



An official website of the United States government
[Here's how you know](#)

Nucleotide

GenBank

Homo sapiens BRCA2 DNA repair associated (BRCA2), transcript variant 1, mRNA

NCBI Reference Sequence: NM_000059.4

[FASTA](#) [Graphics](#)

Go to:

LOCUS	NM_000059	11954 bp	mRNA	linear	PRI 22-JAN-2023
DEFINITION	Homo sapiens BRCA2 DNA repair associated (BRCA2), transcript variant 1, mRNA.				
ACCESSION	NM_000059				
VERSION	NM_000059.4				
KEYWORDS	RefSeq; MANE Select.				
SOURCE	Homo sapiens (human)				
ORGANISM	Homo sapiens Eukaryota; Metazoa; Chordata; Craniata; Vertebrata; Euteleostomi; Mammalia; Eutheria; Euarchontoglires; Primates; Haplorrhini; Catarrhini; Hominidae; Homo.				
REFERENCE	1 (bases 1 to 11954)				
AUTHORS	Ogony J, Hoskin TL, Stallings-Mann M, Winham S, Brahmabhatt R, Arshad MA, Kannan N, Pena A, Allers T, Brown A, Sherman ME, Visscher DW, Knutson KL, Radisky DC and Degnim AC.				
TITLE	Immune cells are increased in normal breast tissues of BRCA1/2 mutation carriers				
JOURNAL	Breast Cancer Res Treat 197 (2), 277-285 (2023)				
PUBMED	36380012				
REMARK	GeneRIF: Immune cells are increased in normal breast tissues of BRCA1/2 mutation carriers.				
REFERENCE	2 (bases 1 to 11954)				
AUTHORS	Darabi S, Braxton DR, Xiu J, Carneiro BA, Swensen J, Antonarakis ES, Liu SV, McKay RR, Spetzler D, El-Deiry WS and Demeure MJ.				
TITLE	BRCA1/2 Reversion Mutations in Patients Treated with Poly ADP-Ribose Polymerase (PARP) Inhibitors or Platinum Agents				
JOURNAL	Medicina (Kaunas) 58 (12), 1818 (2022)				
PUBMED	36557020				
REMARK	GeneRIF: BRCA1/2 Reversion Mutations in Patients Treated with Poly ADP-Ribose Polymerase (PARP) Inhibitors or Platinum Agents. Publication Status: Online-Only				
REFERENCE	3 (bases 1 to 11954)				
AUTHORS	Xie C, Luo J, He Y, Jiang L, Zhong L and Shi Y.				
TITLE	BRCA2 gene mutation in cancer				
JOURNAL	Medicine (Baltimore) 101 (45), e31705 (2022)				
PUBMED	36397405				
REMARK	GeneRIF: BRCA2 gene mutation in cancer. Review article				
REFERENCE	4 (bases 1 to 11954)				
AUTHORS	Shah I, Silva-Santisteban A, Germansky KA, Kandasamy C, Mlabasati J, Huang DC, Wadhwa V, Bilal M and Sawhney MS.				
TITLE	Association Between Family History and Risk of Pancreatic Cancer in Patients With BRCA1 and BRCA2 Pathogenic Variants				
JOURNAL	Pancreas 51 (7), 733-738 (2022)				
PUBMED	36395396				
REMARK	GeneRIF: Association Between Family History and Risk of Pancreatic Cancer in Patients With BRCA1 and BRCA2 Pathogenic Variants. Review article				
REFERENCE	5 (bases 1 to 11954)				
AUTHORS	Whitney M, Thayer M, Reifsteck C, Olson S, Smith L, Jakobs PM, Leach R, Naylor S, Joenje H and Grompe M.				
TITLE	Microcell mediated chromosome transfer maps the Fanconi anaemia group D gene to chromosome 3p				
JOURNAL	Nat Genet 11 (3), 341-343 (1995)				

PUBMED [7581463](#)

REFERENCE 6 (bases 1 to 11954)

AUTHORS Schutte M, da Costa LT, Hahn SA, Moskaluk C, Hoque AT, Rozenblum E, Weinstein CL, Bittner M, Meltzer PS, Trent JM et al.

TITLE Identification by representational difference analysis of a homozygous deletion in pancreatic carcinoma that lies within the BRCA2 region

JOURNAL Proc Natl Acad Sci U S A 92 (13), 5950-5954 (1995)

PUBMED [7597059](#)

REFERENCE 7 (bases 1 to 11954)

AUTHORS Mehta,P.A. and Ebens,C.

TITLE Fanconi Anemia

JOURNAL (in) Adam MP, Everman DB, Mirzaa GM, Pagon RA, Wallace SE, Bean LJH, Gripp KW and Amemiya A (Eds.);
GENEREVIEWS(R);
(1993)

PUBMED [20301575](#)

REFERENCE 8 (bases 1 to 11954)

AUTHORS Turner,J.T., Brzezinski,J. and Dome,J.S.

TITLE Wilms Tumor Predisposition

JOURNAL (in) Adam MP, Everman DB, Mirzaa GM, Pagon RA, Wallace SE, Bean LJH, Gripp KW and Amemiya A (Eds.);
GENEREVIEWS(R);
(1993)

PUBMED [20301471](#)

REFERENCE 9 (bases 1 to 11954)

AUTHORS Petrucelli,N., Daly,M.B. and Pal,T.

TITLE BRCA1- and BRCA2-Associated Hereditary Breast and Ovarian Cancer

JOURNAL (in) Adam MP, Everman DB, Mirzaa GM, Pagon RA, Wallace SE, Bean LJH, Gripp KW and Amemiya A (Eds.);
GENEREVIEWS(R);
(1993)

PUBMED [20301425](#)

REFERENCE 10 (bases 1 to 11954)

AUTHORS Watson,C.G.

TITLE The life of a resolution--how ADA policy is made

JOURNAL J Conf Workshop, 14-23 (1975)

PUBMED [1072445](#)

COMMENT REVIEWED [REFSEQ](#): This record has been curated by NCBI staff. The reference sequence was derived from [AL445212.9](#) and [AL137247.14](#).

On Feb 27, 2020 this sequence version replaced [NM_000059.3](#).

Summary: Inherited mutations in BRCA1 and this gene, BRCA2, confer increased lifetime risk of developing breast or ovarian cancer. Both BRCA1 and BRCA2 are involved in maintenance of genome stability, specifically the homologous recombination pathway for double-strand DNA repair. The largest exon in both genes is exon 11, which harbors the most important and frequent mutations in breast cancer patients. The BRCA2 gene was found on chromosome 13q12.3 in human. The BRCA2 protein contains several copies of a 70 aa motif called the BRC motif, and these motifs mediate binding to the RAD51 recombinase which functions in DNA repair. BRCA2 is considered a tumor suppressor gene, as tumors with BRCA2 mutations generally exhibit loss of heterozygosity (LOH) of the wild-type allele. [provided by RefSeq, May 2020].

Publication Note: This RefSeq record includes a subset of the publications that are available for this gene. Please see the Gene record to access additional publications.

##Evidence-Data-START##

Transcript exon combination :: SRR14038193.3812502.1 [ECO:0000332]
RNAseq introns :: single sample supports all introns
SAMEA1965299, SAMEA1968968
[ECO:0000348]

##Evidence-Data-END##

##RefSeq-Attributes-START##

MANE Ensembl match :: ENST00000380152.8/ ENSP00000369497.3
RefSeq Select criteria :: based on manual assertion, conservation,
expression, longest protein

##RefSeq-Attributes-END##

PRIMARY	REFSEQ_SPAN	PRIMARY_IDENTIFIER	PRIMARY_SPAN	COMP
	1-160	AL445212.9	83696-83855	
	161-266	AL445212.9	84610-84715	

267-515	AL445212.9	87265-87513
516-624	AL445212.9	93264-93372
625-674	AL445212.9	94289-94338
675-715	AL445212.9	94430-94470
716-830	AL445212.9	94687-94801
831-880	AL445212.9	97631-97680
881-992	AL445212.9	99107-99218
993-2108	AL445212.9	100460-101575
2109-7040	AL445212.9	104453-109384
7041-7136	AL445212.9	112746-112841
7137-7206	AL445212.9	115015-115084
7207-7634	AL445212.9	123049-123476
7635-7816	AL445212.9	124616-124797
7817-8004	AL445212.9	125930-126117
8005-8175	AL445212.9	130711-130881
8176-8530	AL445212.9	131367-131721
8531-8686	AL445212.9	138590-138745
8687-8831	AL445212.9	139144-139288
8832-8953	AL445212.9	144858-144979
8954-9152	AL445212.9	147505-147703
9153-9316	AL445212.9	147938-148101
9317-9455	AL445212.9	148195-148333
9456-9700	AL445212.9	162877-163121
9701-9847	AL445212.9	165086-165232
9848-10155	AL445212.9	166350-166657
10156-11954	AL137247.14	101-1899

FEATURES

	Location/Qualifiers
source	1..11954 /organism="Homo sapiens" /mol_type="mRNA" /db_xref="taxon: 9606 " /chromosome="13" /map="13q13.1"
gene	1..11954 /gene="BRCA2" /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11" /note="BRCA2 DNA repair associated" /db_xref="GeneID: 675 " /db_xref="HGNC: HGNC:1101 " /db_xref="MIM: 600185 "
exon	1..160 /gene="BRCA2" /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11" /inference="alignment:Splign:2.1.0"
exon	161..266 /gene="BRCA2" /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11" /inference="alignment:Splign:2.1.0"
misc feature	191..193 /gene="BRCA2" /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11" /note="upstream in-frame stop codon"
CDS	200..10456 /gene="BRCA2" /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11" /note="isoform 1 is encoded by transcript variant 1; BRCA1/BRCA2-containing complex, subunit 2; breast cancer type 2 susceptibility protein; DNA repair-associated BRCA2; breast cancer 2 tumor suppressor; breast and ovarian cancer susceptibility gene, early onset; Fanconi anemia group D1 protein; breast and ovarian cancer susceptibility protein 2; breast cancer 2, early onset; mutant BRCA2; mutant DNA repair-associated protein 2" /codon_start=1 /product="breast cancer type 2 susceptibility protein isoform 1" /protein_id=" NP_000050.3 " /db_xref="CCDS: CCDS9344.1 " /db_xref="GeneID: 675 " /db_xref="HGNC: HGNC:1101 " /db_xref="MIM: 600185 "

/translation="MPIGSKERPTFFEIFKTRCNKADLGPISLNWFELSSSEAPPYNS
EPAESEHKNNNYEPNLFKTPQRKPSYNQLASTPIIFKEQGLTLPLYQSPVKELDKFK
LDLGRNVPNRSHKLSRTVKTMDQADDVSCPLLNSCLSESPPVVLQCTHVTQQRDKSVV
CGSLFHTPKFVKGRQTPKHISESLGAEVDPMSSSSSLATPPTLSSTVLIVRNEEASE
TVFPHDTTANVKSIFYSNHDESLKKNDRFIASVTDSENTNQREAAASHGFGKTSNGNSFKV
NSCKDHIGKSMNPVLEDEVYETVVDTSEEDSFSLCFKCRKTNLQKVRTSKTRKKIFH
EANADECESKSNQVKEKYSFVSEVEPNDDPLDSNVANQKPFESGSDKISKEVVPPLA
CEWSQLTSLGLNGAQMEKIPLHLHSSCDQNISEKDLLDTENKRRKDFLTSENSLPRIS
SLPKSEKPLNEETVVNKRDEEQHLESHTDCILAVKQAISGTSPPVASSFQGIKKSIFRI
RESPKETFNASFSGHMTDPNFKKETEASESGLEIHTVCSQKEDSLCPNLIDNGSWPAT
TTQNSVALKNAGLISLTKKKTNKFYIAIHDETSYKGGKIPKDKSELINCSAQFEANA
FEAPLTFANADSGLLHSSVKRSCSQNDSEPTLSLTSSFGTILRKCSRNETCSNNTVI
SQDLDYKEAKCNKEKLQLFITPEADSLSCLQEGQCENDPKSKKVDIKEEVLAAACHP
VQHSKVEYSDDTDFQSQSKSLLYDHENASTLILTPTSKDVLSNLVMSIRGKESYKMSDKL
KGNNYESDVDELTKNIMEKNQDVCLNENYKNVELLPPEKYMVASPSRKVFNQNTN
LRVIQNKQETTSISKITVNPDSSEELFSDNENNFFVQVANERNNALGNTKELHETDL
TCVNEPIFKNSTMVLYGDTGDKQATQVSIKDLVYVLAENKNSVKQHIKMTLGQDLK
SDISLNDKIPKKNNDYMNKWAGLLGPISNHSFGGSFRTASNKEIKLSEHNIKSKSMF
FKDIEEQYPTSLACVEIVNTLALDNQKKLSKQPQINTVSAHLQSSVVVSDCKNSHITP
QMLFSKQDFNSNHNLTSPQKAEITELSTILEESGSQFEFTQFRKPSYILQKSTFEVPE
NQMTILTKTSEECRDADLHVIMNAPSIGQVDSSKQFEGTVEIKRKFAGLLKNDCKNSA
SGYLTDENEVGFRGFYSAHGTKLVNSTEALQKAVKLFSDIENISEETSAEVHPISSLSS
SKCHDSVVSMMFKIENHNDKTVSEKNKQCLILQNNIEMTTGTTFVEEITENYKRNTE
DNKYTAASRNSHNLEFDDGSDSSKNDTVCIHKDETDLLFTDQHNICLKLGSQFMKEGNT
QIKEDLSDLTFLEVAQAQEACHGNTSNKEQLTATKTEQNIKDFETSDTFFQTASGKNI
SVAKESFNKIVNFPDQKPEELHNFSLNSELHSDIRKNKMDILSYEETDIVKHILKES
VPVGTGNQLVTFQGGQPERDEKIKEPTLLGFHTASGKKVKIAKESLDKVKNLDFEKEQG
TSBITTSFHWAKTLKYREACKDLELACETIEITAAPKCKEMQNSLNNDKNLVSIE
TVVPPKLLSDNLRCQTEENLTKTSKIFLKVKHENVEKETAKSPATCYTNQSPYSVIEN
SAFAYTSCSRKTSVSQTSLEAKKWLREGIFDQGERINTADYVGNLYENNSNSTIAE
NDKNHLEKQDPTYSLSNSSMSNSYSYHSDVYNDSGYLSKNKLDGIEPLVKNVEDQKN
TSFSKVISNVKDANAYPQTVNEDICVEELVTSSSPCKNKNAIKLSISNSNNFEVGGP
AFRIASGKIVCVSHETIKKVKDIFTDSFSKVIKENNENKSKICQTKIMAGCYEALDDS
EDILHNSLDNDECSTHSHKVFADIQSEEILQHNQNMGLEKVSISKIPCDVSLSTSIC
KCSIGKLHKSVSANTCGIFSTASGKSVQVSDASLQNAQVFEIEDSTKQVFSKVL
KSNHSDQLTREETTAIRTPHEILISQKGFSYNVNNSAFSGFSTASGKQVSILESSLH
KVGKVLLEFDLIRTEHSLHYSPTSQRNVSKILPRVDKRNPEHCNVSEMEKTSKEFKL
SNNLNVBGGGSENHNSIKVSPYLSQFQQDKQQLVLGTQVSLVENIHLVKEQASPKNV
KMEIGKTETFDVDPVKTNIIEVCSYSTSKDSENYFETEAVEIAKAFMEDDELDTSKLPSH
ATHSLFTCPENEEMVLSNSRIGKRGEPLILVGEPSIKRNLNNEFDRIENQEKS
SLKASKSTPDGTIKDRRLFMHHVSLLEPITCVPFRTTKERQEIQNPNTAPGQEF
LSKSHLYEHLTLEKSSSNLAVSGHPFYQVSATRNEKMRHLITGRPTKVFPVPPFKTS
KSHFHRVEQCVRNINLEENRQKQNIIDGHGSDSKNKINDNEIHQFNKNNSQAVAVT
FTKCEEPDLITSLQNARDIQDMRIKKQRQRVFPQPGSLYLAKTSTLPRISLKA
AVGGQVPSACSHKQLYTYGVSKHCIKINSKNAESFQFHTEYFGKESLWTGKGIQLAD
GGWLIPSDGKAGKEEFYRALCOTPGVDPKLISRIVVYNHYRWIWKLAAMECAFPKE
FANRCLSPERVLLQLKYRYDTEIDRSRRSAIKKIMERDDTAAKTLVLCVSDIISL
SANISETSSNKTSSADTQVVAIIELTGWIYAVKAQLDPPLAVLKNGRITVGQKIILH
GAELVGSPPDACTPLEAPESLMLKISANSTRPARWYTKLGFFDPDPRFPPLPLSS
LFSDDGNGVCVDVIIQRAYPIQWMEKTSSGLYIFRNEREEKEAAKYVEAQQRLEALF
TKIQEEFEHEENTTKPYLPSRALTRQQVRALQDGAELYEAVKNAADPAYLEGYFSE
EQLRALNNHRQMLNDKKQAQIQLEIRKAMESAEQEQGLSRDVTTVWKLIVSYSKKE
KDSVILSIWRPSSDLYSLLTEGKYRIYHLATSKSKSKSERANIQLAATKKTQYQQLP
VSDILFQIYQPRELHFSGFLDPDFQPSCEVDLIGFVVSVVKKTGLAPFVYLSDECY
NLLAIKFWDLNEDIKPHMLIAASNQWRPESKSGLLTLFAGDFSVFSASPKEGHFQET
FNKMKNVTENIDILCNEAENKLMHILHANDPKWSTPTKDCSTGPTYAQIIPGTGNKLLM
SSPNCEIYYQSPLSLCMAKRKSVPVSAQMTSKCKGEKEIDDQKNCKRRALDFLSRLP
LPPPVSPICTFVSPAAQKAFQPPRSCGTFYETPIKKKELNSPQMTPFKFKFNEISL
LESNSIADDEALINTQALLSGSTGEKQFISVSESTRTAPTSSDYLRLLKRRCTTSLI
KEQESSQASTECEKNKQDTITTKKYI"

misc feature

200..319
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/note="propagated from UniProtKB/Swiss-Prot (P51587.4);
Region: Interaction with PALB2"

misc feature

308..403
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/note="propagated from UniProtKB/Swiss-Prot (P51587.4);
Region: Disordered. /evidence=ECO:0000256|SAM:MobiDB-lite"

misc feature

407..409
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"

/note="Phosphoserine.
 /evidence=ECO:0007744|PubMed:23186163; propagated from
 UniProtKB/Swiss-Prot (P51587.4); phosphorylation site"
 1271..1342
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
 FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4);
 Region: Disordered. /evidence=ECO:0000256|SAM:MobiDB-lite"
 1532..1534
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
 FANCD1; GLM3; PNCA2; XRCC11"
 /note="Phosphoserine.
 /evidence=ECO:0007744|PubMed:23186163; propagated from
 UniProtKB/Swiss-Prot (P51587.4); phosphorylation site"
 1673..1675
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
 FANCD1; GLM3; PNCA2; XRCC11"
 /note="Phosphoserine.
 /evidence=ECO:0007744|PubMed:23186163; propagated from
 UniProtKB/Swiss-Prot (P51587.4); phosphorylation site"
 2114..3199
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
 FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4);
 Region: Interaction with NPM1.
 /evidence=ECO:0000269|PubMed:21084279"
 2462..2464
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
 FANCD1; GLM3; PNCA2; XRCC11"
 /note="Phosphoserine.
 /evidence=ECO:0007744|PubMed:17525332; propagated from
 UniProtKB/Swiss-Prot (P51587.4); phosphorylation site"
 3203..3307
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
 FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4);
 Region: BRCA2 1"
 3206..6445
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
 FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4);
 Region: Interaction with RAD51.
 /evidence=ECO:0000250|UniProtKB:P97929"
 4211..5542
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
 FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4);
 Region: Interaction with POLH.
 /evidence=ECO:0000269|PubMed:24485656"
 4427..4984
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
 FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4);
 Region: Required for stimulation of POLH DNA
 polymerization activity"
 6107..6109
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
 FANCD1; GLM3; PNCA2; XRCC11"
 /note="Phosphoserine.
 /evidence=ECO:0007744|PubMed:23186163; propagated from
 UniProtKB/Swiss-Prot (P51587.4); phosphorylation site"
 6302..6304
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
 FANCD1; GLM3; PNCA2; XRCC11"
 /note="Phosphothreonine.

misc feature
 /evidence=ECO:0007744|PubMed:23186163; propagated from UniProtKB/Swiss-Prot (P51587.4); phosphorylation site" 6350..6454
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FADC; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4); Region: BRCA2 8"

misc feature
 6482..6484
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FADC; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11"
 /note="Phosphoserine.
 /evidence=ECO:0007744|PubMed:23186163; propagated from UniProtKB/Swiss-Prot (P51587.4); phosphorylation site" 7007..7210
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FADC; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4); Region: Interaction with HSF2BP.
 /evidence=ECO:0000269|PubMed:31242413"

misc feature
 7247..7834
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FADC; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4); Region: Interaction with FANCD2"

misc feature
 7487..7549
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FADC; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4); Region: Disordered. /evidence=ECO:0000256|SAM:MobiDB-lite"

misc feature
 7640..8695
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FADC; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4); Region: Interaction with SEM1.
 /evidence=ECO:0000269|PubMed:10373512, ECO:0000269|PubMed:16205630"

misc feature
 8243..8293
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FADC; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4); Region: Nuclear export signal, masked by interaction with SEM1. /evidence=ECO:0000269|PubMed:24013206"

misc feature
 10070..10072
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FADC; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11"
 /note="Phosphoserine, by CDK1 and CDK2.
 /evidence=ECO:0000269|PubMed:15800615; propagated from UniProtKB/Swiss-Prot (P51587.4); phosphorylation site"

misc feature
 10154..10156
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FADC; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11"
 /note="Phosphoserine.
 /evidence=ECO:0007744|PubMed:23186163; propagated from UniProtKB/Swiss-Prot (P51587.4); phosphorylation site"

misc feature
 10358..10360
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FADC; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11"
 /note="Phosphothreonine, by CHEK1 and CHEK2.
 /evidence=ECO:0000269|PubMed:18317453; propagated from UniProtKB/Swiss-Prot (P51587.4); phosphorylation site"

misc feature
 10376..10453
 /gene="BRCA2"
 /gene_synonym="BRCC2; BROVCA2; FADC; FAD; FAD1; FANCD; FANCD1; GLM3; PNCA2; XRCC11"
 /note="propagated from UniProtKB/Swiss-Prot (P51587.4); Region: Disordered. /evidence=ECO:0000256|SAM:MobiDB-lite"

exon
267..515
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
516..624
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
625..674
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
675..715
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
716..830
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
831..880
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
881..992
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
993..2108
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
2109..7040
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
7041..7136
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
7137..7206
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
7207..7634
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
7635..7816
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
7817..8004
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
8005..8175
/gene="BRCA2"
/gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/inference="alignment:Splign:2.1.0"

exon
8176..8530

```

/ gene="BRCA2"
/ gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/ inference="alignment:Splign:2.1.0"
exon
.....
8531..8686
/ gene="BRCA2"
/ gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/ inference="alignment:Splign:2.1.0"
exon
.....
8687..8831
/ gene="BRCA2"
/ gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/ inference="alignment:Splign:2.1.0"
exon
.....
8832..8953
/ gene="BRCA2"
/ gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/ inference="alignment:Splign:2.1.0"
exon
.....
8954..9152
/ gene="BRCA2"
/ gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/ inference="alignment:Splign:2.1.0"
exon
.....
9153..9316
/ gene="BRCA2"
/ gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/ inference="alignment:Splign:2.1.0"
exon
.....
9317..9455
/ gene="BRCA2"
/ gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/ inference="alignment:Splign:2.1.0"
exon
.....
9456..9700
/ gene="BRCA2"
/ gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/ inference="alignment:Splign:2.1.0"
exon
.....
9701..9847
/ gene="BRCA2"
/ gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/ inference="alignment:Splign:2.1.0"
exon
.....
9848..11954
/ gene="BRCA2"
/ gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/ inference="alignment:Splign:2.1.0"
regulatory
.....
11933..11938
/ regulatory_class="polyA_signal_sequence"
/ gene="BRCA2"
/ gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/ note="hexamer: AATAAA"
polyA site
.....
11954
/ gene="BRCA2"
/ gene_synonym="BRCC2; BROVCA2; FACD; FAD; FAD1; FANCD;
FANCD1; GLM3; PNCA2; XRCC11"
/ note="major polyA site"

```

ORIGIN

```

1 agaggcggag ccgctgtggc actgctgcgc ctctgctgcg cctcgggtgt cttttgcggc
61 ggtgggtcgc cgccgggaga agcgtgaggg gacagatttg tgaccggcgc ggtttttgtc
121 agcttactcc ggccaaaaaa gaactgcacc tctggagcgg acttatttac caagcattgg
181 aggaatatcg taggtaaaaa tgcctatttg atccaaagag aggccaacat tttttgaaat
241 ttttaagaca cgtgcgaaca aagcagattt aggaccaata agtcttaatt ggtttgaaga
301 actttcttca gaagctccac cctataattc tgaacctgca gaagaatctg aacataaaaa
361 caacaattac gaaccaaacc tatttaaaac tccacaaagg aaaccatctt ataatcagct
421 ggtttcaact ccaataatat tcaaagagca agggctgact ctgccgctgt accaatctcc
481 tgtaaaagaa ttagataaat tcaaattaga cttaggaagg aatgttccca atagtagaca
541 taaaagtcctt cgacagtgta aaactaaaat ggatcaagca gatgatgttt cctgtccact
601 tctaaattct tgtcttagtg aaagtcctgt tgttctacaa tgtacacatg taacaccaca
661 aagagataag tcagtgggat gtgggagttt gtttcataca ccaaagtttg tgaagggtcg
721 tcagacacca aaacatatct ctgaaagtct aggagctgag gtggatcctg atatgtcttg
781 gtcaagttct ttagctacac caccaccctc tagttctact gtgctcatag tcagaaatga
841 agaagcatct gaaactgtat ttcctcatga tactactgct aatgtgaaaa gctatttttc

```

901 caatcatgat gaaagtctga agaaaaatga tagattttatc gcttctgtga cagacagtga
 961 aaacacaaat caaagagaag ctgcaagtca tggatttgga aaaacatcag ggaattcatt
 1021 taaagtaa at agctgcaaa accacattgg aaagtcaatg ccaaatgtcc tagaagatga
 1081 agtatatgaa acagttgtag atacctctga agaagatagt ttttcattat gtttttctaa
 1141 atgtagaaca aaaaatctac aaaaagtaag aactagcaag actaggaaaa aaattttcca
 1201 tgaagcaaac gctgatgaat gtgaaaaatc taaaaaccaa gtgaaagaaa aatactcatt
 1261 tgtatctgaa gtggaaccaa atgatactga tccattagat tcaaatgtag caaatcagaa
 1321 gccctttgag agtggaagtg acaaaatctc caagggaagt gtaccgtctt tggcctgtga
 1381 atgggtctca ctaccccttt caggtctaaa tggagcccag atgggaaaaa tacccttatt
 1441 gcataatttc tcatgtgac aaaaattttc agaaaaagac ctattagaca cagagaacaa
 1501 aagaaagaaa gattttctta ctccagagaa ttctttgcca cgtatttcta gcctacccaa
 1561 atcagagaag ccattaaatg aggaacacgt ggtaaataag agagatgaag agcagcatct
 1621 tgaatctcat acagactgca ttcttgacgt aaagcaggca atatctggaa ctctccaggt
 1681 ggccttctca tttcagggta tcaaaaagtc tatattcaga ataagagaat cacctaaaga
 1741 gactttcaat gcaagttttt caggtcatat gactgatcca aactttaaaa aagaaactga
 1801 agcctctgaa agtggactgg aaatacatac tgtttgctca cagaaggagg actccttatg
 1861 tccaaattta attgataatg gaagctggcc agccaccacc acacagaatt ctgtagcttt
 1921 gaagaatgca ggtttaatat ccactttgaa aaagaaaaa aataagttta tttatgctat
 1981 acatgatgaa acatcttata aaggaaaaaa aataccgaaa gaccaaaaat cagaactaat
 2041 taactgttca gcccgatttg aagcaaatgc ttttgaagca ccacttacat ttgcaaatgc
 2101 tgattcaggt ttattgcatt ctctgtgtaa aagaagctgt tcacagaatg attctgaaga
 2161 accaactttg tcttaacta gctcttttg gacaattctg aggaatgtt ctagaatga
 2221 aacatgttct aataatacag taatctctca ggtcttgat tataaagaag caaaatgtaa
 2281 taaggaaaaa ctacagttat ttattacccc agaagctgat tctctgtcat gcctgcagga
 2341 aggacagtgt gaaaatgatc caaaaagcaa aaaagtttca gatataaaag aagaggtctt
 2401 ggctgcagca tgtccaccag tacaacattc aaaagtggaa tacagtgata ctgactttca
 2461 atcccagaaa agtcttttat atgatcatga aaatgccagc actcttattt taactcctac
 2521 ttccaaggat gttctgtcaa acctagtcac gatttctaga ggcaagaat catacaaaat
 2581 gtcagacaag ctcaaaggta acaattatga atctgatgtt gaattaacca aaaatattcc
 2641 catgaaaaag aatcaagatg tatgtgcttt aaatgaaaat tataaaaacg ttgagctgtt
 2701 gccacctgaa aaatacatga gagtgcacac accttcaaga aaggtacaat tcaacccaaa
 2761 cacaaatcta agagtaatcc aaaaaaatca agaagaaact acttcaattt caaaaataac
 2821 tgtcaatcca gactctgaag aacttttctc agacaatgag aataattttg tcttccaagt
 2881 agctaataaa aggaataatc ttgcttttag aaataactaag gaacttcag aaacagactt
 2941 gactttgtga aacgaaccca ttttcaagaa ctctaccatg gttttatatg gagacacagg
 3001 tgataaacaa gcaaccacag tgtcaattaa aaaagatttg gtttatgttc ttgcagagga
 3061 gaacaaaaat agtgtaaagc agcatataaa aatgactcta ggtcaagatt taaaatcgga
 3121 catctccttg aatatagata aaataccaga aaaaaataat gattacatga acaaatgggc
 3181 aggactctta ggtccaattt caaatcacag ttttggaggt agcttcagaa cagcttcaaa
 3241 taaggaaatc aagctctctg aacataacat taagaagagc aaaatgttct tcaaatgat
 3301 tgaagaacaa tatctacta gtttagcttg tgttgaaatt gtaataacct tggcattaga
 3361 taatcaaaag aaactgagca agcctcagtc aattaatact gtatctgcac atttacagag
 3421 tagttagtgg gtttctgatt gtaaaaatag tcatataacc cctcagatgt tattttcaa
 3481 gcaggatttt aattcaaac ataatttaac acctagccaa aaggcagaaa ttacagaact
 3541 ttctactata ttagaagaat caggaagtca gtttgaattt actcagttta gaaaaccaag
 3601 ctacataattg cagaagagta catttgaagt gcctgaaaac cagatgacta tcttaagac
 3661 cacttctgag gaatgcagag atgctgatct tcatgtcata atgaatgcc catcgattgg
 3721 tcaggttagac agcagcaagc aatttgaagg tacagttgaa attaaacgga agtttgctgg
 3781 cctgttgaaa aatgactgta acaaaagtgc ttctggttat ttaacagatg aaaatgaagt
 3841 ggggtttagg ggccttttat ctgctcatgg caaaaaactg aatgtttcta ctgaagctct
 3901 gcaaaaagct gtgaaactgt tttagtgatg tgagaatatt agtgaggaaa cttctgcaga
 3961 ggtacatcca ataagtttat cttcaagtaa atgtcatgat tctgtgtgtt caatgtttaa
 4021 gatagaaaat cataatgata aaactgtgag tgaaaaaat aataaatgcc aactgatatt
 4081 acaaaaataat attgaaatga ctactggcac ttttgttgaa gaaattactg aaaattacaa
 4141 gagaaatact gaaaatgaag ataacaataa tactgtgcc agtagaatt ctcataactt
 4201 agaatttgat ggcagtgatt caagtaaaaa tgatactgtt tgtattcata aagatgaaac
 4261 ggacttgcta tttactgac agcacacac atgtctttaa ttatctggcc agtttatgaa
 4321 ggagggaaac actcagatta aagaagattt gtcagattta acttttttgg aagttgcgaa
 4381 agctcaagaa gcatgtcatg gtaatacttc aataaagaa cagttaactg ctactaaaac
 4441 ggagcaaaa ataaaagatt ttgagacttc tgatacattt tttcagactg caagtgggaa
 4501 aaatatttagt gtgcgcaaa agtcatttaa taaaattgta aatttcttgg atcagaaaac
 4561 agaagaattg cataactttt ccttaaatc tgaattacat tctgacataa gaaagaacaa
 4621 aatggacatt ctaagttagt aggaacacaga catagttaaa cacaaaatc tgaaagaaag
 4681 tgtcccagtt ggtactggaa atcaactagt gacctccag ggacaacccg aacgtgatga
 4741 aaagatcaaa gaacctactc tattgggttt tcatacagct agcgggaaaa aagttaaaat
 4801 tgcaaaaggaa tctttggaca aagtgaaaaa cctttttgat gaaaaagagc aaggtactag
 4861 tgaatcacc agtttttagc atcaatgggc aaagacccta aagtacagag aggcctgtaa
 4921 agacctgaa tttagcatgt agaccattga gatcacagct gccccaaagt gtaaaagaaat
 4981 gcagaattct ctcaataatg ataaaaacct tgtttctatt gagactgtgg tgccacctaa
 5041 gctcttaagt gataatttat gtgacaaaac tgaatatctc aaaacatcaa aaagtatctt
 5101 tttgaaagtt aaagtacatg aaaaatgtag aaaaagaaac gcaaaaagtc ctgcaacttg
 5161 ttacacaaat cagtccctt attcagtcac tgaaaattca gccttagctt ttacacaaag
 5221 ttgtagtaga aaaactctct tgagtcagac ttcttactt gaagcaaaaa aatggcttag
 5281 agaaggaata tttgatggtc aaccagaaag aataaatact gcagattatg taggaaatta
 5341 tttgatgaa aataattcaa acagtactat agctgaaaat gacaaaaatc atctctccga
 5401 aaaacaagat acttatttaa gtaacagtag catgtctaac agctattcct accattctga

5461 tgaggatatat aatgattcag gatattctctc aaaaaataaa cttgattctg gtattgagcc
 5521 agtattgaag aatgttgaag atcaaaaaaa cactagtttt tccaaagtaa tatccaatgt
 5581 aaaagatgca aatgcatacc cacaactgtt aatgaagat atttgcgttg aggaacttgt
 5641 gactagctct tcaccctgca aaaataaaaa tgcagccatt aaattgtcca tatctaatag
 5701 taataatttt gaggttaggc cacctgcatt taggatagcc agtggtaaaa tcgttttgtt
 5761 ttcacatgaa acaattaaaa aagtgaaga catatttaca gacagtttca gtaagtaaat
 5821 taaggaaaac aacgagaata aatcaaaaat ttgccaaacg aaaattatgg caggttgtta
 5881 cgaggcattg gatgattcag aggatattct tcataactct ctagataatg atgaatgtag
 5941 cagcatttca cataagggtt ttgctgacat tcagagttaa gaaattttac aacataacca
 6001 aaatatgtct ggtattgaga aagtttctaa aatatcacct tgtgatgtta gtttggaac
 6061 ttcagatata tgtaaatgta gtataggaaa gcttcoataa tcagtctcat ctgcaaatac
 6121 ttgtgggatt tttagcacag caagtggaaa atctgtccag gtatcagatg cttcattaca
 6181 aaacgcaaga caagtgtttt ctgaaataga agatagtacc aagcaagtct tttccaaagt
 6241 attgtttaaa agtaacgaac attcagacca gctcacaaag gaagaaaata ctgctatacg
 6301 tactccagaa ctttaatat cccaaaaagg cttttcatat aatgtggtaa attcatctgc
 6361 tttctctgga tttagtacag caagtggaaa gcaagtttcc attttagaaa gttccttaca
 6421 caaagttaag ggagtgttag aggaatttga tttaatcaga actgagcata gtcttacta
 6481 ttcacctacg tctagacaaa atgtatcaaa aatacttctc cgtgttgata agagaaaccc
 6541 agagcactgt gtaaaactcag aaatggaaaa aacctgcagt aaagaattta aattatcaaa
 6601 taacttaaat gttgaagggt gttcttcaga aaataatcac tctattaaag tttctccata
 6661 tctctctcaa tttcaaacag acaacaaca gttggtatta ggaaccaag gtgtacttgt
 6721 tgagaacatt catgttttgg gaaaagaaca ggcttcacct aaaaacgtaa aaatggaaat
 6781 tggtaaaact gaaacttttt ctgatgttcc tgtgaaaaca aatatagaag tttgttctac
 6841 ttactccaaa gattcagaaa actactttga aacagaagca gtagaatttg ctaaagcttt
 6901 tatggaagat gatgaactga cagattctaa actgccaagt catgccacac attctctttt
 6961 tacatgtccc gaaaatgagg aaatggtttt gtcaaatcca agaattggaa aaagaagagg
 7021 agagccctct atcttagtgg gagaaccctc aatcaaaaga aacttattaa atgaatttga
 7081 caggataata gaaatcaag aaaaatcctt aaaggcttca aaaagcactc cagatggcac
 7141 aataaaagat cgaagattgt ttatgcatca tgtttcttta gagcggatta cctgtgtacc
 7201 ctttcgcaca actaaggaa gtcaagagat acagaatcca aattttaccg cactgggtca
 7261 agaatttctg tctaaatctc atttctatga acatctgact ttggaaaaat cttcaagcaa
 7321 tttagcagtt tcaggacatc cattttatca agtttctgct acaagaaatg aaaaaatgag
 7381 acacttgatt actacaggca gaccaaccaa agtctttgtt ccacctttta aaactaaatc
 7441 acattttcac agagtgtgaac agtgtgttag gaatattaac ttggaggaaa acagacaaaa
 7501 gcaaaacatt gatggacatg gctctgatga tagtaaaat aagattaatg acaatgagat
 7561 tcatcagttt aacaaaaaca actccaatca agcagtagct gtaactttca caaagtgtga
 7621 agaagaacct tttagattta ttacaagtct tcagaatgcc agagatatac aggatatgag
 7681 aattaagaag aaacaaaggc aacgcgtctt tccacagcca ggcagtctgt atcttgcaaa
 7741 aacatccact ctgcctcgaa tctctctgaa agcagcagta ggaggccaa gtccctctgc
 7801 gtgttctcat aaacagctgt atacgtatgg cgtttctaaa cattgcataa aaattaacag
 7861 caaaaatgca gagtcttttc agtttcacac tgaagattat tttggttaag aaagtttatg
 7921 gactggaaaa ggaatacagt tggctgatgg tggatggctc ataccctcca atgatggaaa
 7981 ggctggaaaa gaagaatttt atagggtctc gtgtgacact ccaggtgtgg atccaaagct
 8041 tatttctaga atttgggttt ataactacta tagatggatc atattggaaac tggcagctat
 8101 ggaatgtgcc ttctctaagg aatttgctaa tagatgccta agcccagaaa gggtgcttct
 8161 tcaactaaaa tacagatatg atacggaat tgatagaagc agaagatcgg ctataaaaaa
 8221 gataatggaa agggatgaca cagctgcaaa aacacttgtt ctctgtgttt ctgacataat
 8281 ttcattgagc gcaaatatat ctgaaacttc tagcaataaa actagtagtg cagatacca
 8341 aaaagtggcc attattgaac ttacagatgg gtgttatgct gtttaaggcc agttagatcc
 8401 tccctcttta gctgtcttaa agaatggcag actgacagtt ggtcagaaga ttattcttca
 8461 tggagcagaa ctggtgggct ctctgtatgc ctgtacacct cttgaagccc cagaatctct
 8521 tatgttaaag atttctgcta acagtactcg gctgtctcgc tggatatacca aacttgatt
 8581 ctttctgac cctagacctt ttctctgccc cttatcatcg ctttctcagtg atggaggaaa
 8641 tgttggttgt gttgatgtaa ttattcaaa agcataacct atacagtgga tggagaagac
 8701 atcatctgga ttatacatat ttgcgaatga aagagaggaa gaaaaggaa cagcaaaaa
 8761 tgtggaggcc caacaaaaga gactagaagc cttattcact aaaattcagg aggaatttga
 8821 agaacatgaa gaaaacacaa caaaaccata tttaccatca cgtgcactaa caagacagca
 8881 agttcgtgct ttgcaagatg gtgcagagct ttatgaagca gtgaagaatg cagcagacc
 8941 agcttacctt gaggggtatt tcagtgaaga gcagttaaga gccttgaata atcacaggca
 9001 aatgttgaat gataagaaac aagctcagat ccagttggaa attaggaagg ccatggaatc
 9061 tgctgaacaa aagggaacaag gtttatcaag ggaatgtaca accgtgtgga agttgcgtat
 9121 tgtaagctat tcaaaaaaag aaaaagattc agttatactg agtatttggc gtccatcatc
 9181 agatttatat tctctgttaa cagaaggaaa gagatacaga atttatcatc ttgcaacttc
 9241 aaaatctaaa agtaaatctg aaagagctaa catacagtta gcagcgacaa aaaaaactca
 9301 gtatcaacaa ctaccgggtt cagatgaaat tttatttcag atttaccagc caccggagcc
 9361 ccttcaacttc agcaaatttt tagatccaga ctttoagcca tcttgttctg aggtggacct
 9421 aataggattt gtcgtttctg ttgtgaaaa aacaggactt gccctttctg tctatttgtc
 9481 agacgaatgt tacaatttac tggcaataaa gttttggata gaccttaatg aggacattat
 9541 taagcctcat atgttaattg ctgcaagcaa cctccagtgg cgaccagaat ccaaatcagg
 9601 ccttcttact ttatttgtct gagatttttc tgtgtttctc gctagtccaa aagagggcca
 9661 ctttcaagag acattcaaca aatgaaaaa tactgttgag aatattgaca tactttgcaa
 9721 tgaagcagaa aacaagctta tgcatatact gcatgcaaat gatcccaagt ggtccacccc
 9781 aactaaagac tgtacttcag gcccgtagac tgctcaaatc attccttgta caggaaacaa
 9841 gcttctgatg tcttctccta attgtgagat atattatcaa agtcctttat cactttgtat
 9901 ggccaaaagg aagtctgttt ccacacctgt ctgagcccag atgacttcaa agtcttgtta
 9961 aggggagaaa gagattgatg accaaaagaa ctgcaaaaag agaagagcct tggatttctt

```

10021 gagtagactg cctttacctc cacctgttag tccatttgt acatttgttt ctccggtgc
10081 acagaaggca tttcagccac caaggagtgt tggcaccaaa tacgaaacac ccataaagaa
10141 aaaagaactg aattctctctc agatgactcc atttaaaaaa ttcaatgaaa tttctctttt
10201 ggaagtaat tcaatagctg acgaagaact tgcattgata aatacccaag ctcttttgtc
10261 tggttcaaca ggagaaaaac aatttatatc tgtcagttaa tccactagga ctgctccac
10321 cagttcagaa gattatctca gactgaaacg acgttgtact acatctctga tcaaagaaca
10381 ggagagtcc caggccagta cggagaagtg tgagaaaaat aagcaggaca caattacaac
10441 taaaaaatat atctaagcat ttgcaaaggc gacaataaat tattgacgct taacctttcc
10501 agtttataag actggaatat aatttcaaac cacacattag tacttatgtt gcacaatgag
10561 aaaagaaatt agtttcaaat ttacctcagc gtttgtgtat cgggcaaaaa togttttgcc
10621 cgattccgta ttggtatact tttgcttcag ttgcatactt taaaactaaa tgtaatttat
10681 taactaatca agaaaaacat ctttggctga gctcgggtgc tcatgcctgt aatcccaaca
10741 ctttgagaag ctgaggtggg aggagtgtt gaggccagga gttcaagacc agcctgggca
10801 acatagggag acccccctct ttcaaaagaa aaaaaaaagg ggaaaagaaa atctttttaa
10861 tctttggatt tgatcactac aagtattatt ttacaagtga aataaacata ccattttctt
10921 ttagattgtg tcattaaatg gaatgaggtc tcttagtaca gttattttga tgcagataat
10981 tccttttagt ttagctacta ttttagggga ttttttttag aggtaactca ctatgaaata
11041 gttctcctta atgcaaatat gttggttctg ctatagttcc atcctgttca aaagtcagga
11101 tgaatatgaa gagtggtgtt tccttttgag caattcttca tccttaagtc agcatgatta
11161 taagaaaaat agaaccctca gtgtaactct aattcctttt tactattcca gtgtgatctc
11221 tgaaattaaa ttacttcaac taaaaattca aatactttaa atcagaagat ttcatagtta
11281 atttattttt tttttcaaca aaatggctcat ccaaaactcaa acttgagaaa atatcttgct
11341 ttcaaattgg cactgattct gcctgcttta tttttagcgc tatcacagga cccagagcct
11401 atgccctttt aaacttacca caaaagcaga agattaattc aatttaagat gatactctca
11461 tttgttacgt cctttttttt tttttttgga gatggagtct tgctttgtcg cccatgctgg
11521 agtgacgtgg catgatcctg gctcactgca gcctccactt cccgggttca cgtaattctc
11581 ccacctcaag cctccctagt agctgggatt acagggacgc accaccatgc ccagctaatt
11641 tttgcatttt tagtagagac tgggttttac catgttgcc aagctggtct caaactcctg
11701 atgtcagggt atccatctgc ctacagctcc caaagtgtg ggattatagg cgtgagccac
11761 tgtgcccggc caatatttgt tactttctta ggtttaatag agaaaaggga taaaacattt
11821 ctaactggga gttaattgca tggagaaggc cttaaatcag atgttttaat gccttaaatg
11881 tctgtataat atcatgtttt caaatctaata taaaatacag tttaaagcca agaataaatc
11941 ttttaaaaaa ttga

```

//