EXT1 gene
exostosin glycosyltransferase 1

Normal Function
The \textit{EXT1} gene provides instructions for producing a protein called exostosin-1. This protein is found in a cell structure called the Golgi apparatus, which modifies newly produced enzymes and other proteins. In the Golgi apparatus, exostosin-1 attaches (binds) to another protein, exostosin-2, to form a complex that modifies heparan sulfate. Heparan sulfate is a complex of sugar molecules (a polysaccharide) that is added to proteins to form proteoglycans, which are proteins attached to several sugars. Heparan sulfate is involved in regulating a variety of body processes including blood clotting and the formation of blood vessels (angiogenesis). It also has a role in the spreading (metastasis) of cancer cells.

Health Conditions Related to Genetic Changes

\textbf{Hereditary multiple osteochondromas}

About 480 mutations in the \textit{EXT1} gene have been identified in people with hereditary multiple osteochondromas type 1, a condition in which people develop multiple benign (noncancerous) bone tumors called osteochondromas. Most of these mutations are known as "loss-of-function" mutations because they prevent any functional exostosin-1 protein from being made. The loss of functional exostosin-1 protein prevents it from forming a complex with the exostosin-2 protein and adding heparan sulfate to proteins. It is unclear how this impairment leads to the signs and symptoms of hereditary multiple osteochondromas.

\textbf{Trichorhinophalangeal syndrome type II}

The \textit{EXT1} gene is located in a region of chromosome 8 that is deleted in people with trichorhinophalangeal syndrome type II (TRPS II). TRPS II is a condition that causes bone and joint malformations including multiple osteochondromas (described above); distinctive facial features; intellectual disability; and abnormalities of the skin, hair, teeth, sweat glands, and nails. As a result of this deletion, affected individuals are missing one copy of the \textit{EXT1} gene in each cell. A shortage of exostosin-1 protein causes the osteochondromas in people with TRPS II. The deletion of other genes near the \textit{EXT1} gene likely contributes to the additional features of this condition.
**Chromosomal Location**

Cytogenetic Location: 8q24.11, which is the long (q) arm of chromosome 8 at position 24.11

Molecular Location: base pairs 117,799,363 to 118,111,819 on chromosome 8 (Homo sapiens Updated Annotation Release 109.20190607, GRCh38.p13) (NCBI)

Credit: Genome Decoration Page/NCBI

**Other Names for This Gene**

- exostoses (multiple) 1
- exostosin 1
- EXT
- EXT1_HUMAN
- Glucuronosyl-N-acetylglucosaminyl-proteoglycan 4-alpha-N-acetylglucosaminyltransferase
- N-acetylglucosaminyl-proteoglycan 4-beta-glucuronosyltransferase

**Additional Information & Resources**

**Clinical Information from GeneReviews**

- Hereditary Multiple Osteochondromas
  https://www.ncbi.nlm.nih.gov/books/NBK1235
- Trichorhinophalangeal Syndrome
  https://www.ncbi.nlm.nih.gov/books/NBK425926

**Scientific Articles on PubMed**

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28EXT1%5BTIAB%5D%29+OR+%28exostoses+++1%5BTIAB%5D%29%29+AND+%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22+OR+1800+days%22+AND+5D
Catalog of Genes and Diseases from OMIM

• EXOSTOSIN GLYCOSYLTRANSFERASE 1
  http://omim.org/entry/608177

Research Resources

• Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/EXT1ID212.html

• ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=EXT1%5Bgene%5D

• HGNC Gene Symbol Report

• Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:2131

• NCBI Gene

• UniProt
  https://www.uniprot.org/uniprot/Q16394

Sources for This Summary

• OMIM: EXOSTOSIN GLYCOSYLTRANSFERASE 1
  http://omim.org/entry/608177

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/11432960
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1757186/

  Determination of the mutation spectrum of the EXT1/EXT2 genes in British Caucasian patients
  with multiple osteochondromas, and exclusion of six candidate genes in EXT negative cases.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17041877

• Maas S, Shaw A, Bikker H, Hennekam RCM. Trichorhinophalangeal Syndrome. 2017 Apr 20. In:
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  Mettford HC, Smith RJH, Stephens K, editors. GeneReviews® [Internet]. Seattle (WA): University of
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/28426188
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/25792522

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  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC15388/

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/9463333
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1376901/

Reprinted from Genetics Home Reference:
  https://ghr.nlm.nih.gov/gene/EXT1

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