EDNRB gene
endothelin receptor type B

Normal Function

The *EDNRB* gene provides instructions for making a protein called endothelin receptor type B. This protein is located on the surface of cells and functions as a signaling mechanism, transmitting information from outside the cell to inside the cell. The receptor interacts with proteins called endothelins to regulate several critical biological processes, including the development and function of blood vessels, the production of certain hormones, and the stimulation of cell growth and division.

Endothelin 3 (produced from the *EDN3* gene) is one of the proteins that interacts with endothelin receptor type B. During early development before birth (embryonic development), endothelin 3 and endothelin receptor type B together play an important role in neural crest cells. These cells migrate from the developing spinal cord to specific regions in the embryo, where they give rise to many different types of cells. In particular, endothelin 3 and endothelin receptor type B are essential for the formation of nerves in the intestine (enteric nerves) and for the production of specialized cells called melanocytes. Melanocytes produce melanin, a pigment that contributes to skin, hair, and eye color. Melanin is also involved in the normal function of the inner ear.

Health Conditions Related to Genetic Changes

Hirschsprung disease

More than 30 mutations in the *EDNRB* gene have been found to cause Hirschsprung disease, a disorder that causes severe constipation or blockage of the intestine. Although Hirschsprung disease is a feature of another condition called Waardenburg syndrome type IV (described below), *EDNRB* gene mutations can also cause Hirschsprung disease in people without Waardenburg syndrome. People with a mutation in one of the two copies of the *EDNRB* gene tend to develop Hirschsprung disease, while people with mutations in both copies of the gene usually develop Waardenburg syndrome type IV. Most of these mutations change single DNA building blocks (nucleotides) in the gene. Changes in the *EDNRB* gene disrupt the normal function of endothelin receptor type B, preventing it from playing its usual role in the development of enteric nerves. As a result, these cells do not form normally during embryonic development. A lack of enteric nerves prevents stool from being moved through the intestine normally, leading to severe constipation or intestinal blockage.

Waardenburg syndrome

More than a dozen mutations in the *EDNRB* gene have been identified in people with Waardenburg syndrome type IV (also known as Waardenburg-Shah syndrome).
This type of Waardenburg syndrome is characterized by changes in skin, hair, and eye coloring; hearing loss; and Hirschsprung disease. Mutations in the \textit{EDNRB} gene disrupt the normal function of endothelin receptor type B or lead to the production of an abnormally small, nonfunctional version of the protein. Because the receptor is necessary for the formation of enteric nerves and melanocytes, these cell types do not form normally during embryonic development. Missing enteric nerves in certain parts of the intestine cause the signs and symptoms of Hirschsprung disease. A lack of melanocytes affects the coloring of skin, hair, and eyes and causes the hearing loss characteristic of Waardenburg syndrome.

\textbf{Cancers}

Several studies have suggested that inherited variations in the \textit{EDNRB} gene may be associated with an increased risk of melanoma, a common form of skin cancer that begins in melanocytes. However, other studies have not shown this association, and this gene’s role in cancer risk remains unclear.

\textbf{Chromosomal Location}

Cytogenetic Location: 13q22.3, which is the long (q) arm of chromosome 13 at position 22.3

Molecular Location: base pairs 77,895,481 to 77,975,723 on chromosome 13 (\textit{Homo sapiens Annotation Release 109, GRCh38.p12}) (NCBI)

\textbf{Other Names for This Gene}

- ABCDS
- EDNRB\_HUMAN
- endothelin receptor, non-selective type
- ETB
- ETBR
- ETRB
- HSCR
• HSCR2
• RP11-318G21.1
• WS4A

Additional Information & Resources

Educational Resources

• Developmental Biology (sixth edition, 2000): The Neural Crest
  https://www.ncbi.nlm.nih.gov/books/NBK10065/

• Madame Curie Bioscience Database: Neural Crest and the Development of the
  Enteric Nervous System
  https://www.ncbi.nlm.nih.gov/books/NBK6273/

Clinical Information from GeneReviews

• Hirschsprung Disease Overview
  https://www.ncbi.nlm.nih.gov/books/NBK1439

Scientific Articles on PubMed

• PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28EDNRB%5BTIAB%5D %29+OR+%28endothelin+receptor+type+B%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+AND+5Bdp%5D

Catalog of Genes and Diseases from OMIM

• ENDOTHELIN RECEPTOR, TYPE B
  http://omim.org/entry/131244

Research Resources

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

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

• HGNC Gene Symbol Report

• Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:1910
Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/8852660

- Barlow A, de Graaff E, Pachnis V. Enteric nervous system progenitors are coordinately controlled by the G protein-coupled receptor EDNRB and the receptor tyrosine kinase RET. Neuron. 2003 Dec 4;40(5):905-16. 
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/14659090

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/8001160

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/14669347
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4612066/

- OMIM: ENDOTHELIN RECEPTOR, TYPE B 
  http://omim.org/entry/131244

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/11303518
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1734825/

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/12895026

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16145050

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/21507037
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/20009762

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16954478

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