Bgene%5D>
- HGNC Gene Symbol Report
https://www.genenames.org/data/gene-symbol-report/#!/hgnc_id/HGNC:2577
- Monarch Initiative
<https://monarchinitiative.org/gene/NCBIGene:1535>
- NCBI Gene
<https://www.ncbi.nlm.nih.gov/gene/1535>
- UniProt
<https://www.uniprot.org/uniprot/P13498>

Sources for This Summary

- OMIM: CYTOCHROME b(-245), ALPHA SUBUNIT
<http://omim.org/entry/608508>
- Kannengiesser C, Gérard B, El Benna J, Henri D, Krowiarski Y, Chollet-Martin S, Gougerot-Pocidal MA, Elbim C, Grandchamp B. Molecular epidemiology of chronic granulomatous disease in a series of 80 kindreds: identification of 31 novel mutations. *Hum Mutat.* 2008 Sep;29(9):E132-49. doi: 10.1002/humu.20820.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/18546332>

- Roos D, Kuhns DB, Maddalena A, Bustamante J, Kannengiesser C, de Boer M, van Leeuwen K, Köker MY, Wolach B, Roesler J, Malech HL, Holland SM, Gallin JI, Stasia MJ. Hematologically important mutations: the autosomal recessive forms of chronic granulomatous disease (second update). *Blood Cells Mol Dis*. 2010 Apr 15;44(4):291-9. doi: 10.1016/j.bcmd.2010.01.009. Epub 2010 Feb 18. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/20167518>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4568122/>
 - Stasia MJ, Li XJ. Genetics and immunopathology of chronic granulomatous disease. *Semin Immunopathol*. 2008 Jul;30(3):209-35. doi: 10.1007/s00281-008-0121-8. Epub 2008 May 29. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/18509647>
 - Sumimoto H. Structure, regulation and evolution of Nox-family NADPH oxidases that produce reactive oxygen species. *FEBS J*. 2008 Jul;275(13):3249-77. doi: 10.1111/j.1742-4658.2008.06488.x. Epub 2008 May 30. Review. Erratum in: *FEBS J*. 2008 Aug;275(15):3984.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/18513324>
-

Reprinted from Genetics Home Reference:
<https://ghr.nlm.nih.gov/gene/CYBA>

Reviewed: August 2012
Published: August 17, 2020

Lister Hill National Center for Biomedical Communications
U.S. National Library of Medicine
National Institutes of Health
Department of Health & Human Services