BUB1B gene

BUB1 mitotic checkpoint serine/threonine kinase B

Normal Function

The *BUB1B* gene provides instructions for making a protein called BUBR1, which is important for proper chromosome separation during cell division. Before cells divide, they must copy all of their chromosomes. The copied DNA from each chromosome is arranged into two identical structures, called sister chromatids, which are attached to one another during the early stages of cell division. The sets of chromosomes align within the cell, with each chromatid attached to a structure called a spindle microtubule; when all chromatids are correctly attached, the spindle microtubule pulls the two halves of the chromatid pair to opposite sides of the cell. The cell then divides in two such that each new cell contains one complete set of chromosomes.

The BUBR1 protein helps ensure that each sister chromatid is attached to a spindle microtubule. If any chromatids remain unattached, the protein prevents cell division.

Health Conditions Related to Genetic Changes

Mosaic variegated aneuploidy syndrome

More than a dozen mutations in the *BUB1B* gene have been found to cause mosaic variegated aneuploidy (MVA) syndrome type 1. This condition is characterized by cells with abnormal numbers of chromosomes, a situation known as aneuploidy. Affected individuals grow slowly and have an unusually small head size (microcephaly) and an increased risk of developing cancer in childhood.

MVA syndrome type 1 occurs when both copies of the *BUB1B* gene have mutations. These mutations reduce the amount of BUBR1 protein in cells or impair the protein's ability to function. A shortage of functioning BUBR1 protein leads to errors in the distribution of chromatids during cell division. Without BUBR1 protein, cell division can proceed, even if all the chromatids are not attached to spindle microtubules. Unattached chromatids are not positioned correctly for separation, and the resulting cells have abnormal numbers of chromosomes.

Research suggests that impairment of the process that delays cell division until the correct time underlies the increased risk of cancer in MVA syndrome, although the mechanism is not completely understood. It is also unclear how *BUB1B* gene mutations or aneuploidy leads to the other features of MVA syndrome. Researchers speculate that the abnormal cells undergo self-destruction (apoptosis). The signs and symptoms of MVA syndrome may be due to the loss of cells from various tissues during early development.

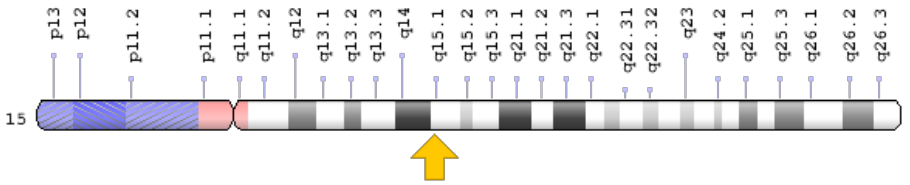
Other disorders

Mutations in the *BUB1B* gene can also cause a related problem with chromosomes called premature chromatid separation trait. Although individuals with this trait have chromosome abnormalities that indicate trouble with normal chromosome separation during cell division, affected individuals usually have no health problems related to the trait. This trait occurs in individuals with a genetic change in one of the two copies of the *BUB1B* gene.

Chromosomal Location

Cytogenetic Location: 15q15.1, which is the long (q) arm of chromosome 15 at position 15.1

Molecular Location: base pairs 40,161,009 to 40,221,136 on chromosome 15 (Homo sapiens Updated Annotation Release 109.20190607, GRCh38.p13) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- Bub1A
- BUB1B, mitotic checkpoint serine/threonine kinase
- BUB1beta
- BUBR1
- budding uninhibited by benzimidazoles 1 homolog beta
- hBUBR1
- MAD3/BUB1-related protein kinase
- MAD3L
- mitotic checkpoint kinase MAD3L
- mitotic checkpoint serine/threonine-protein kinase BUB1 beta
- MVA1
- SSK1

Additional Information & Resources

Educational Resources

- Molecular Biology of the Cell (fourth edition, 2002): Mitosis
  https://www.ncbi.nlm.nih.gov/books/NBK26934/
- The Cell: A Molecular Approach (second edition, 2000): Cell Cycle Checkpoints
  https://www.ncbi.nlm.nih.gov/books/NBK9876/#_A2443_

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28BUB1B%5BTIAB%5D%29+OR+%28BUB1+mitotic+checkpoint+serine/threonine+kinase+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%5Bdp%5D

Catalog of Genes and Diseases from OMIM

- BUDDING UNINHIBITED BY BENZIMIDAZOLES 1, S. CEREVISIAE, HOMOLOG OF, BETA
  http://omim.org/entry/602860

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/BUB1BID854ch15q15.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=BUB1B%5Bgene%5D
- HGNC Gene Symbol Report
  https://www.genenames.org/data/gene-symbol-report/#!/hgnc_id/HGNC:1149
- Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:701
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/701
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  https://www.uniprot.org/uniprot/O60566

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