

Introduction

Description

Breast cancer 1 early onset, a transcription regulator that acts in double-strand break repair, apoptosis, protein folding, and mRNA cleavage, upregulated in breast, ovary, and prostatic neoplasms; mRNA is downregulated in melanoma

Gene symbol

BRCA1

Synonyms

IRIS; BRC1; PSCP; BRCAI; (BRCC1); PNCA4; FANCS; BRCA1; RNF53; BROVCA1; PPP1R53; breast cancer 1; BRCA1 DNA repair associated; BRCA1, DNA repair associated; breast cancer 1, early onset; breast cancer type 1 susceptibility protein

Gene Ontology [what is this?](#)

Molecular function

DNA binding [E, K], estrogen receptor binding [E], NF-kappaB binding [E], p53 binding [E], progesterone receptor binding [P], protein binding [K]... [details](#)

Biological process

anatomical structure morphogenesis [K], apoptotic process [K, E], cell aging [K], cell cycle [K], cell cycle arrest [K, E], cell death [E]... [details](#)

Cellular component

centrosome [E], cytoplasm [E], DNA-directed RNA polymerase II, holoenzyme [E], Golgi apparatus [E], intracellular organelle [K], microvillus [E]... [details](#)

Orthologs & Molecular Hierarchy [what is this?](#)

Hierarchy of orthologous relationships for this locus

[+](#) View orthologous relationships

Biomarker Associations [what is this?](#)

Diseases associated with BRCA1 (35 entries)

Show **5** ▾ entries

Search:

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Ovarian Neoplasms	31 associations	7 associations	24 associations			7 associations	5 associations	
Colorectal Neoplasms	21 associations		18 associations		3 associations		11 associations	
Prostatic Neoplasms	16 associations	2 associations	10 associations		4 associations	2 associations	7 associations	2 associations
Stomach Neoplasms	9 associations		9 associations				3 associations	

Showing 1 to 5 of 35 entries

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GENE

Mutations

Inherited BRCA1 mutations

The [Human Gene Mutation Database \(HGMD®\) report](#) provides information on the following inherited BRCA1 mutations (subscription required):

Mutation Type	Count	Mutation Type	Count
Missense/nonsense	1216	Small indels	61
Splicing	289	Gross deletions	337
Regulatory	52	Gross insertions	90
Small deletions	921	Complex rearrangements	24
Small insertions	364	Repeat variations	1

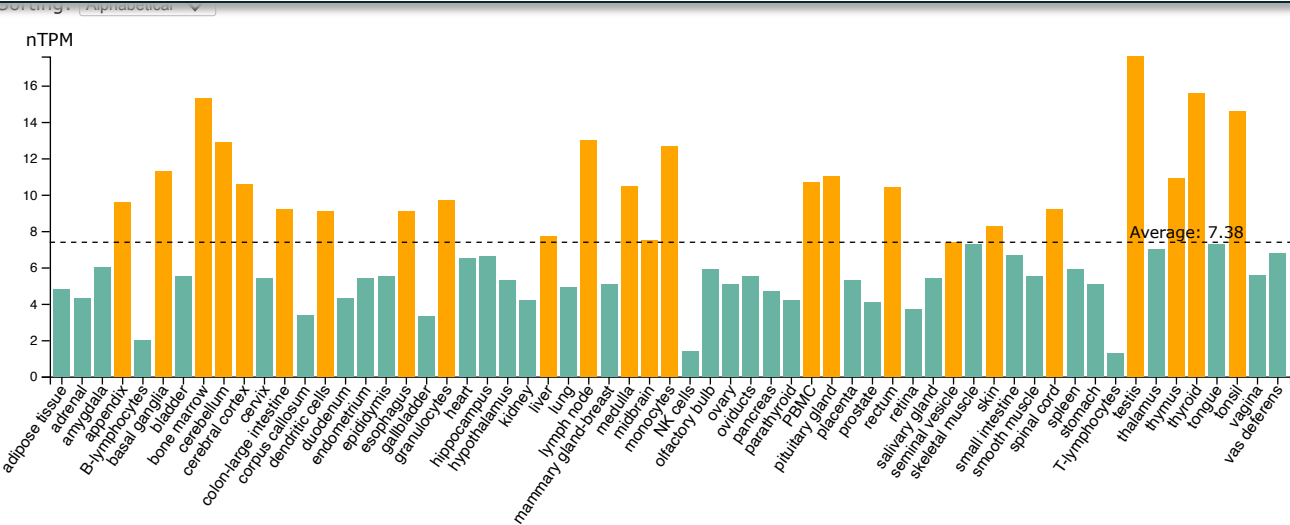
Mutant Phenotype [what is this?](#)

Mutant phenotype of closely related homolog(s)

- Mouse **Brca1** (54.0% identity to Human BRCA1 [1e-109])
- Viability effects : inviable; viable [details](#)
- Anatomical effects : body; ear; embryonic stem cells; fibroblasts; mammary gland/breast; oral cavity; ovary; skin; tumor [details](#)
- Physiological effects : aging; cell cycle control; cell death/apoptosis; DNA repair; drug response; fertile; regulated expression [details](#)

Expression [what is this?](#)

Tissue expression



+ View organ or tissue, cell type, and tumor type entries in detail

Regulation of BRCA1 expression

Proteins, complexes, or pathways that influence BRCA1 expression (20 entries)

Show 5 entries Search:

Regulator details	Effect
AhR	Not affected by
c-Ets-2	Downregulated by
c-Myc	Upregulated by
CREB	Not affected by
CUX-1	Upregulated by

Showing 1 to 5 of 20 entries

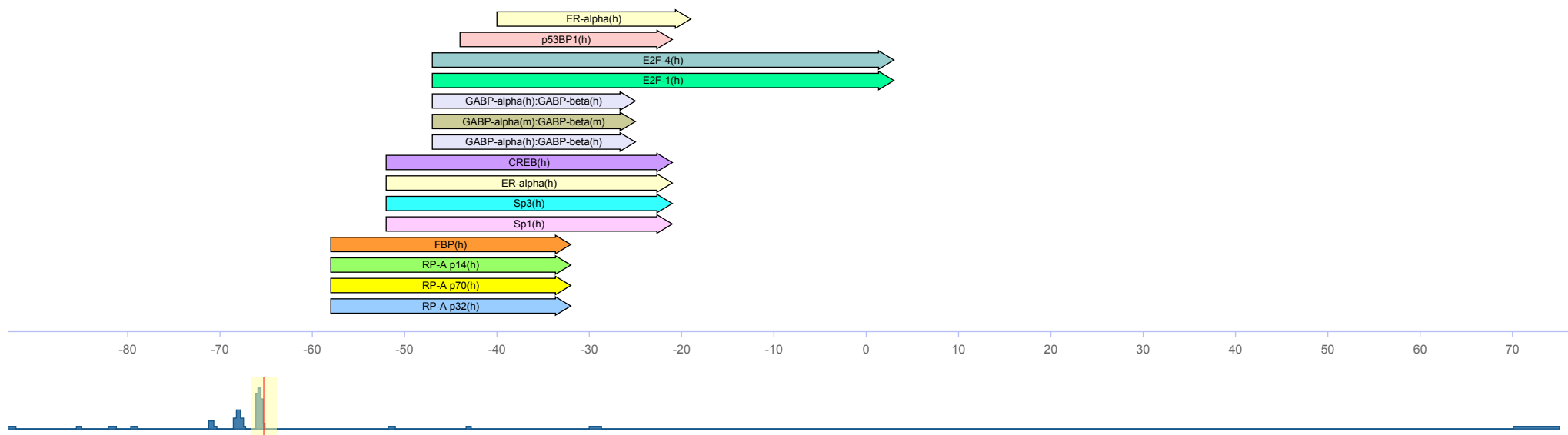
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Transcriptional Regulation [what is this?](#)

Regulation of BRCA1 gene expression

MATCH SUITE

Analyze BRCA1 with MATCH Suite



Viewing nucleotides -93 to 86

* Note: Only binding sites whose location is relative to the TSS are graphically displayed. Binding sites with an asterisk (*) are not included in the graphical display.

Transcription factor binding sites within the BRCA1 gene (54 entries)

Show 5 entries

Search:

Identifier	Relative Location	Genomic Location	Binding Factor(s)	DNA Binding Reaction	Effect
HS\$BRCA1_19	8804 to 8998	Chr17 43119737 43119931 -			
HS\$BRCA1_18	8674 to 8778	Chr17 43119957 43120061 -			
HS\$BRCA1_09	2250 to 2334	Chr17 43124634 43124717 -			
HS\$BRCA1_08	1415 to 1432	Chr17 43125540 43125557 -			
HS\$BRCA1_39	-1303 to -1274	Chr17 43126665 43126694 -	c-Myc(h)	c-Myc(h) --> BRCA1(h)	transactivation

Showing 1 to 5 of 54 entries

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In vivo fragments within the promoter(s) of the BRCA1 gene that are bound by transcription factors (1651 entries)

Show 5 entries

Search:

Promoter	Transcription Factor	Genomic Location	Cell Source	Matrix	Relative Location	CSS	MSS	Sequence	Reference
PM000854077	ZNF784(h)	17:43135089..43135784	HepG2	V\$ZNF784_03	-10214	0.945	0.910	AACCTTCCC	ENCODE Data ↗ 22955616 ↗

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PM000854077

ZNF280B(h)

17:43134926..43135405

HepG2

V\$ZNF280B_01

-10037

1.000

0.868

CAATCCAATGCA

ENCODE Data

22955616

PM000854077

ZNF48(h)

17:43134799..43135378

HepG2

V\$ZNF553_01

-10024

0.830

0.762

GGCGGTAGCT

ENCODE Data

22955616

PM000643642

FOXA1(h)

17:43114636..43114828

VCaP + R1881

V\$HNF3A_Q6

-9994

1.000

0.991

ACAAACAT

GEO Data

25552417

29126285

23193258

Showing 1 to 5 of 1,651 entries

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Regions of the BRCA1 gene with characterized functionality (2 entries)

Show 5 entries

Search:

Identifier	Location	Name	Element
FE00429	-204 to -159	RIBS	Proximal Promoter
FE00430	-58 to -23	PRR (Positive Regulatory Region)	Regulatory

Showing 1 to 2 of 2 entries

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Predicted enhancers / silencers for BRCA1 regulation (51 entries)

Show 5 entries

Search:

Accession	Effect	Chromosomal location	Length (bp)	Identification method	Active in tissue (cell type or line)	Reference
EN000024071	activation	chr17:42886377..42886513	137	pair-wise expression correlation with robust FANTOM5 promoter	blood (neutrophils), blood (monocytes), blood, brain, thymus	FANTOM5
EN000176015	activation	chr17:43314238..43317398	3161	chromatin interaction study	blood (K562)	HACER
EN000176016	activation	chr17:43314406..43324736	10331	chromatin interaction study	blood (GM12878)	HACER
EN000176017	activation	chr17:43314407..43317121	2715	chromatin interaction study	blood (U-936)	HACER
EN000176018	activation	chr17:43314422..43317080	2659	chromatin interaction study	mammary gland/breast (MCF-7)	HACER

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Translational Regulation [what is this?](#)

Regulation of BRCA1 mRNA expression

miRNA binding sites within BRCA1 mRNA (18 entries)

Show 5 entries

Search:

Identifier	Region	Location	Location Reference Point	Binding Factor(s)
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HS\$BRCA1_32	3' UTR	489 to 507	stop codon (end of coding sequence (CDS))	hsa-miR-146b-5p(h)
HS\$BRCA1_33	3' UTR			hsa-miR-20b-5p(h)
HS\$BRCA1_36	3' UTR	1138 to 1155	stop codon (end of coding sequence (CDS))	hsa-miR-545-3p(h)

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RNA Features [what is this?](#)

Overview of RNA sequence

Nucleotide Sequence : CTTAGCG...AAAAAAA (1..3800; 3800 nt) [details](#)

Sequence source : REFSEQ#NM_007299

FASTA [↓](#)

PROTEIN

Drug Interactions [what is this?](#)

Drug(s) targeting BRCA1 (11 entries)

Show

5

 entries

Search:

Drug(s)	Status	Interaction Data Source	Reference(s)
3-METHYL-1,6,8-TRIHYDROXYANTHRAQUINONE	small molecule,experimental	DGIdb	14694444 29156001
Doxorubicin	small molecule,approved,investigational	DGIdb	12698198 29156001
fimepinostat	small molecule, investigational	DrugBank	29760046
Gemcitabine	small molecule,approved	DGIdb	12684687 29156001
MGI-114	small molecule,investigational	DGIdb	17229870 29156001

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Pathways & Interactions [what is this?](#)

Show 5 entries

Search:

Name	View Supporting Reactions	View Graphic Representation	Load in PathFinder
ER-alpha pathway	View Supporting Reactions		 Load in PathFinder
IFNgamma signaling	View Supporting Reactions	View Graphic Representation	 Load in PathFinder

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Subcomponents assembled from experiments involving orthologous proteins (2 entries)

Show 5 entries

Search:

Name	View Supporting Reactions	View Graphic Representation	Load in PathFinder
brca1 ---> IRF7	View Supporting Reactions		 Load in PathFinder
ER-alpha (NR3A1) ubiquitination	View Supporting Reactions		 Load in PathFinder

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Pathways from Reactome (47 entries)

Provided by the [Reactome](#) database, release 78 ([ReactomePathways.gmt](#)).

Show 5 entries

Search:

Name	Reactome pathway report link	Reactome pathway browser link
Cell Cycle	R-HSA-1640170	Open in Reactome Browser
Cell Cycle Checkpoints	R-HSA-69620	Open in Reactome Browser
Defective DNA double strand break response due to BARD1 loss of function	R-HSA-9699150	Open in Reactome Browser
Defective DNA double strand break response due to BRCA1 loss of function	R-HSA-9663199	Open in Reactome Browser
Defective HDR through Homologous Recombination (HRR) due to BRCA1 loss-of-function	R-HSA-9701192	Open in Reactome Browser

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Pathways from WikiPathways (16 entries)

Provided by the [WikiPathways](#) database.

Show 5 entries

Search:

Name	Display below	WikiPathways external link
Androgen receptor signaling pathway	View	WikiPathways
ATM signaling pathway	View	WikiPathways
Breast cancer pathway	View	WikiPathways
DNA damage response	View	WikiPathways
DNA IR-damage and cellular response via ATR	View	WikiPathways

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Protein-protein interactions

☐ Proteins bound by BRCA1 (229 partners)

Show

5

 entries

Search:

Binding Partner(s)	Direct / Indirect	Supporting Reaction	Effect
(STAT1alpha)2	direct	BRCA1 + (STAT1alpha{pY701}{pS727})2 <==> BRCA1:(STAT1alpha{pY701}{pS727})2 [p.s.] details	binding
ABLIM3-isoform2(h)	direct	ABLIM3-isoform2(h) + BRCA1-isoform2(h) <==> ABLIM3-isoform2(h):BRCA1-isoform2(h) [m.e.] details	binding
ACCalpha(h)	direct	ACCalpha(h) + BRCA1-isoform1(h) <==> ACCalpha(h):BRCA1-isoform1(h) [m.e.] details	binding
ACCalpha(h)	direct	BRCA1(h) + ACCalpha(h) <==> BRCA1(h):ACCalpha(h) [m.e.] details	binding
ACCalpha(h)	direct	BRCA1-isoform1(h) + ACCalpha(h){pS80} <==> BRCA1-isoform1(h):ACCalpha(h){pS80} [m.e.] details	binding

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☐ Protein-protein associations (20 partners)

ATF-1	coimmunoprecipitation
ATM	coimmunoprecipitation
BAF60B	coimmunoprecipitation
BARD1	in vitro binding, coimmunoprecipitation

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Events acting on BRCA1

- + Proteins or complexes that activate BRCA1 (1 partner)
- + Proteins or complexes that phosphorylate BRCA1 (44 partners)
- + Proteins or complexes that affect BRCA1 in other ways (162 partners)

Events triggered by BRCA1

- + Proteins or complexes activated by BRCA1 (2 partners)
- + Proteins or complexes inhibited by BRCA1 (2 partners)
- + Proteins or complexes phosphorylated (directly or indirectly) by BRCA1 (13 partners)
- + Proteins or complexes affected by BRCA1 in other ways (72 partners)

Genes regulated (directly or indirectly) by BRCA1

Show 5 entries

Search:

Gene details	Effect
ATF1	Upregulated by
BCL2	Upregulated by
CCNB1	Downregulated by
CDKN1A	Upregulated by
CYP1A1	Not affected by

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Transcription Factor Activity

Regulation of gene expression by BRCA1

Transcription factor classification :

RING finger; C0049 (The RING finger or C3HC4 finger is a zinc-binding domain that is found in proteins from plants to humans. It can be described in more detail as CX(2)CX(9-39)CX(1-3)HX(2-3)CX(2)CX(4-48)CX(2) where X can be any amino acid. Only a subset of this large family has been identified as transcription factors, they are also involved in various other molecular functions (e.g. signal transduction). RING-finger-containing proteins are often part of multi-protein-

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Gene	Location within Gene	Binding Site Identifier	DNA Binding Reaction	Effect	Quality Score
AREG(h)	-912 to -763	HS\$AREG_03	BRCA1(h) --> AREG(h)	DNA binding	3
AREG(h)	-210 to -182	HS\$AREG_04	BRCA1(h) --> AREG(h)	DNA binding	3
CDKN1B(h)	-714 to -680	HS\$CDKN1B_01	BRCA1(h) --> CDKN1B(h)	transactivation	6
Cdkn1b(m)	-545 to -511	MOUSE\$CDKN1B_01	BRCA1(h):FOXA1(h) --> Cdkn1b(m)	transactivation	6
Cdkn1b(m)	-609 to -575	MOUSE\$CDKN1B_02	BRCA1(h):FOXA1(h) --> Cdkn1b(m)	transactivation	3

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Artificial sites bound by BRCA1 (45 entries)

Show 5 entries

Search:

Description	Binding Site Identifier	Quality Score
artificial sequence	AS\$BRCA1_01	2
artificial sequence	AS\$BRCA1_02	2
artificial sequence	AS\$BRCA1_03	2
artificial sequence	AS\$BRCA1_04	2
artificial sequence	AS\$BRCA1_05	2

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ChIP-seq or similar experiments for BRCA1(6 entries)

Show 5 entries

Search:

ChIP Experiment Report	Chromosome	Binding Fragments	Cell	Reference
View Report	Human Genome	551	GM12878	ENCODE Data 22955616
View Report	Human Genome	2024	H1-hESC	ENCODE Data 22955616
View Report	Human Genome	8111	HeLa S3	ENCODE Data 22955616
View Report	Human Genome	1496	HepG2	ENCODE Data 22955616
View Report	Human: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22	769	K562	ENCODE Data 22955616

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Positional weight matrices for BRCA1 (2 entries)

	V\$BRCA1_02	retracted	ChIP-Seq
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Transcription factors which interact with BRCA1

Show 5 	entries	Search:
Species	Factor	
Human	AP-2alpha , AP-2gamma , APEX1 , ARNT , ATF-1 , ATM , BACH1 , BACH1{p} , BRCA2 , BRCA2 , BRIP1 , BRIP1{pS990} , c-Jun , c-Myc-isoform1 , CBX3 , CDK2 , CDK2-isoform1 , CREBBP , DHX9 , E2F-1 , E2F-4 , E2F-6 , ELK-1 , ER-alpha , EZH2 , FOXA1 , FOXO3 , GFI1B , HIF-1alpha , HIV-EP1 , HLTF , hRAD51 , JunB , JUP , NBN , NF-kappaB-p65 , NF-YA , p300 , p53 , p63-isoform6 , PARP , POU2F1 , PR A , PR B , RP-A p70 , SMAD3 , SMARCA4 , Sp1 , STAT1alpha , STAT1beta , STAT5A , SUZ12 , USF-2 , ZNF350 , ZNF350	
Mammalia	c-Jun , E2F-1 , E2F-4 , JunB , JunD , p300 , RB1 , SMARCA4	

Protein Features what is this?

Overview of protein sequence and structure

Chromosome : 17q21

Isoforms : [BRCA1-isoform1](#) , [BRCA1-isoform2](#) , [BRCA1-isoform3](#) , [BRCA1-isoform4](#) , [BRCA1-isoform5](#) , [BRCA1-isoform6](#) , [BRCA1-isoform7](#) , [BRCA1-isoform8](#)

+ View associated sequences and their domains

[+ View related proteins](#)

Post-translational modifications of BRCA1 protein



● Acetylated {ace}	● Phosphorylated {p}	● Other
● Sumoylated {sumo}	● Ubiquitinated {ub}	Abbreviations key

+ Phosphorylated forms (17 entries)

+ Sumoylated forms (1 entry)

- + Ubiquitinated forms (1 entry)

+ Other forms (1 entry)

Known types of modification : endoproteolysis; N-linked glycosylation; phosphorylation; serine phosphorylation; ubiquitination [details](#)

View complexes containing BRCA1 protein

Annotations what is this?

[Display all annotations](#)

Description

- Breast cancer 1 early onset, a transcription regulator that acts in double-strand break repair, apoptosis, protein folding, and mRNA cleavage, upregulated in breast, ovary, and prostatic neoplasms; mRNA is downregulated in melanoma [10373498](#) [12928470](#) [9662397](#) [10334989](#) [12527903](#) [10426999](#) [10435628](#)

Function

- BRCA1** negatively regulates the **hTERT** promoter [G002001](#) ; **BRCA1** regulates cellular immortalization through **hTERT** , which is a critical step in carcinogenesis; negative regulation of **hTERT** by **BRCA1** might be involved in the suppression of ovarian cancer development; loss of **BRCA1** inhibition may lead to immortalization and to subsequent development of ovarian cancer [12646176](#)
- BRCA1** /**BARD1** complex containing **TopBP1** and **BACH1** participates in replication origin- and initiation-related events critical for the activation of the S-phase checkpoint through a non-canonical, **CHK1** /**CHK2**-independent pathway. [16391231](#)
- FOXA1** [T02512](#) protein expression is enhanced by coexpression with **BRCA1** and cotransfection of **BRCA1** with **FOXA1** increases the half-life of **FOXA1** protein suggesting that **BRCA1** might be stabilizing **FOXA1** protein [16331276](#)
- Paradoxically involved in both: transcriptional activation and repression [14502648](#)
- Transcriptional activator [10448078](#)

[more](#)

Domains

- Linked to the **Meox1** [T04046](#) chromosomal region [7987315](#)
- N-terminal RING finger domain important for protein-protein interactions, a domain in the middle of **BRCA1** associates with the DNA repair protein **RAD51** and the C-terminal containing two repeats of the BRCT domains [10448078](#)

Expression

- H-MEC, MCF-7, T47D, HBL-100, MDA-MB-453, BT-549, BT-20, MDA-MB-436, SK-BR-3, MDA-MB-231, MDA-MB-361 [12640109](#)

Disease related

- 185delAG and 5382insC variants are not associated with an increased risk of breast or ovarian cancer if present in an individual with a single nucleotide polymorphism 135g to c in the 5-prime untranslated region of **RAD51** [11248061](#)
- 5382insC variant is associated with a predisposition to breast and ovarian cancer [see [11175350](#)]
- A1708E variant may be associated with a predisposition to breast and ovarian cancer [see [11175350](#)]
- Allelic imbalance is associated with familial and non familial forms of breast cancer [18204050](#)
- Amber nonsense Glu1694Ter variant has been identified in a family with eight cases of breast and ovarian cancer [see [11137998](#)]

[more](#)

Identifiers what is this?

BIOBASE protein accession : PR000014377, MO000021981, MO000030930, MO000084229, MO000110506, MO000110510, MO000111632, MO000111872, MO000111998, MO000111999, MO000113387, MO000118790, MO000118834, MO000120804, MO000167146, MO000167147, MO000293507, MO000484153, MO000484502, T04074

Gene

Affymetrix	11735584_x_at, 11744317_x_at, 11749632_a_at, 11750373_a_at, 11755416_x_at, 16845349, 1993_s_at, 204531_s_at, 211851_x_at, 2395433, 33724_at, 3758316, 3758318, 3758319, 3758321, 3758323, 3758324, 3758334, 3758335, 3758337, 3758339, 3758340, 3758341, 3758342, 3758344, 3758345, 3758350, 3758351, 3758355, 3758356, 3758357, 3758358, 3758359, 3758360, 3758361, 3758362, 3758363, 3758364, 3758365, 3758366, 3758367, 3758368, 3758369, 3758370, 3758371, 3758372, 3758373, 3758374, 3758375, 3758395, 3758405, 604_at, 69578_at, 8015769, 83730_at, ADDON001994.hg, g2218153_3p_a_at, g6552300_3p_a_at, L78833_cds1_at, TC17001553.hg, TC17002645.hg, U64805_s_at,
Agilent	A_23_P207400
BRENDA	2.3.2.27 , 6.3.2
Ensembl	ENSG00000012048 , ENST00000352993 , ENST00000354071 , ENST00000357654 , ENST00000412061 , ENST00000461221 , ENST00000461574 , ENST00000461798 , ENST00000468300 , ENST00000470026 , ENST00000471181 , ENST00000472490 , ENST00000473961 , ENST00000476777 , ENST00000477152 , ENST00000478531 , ENST00000484087 , ENST00000487825 , ENST00000489037 , ENST00000491747 , ENST00000492859 , ENST00000493795 , ENST00000493919 , ENST00000494123 , ENST00000497488 , ENST00000586385 , ENST00000591534 , ENST00000591849 , ENST00000618469 , ENST00000621897 , ENST00000634433 , ENST00000642945 , ENST00000644379 , ENST00000644555 , ENST00000652672
EntrezGene	672
Genbank	1147602 , 1418287 , 1498736 , 1546073 , 1698398 , 1834469 , 21411299 , 2218153 , 23266699 , 237681118 , 237681120 , 237681122 , 237681124 , 24430094 , 24430096 , 24430098 , 24430100 , 24430103 , 24430105 , 24430109 , 24430111 , 24431184 , 24431188 , 30039658 , 32140994 , 37537745 , 38382814 , 4502448 , 47939869 , 52001521 , 52001523 , 53794092 , 55250219 , 555931 , 63252881 , 6552298 , 6552300 , 6552302 , 6552304 , 6552306 , 6552308 , 6552310 , 6552312 , 6552314 , 6552316 , 6552318 , 6552320 , 6552322 , 70959461 , 73665397 , 73665399 , 73665403 , 73665405 , 75874526 , 75874616 , 75874674 , 75874793 , 75874870 , 75874960 , 75875068 , 75875128 , 78070588 , 78070809 , 82623247 , 82623249 , 82623251 , 82623253 , 82623255 , 82623257 , 82623261 , 82623270 , 82623275 , 82623284 , 82623286 , 82623288 , 82623290 , 82623292 , 82623294 , 82623296 , 82623300 , 82623302 , 82623304 , 82623306 , 82623308 , 82623310 , 82623312 , 82623314 , 82623316 , 82623318 , 92096023 , 94315230 , 9739178 , AF005068 , AF284812 , AF507076 , AF507078 , AY093484 , AY093485 , AY093486 , AY093487 , AY093489 , AY093490 , AY093492 , AY093493 , AY144588 , AY273801 , AY304547 , AY354539 , AY706911 , AY706912 , AY751490 , BC030969 , BC062429 , BC072418 , BC085615 , BC106745 , BC106746 , BC115037 , DQ116737 , DQ145822 , DQ145823 , DQ145825 , DQ145826 , DQ190450 , DQ190451 , DQ190452 , DQ190453 , DQ190454 , DQ190455 , DQ190456 , DQ190457 , DQ299305 , DQ299306 , DQ299307 , DQ299308 , DQ299309 , DQ299310 , DQ299311 , DQ299312 , DQ299313 , DQ299314 , DQ299315 , DQ299316 , DQ299317 , DQ299318 , DQ299319 , DQ299321 , DQ299322 , DQ299323 , DQ299324 , DQ299325 , DQ299326 , DQ299327 , DQ299328 , DQ299329 , DQ299330 , DQ299331 , DQ478408 , L78833 , NM_000058 , NM_007294 , NM_007295 , NM_007296 , NM_007297 , NM_007298 , NM_007299 , NM_007300 , NM_007301 , NM_007302 , NM_007303 , NM_007304 , NM_007305 , NM_007306 , U14680 , U37574 , U61268 , U64805 , U68041 , Y08757
HGMD	BRCA1
HumanProteinAtlas	ENSG00000012048
Illumina	0000510746, 0006660739, 0007000647, ILMN_1666652
OMIM	113705
PDB	1JNX , 1N5O , 1OQA , 1T15 , 1T29 , 1T2U , 1T2V , 1Y98 , 2ING , 3K0H , 3K0K , 3K15 , 3K16 , 3PXA , 3PXB , 3PXC , 3PXD , 3PXE , 4OFB





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Protein

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