SUPPLEMENTARY APPENDIX

Deregulation of Fas ligand expression as a novel cause of autoimmune lymphoproliferative syndrome-like disease

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Supplement

Supplementary Methods

Sanger sequencing of germline and somatic mutations in classical ALPS genes

Exons including exon/intron borders of *FAS*, *FASLG* and *CASP10* were amplified by PCR employing the Phusion High Fidelity PCR Master Mix (New England Biolabs), specific forward and reverse primers (listed in Supplemental Table 1, 0.5 µM each) and 20 ng of template DNA. Cycling conditions: 30 seconds at 98^{o}C followed by 30 cycles of 7 seconds at 98^{o}C, 23 seconds at 55-65^{o}C, 30 seconds at 72^{o}C and a final extension of 10 minutes at 72^{o}C. Sanger sequencing was carried out by a core facility at the BMFZ (Biological and Medical Research Center, University of Düsseldorf).

Validation of the IL12RB1 sequence variation

Validation of the SNV in the *IL12RB1* gene was performed by PCR/Sanger sequencing using genomic DNA from the patient and family members. A 485 bp fragment was amplified by PCR employing the Phusion High Fidelity PCR Master Mix. *IL12RB1* exon 7 primers (forward primer 5' GAT CCT GGA GGC CCT AAG AG 3' and reverse primer 5' CCC AGC CCC ATT TTA TTT TA 3', 0.5 µM each) and 20 ng of template DNA. Cycling conditions: 30 seconds at 98^{o}C followed by 30 cycles of 7 seconds at 98^{o}C, 23 seconds at 60^{o}C, 30 seconds at 72^{o}C and final extension of 10 minutes at 72^{o}C. Sanger sequencing was carried out by the BMFZ. The SNV was visualized using sequencher software (Gene Codes, Ann Arbor, MI).

Immortalization of primary B and T lymphocytes

Immortalized B cell lines were generated by transformation with Epstein-Barr virus (EBV) (ATCC, Wesel, Germany) as described previously[1] and cultured in RPMI1640 supplemented with 20% FCS, 2 mM L-glutamine, 1% penicillin/streptomycin (Life Technologies). After activation with PHA/IL2, T cells were immortalized using HVS (Herpes Virus Saimiri) transformation as described.[2]

Immunoblotting

Cells were lysed in buffer containing 1% NP-40, 50 mM Tris, pH 7.5, 350 mM NaCl, 0.5 mM EDTA, 2 mM dithiothreitol, protease and phosphatase inhibitor cocktail (Roche). Proteins were separated on 8-15% polyacrylamide gels, transferred to polyvinylidene fluoride membranes and detected by chemiluminescence (GE Healthcare, Freiburg, Germany). The following primary antibodies were used: anti-β-actin (clone AC-74, Sigma-Aldrich, St. Louis, MO) and anti-IL12RB1 (clone C-20), anti-STAT4 (clone C-20), anti-pospho-STAT4 (clone E2) all from Santa Cruz (Santa Cruz, CA).

RealTime PCR

RNA was isolated from primary and immortalized T cells according to the manufacturer (RNeasy Blood kit, Qiagen, Hilden, Germany). cDNA was synthesized employing the QuantiTect Reverse Transcription kit and real time PCR was performed using QuantiTect primers for *GAPDH*, *FASLG* and *IFNG* and the QuantiTect SYBR Green RT-PCR kit according to the manufacturer's recommendation.

Supplementary References

1. Stepensky P, Saada A, Cowan M, Tabib A, Fischer U, Berkun Y, et al. The Thr224Asn mutation in the VPS45 gene is associated with the congenital neutropenia and primary myelofibrosis of infancy. Blood. 2013;121(25):5078-87.
2. Meinl E, Hohlfeld R. T cell transformation with Herpesvirus saimiri: a tool for neuroimmunological research. J Neuroimmunol. 2000;103(1-7.

Supplementary Results

Filtering of whole exome sequencing data

To identify candidate genes associated with the disease we carried out next generation sequencing. DNA samples of the patient and the parents were analyzed by whole-exome sequencing. 95,794 variants were called from the patient's sample. 5.394 of those affected genes involved in the Fas interaction network. (A list of all genes implicated by StringDB to be involved in Fas signaling is provided in Supplemental Table 3.) 534 were nonsynonymous variants called with high confidence (phred score >30). 186 were homozygous variants, 16 of those variants were rare in the healthy population (minor allele frequency, MAF, below 15% in HapMap (www.hapmap.org) and 1000 Genomes (www.1000genomes.org) data sets), and 6 were heterozygous in both healthy parents (Supplemental Table 4). All nonsynonymous homozygous nucleotide variations and frameshift indels not present with the same genotype in the parents of the patient are listed in Supplemental Table 5.

Exclusion of other candidate genes

Six candidate genes (*BNIPL, TRAF3IP2, NCOR2, RBBP6, MAP2K2* and *IL12RB1*, Supplemental Table 4) were obtained after filtering. The *RBBP6* splice donor site deletion (chr. 16:24564879-81, GTA>G, 2 bp deletion) was most likely neutral, because the

adjacent nucleotides were synonymous to the deleted TA dinucleotide. Furthermore, the variant was frequently called with the same genotype in our in-house database of >300 whole-exome data sets. This database includes healthy controls, primary immune defects and tumor samples. Likewise, the missense mutation of *MAP2K3* and the insertion in *NCOR2* were frequently observed in this database. The p.C101R of *MAP2K3* was then finally excluded because it was tolerable for protein function as predicted by the tools SIFT and Polyphen. The inframe insertion of *NCOR2* was finally excluded because our database suggested that it could be a hotspot for triplet CAG extensions/deletions. The missense mutations of *BNIPL1* and *TRAF3IP2* were also included in our in-house database, but at lower frequency. Both mutations were predicted to be damaging to the protein function. Nevertheless, in the 1000 genomes database 24 and 21 healthy individuals had the same *BNIPL1* or *TRAF3IP2* genotype, respectively. In the database of the Exome Variant Server (NHLBI GO Exome Sequencing Project, Seattle WA; http://evs.gs.washington.edu/EVS/) 100 and 72 individuals had the same genotype, respectively. Therefore, *BNIPL1* and *TRAF3IP2* were excluded as potential disease-associated candidates.

Supplemental Tables

Supplemental Table 1: Sequences of used primers

Gene	Exon	Direction	Sequence (5'➔3')	Ref.
FAS	1	fw	GGC CAA GTT GCT GAA TCA AT	none
		rv	GCC TGA GGG AAG GTC CTA AC	none
	2	fw	GGG TTA CAC TTG TTT ACC ACG TTG CTT ACT T	none
		rv	ATG GAG CCA AAT AGA CCA GTC TTC TCA TT	none
	3	fw	CCC CTC CCC TTG TGT TTT AGA AGA GTT TT	Niemela et al. 2006
		rv	TTC TGC GGT ACC CTA GCC ACC TGT CCT	Niemela et al. 2006
	4	fw	CAG CTC CTG CCC ACC ATT TT	Niemela et al. 2006
		rv	GGC AAA GCA GGA CTA GAA CCC TAA	Niemela et al. 2006
	5/6	fw	GGC CCC TAA TTT ACA AAG TGC	none
		rv	GCA TTC AGG GGC AAG AAA T	none
	7	fw	CAT TCT ACA AGG CTG AGA CCT GAG TTG ATA	Niemela et al. 2006
		rv	CAG CCT GGG CTA TGG AGC AAG AC	Niemela et al. 2006
	8	fw	AGG CCG GAA CCT TTC AGA ATA AA	Niemela et al. 2006
		rv	ATA ACA AGA TCC CAT AAT ATG TCA CTG AAA	Niemela et al. 2006
	9	fw	TTC CCC TAG TCA GCT CTT CAT	none
		rv	TAGCTGGCTGTAAATACTGCTTG	none
FASLG	1	fw	TCC TCT TGA GCA GTC AGC AA	none
		rv	TGA AAA GCA CTT TGC AAG C	none
	2	fw	TCT TTC CAG GGC TTG GTT TA	none
		rv	TTC TGA ATT AGC CAG AAT TCC TC	none
	3	fw	TGG ATT TAA ATT CCC ACC AAA	none
		rv	CCC AGA GAA TAG GGG ATC AA	none
	4	fw	CAG CTG TCA TTC TGG GTG AA	none
		rv	TTG AAC CCT GTG GTC TCA AG	none
CASP10	2	fw	GGGCCATATGTCCTCACTCTC	none
		rv	CTCCCATCTCCACCACAGACC	none
	3	fw	TGA AAG CAC TTG ATT GAT TAT GG	none
		rv	CAC CAA AGC CAA TGT TCG TA	none
	4	fw	TGAGTGGATAATCAATAGGCAAGT	none
		rv	GTCCAAGTTAGCAATCACAAGC	none
	5	fw	GCCTTGGTGTTTGCTTCAGTAT	none
		rv	GGGCCTCTCTCTCTTTTTCTTT	none
	6	fw	GTCCTTCCCTGCATCAAGTC	none
		rv	CCCTACCATACCGATCTAAGTTGT	none
	7	fw	TGGGGAAGATATTTGGAGTCTGAG	none

		rv	GCCCCTAAAGAAACCGTCCTT	none
	8	fw	AAGGATTCCTACTAAGTGGCTCTA	none
		rv	GCATTTGATAAACTGTTCCAGA	none
	9	fw	TGTGCCCGGCCTTGTTTCAG	none
		rv	TACCAAAGGTGTTGAATGAGAGTA	none
	10	fw	AAATTTTGTTTTCTTCTTTGTTGC	none
		rv	CAATGATTCGTTTGAGGTCTAAG	none
	11	fw	TTCCCCTTTTATTTCTCTTTGTGC	none
		rv	GTCAATCTCAGGCGATGTGG	none
IL12RB1	7	fw	GAT CCT GGA GGC CCT AAG AG	none
		rv	CCC AGC CCC ATT TTA TTT TA	none

(Primer sequences for the amplification of *FAS* exon 3, 4, 7 and 8 were derived from: Niemela JE, Hsu AP, Fleisher TA, Puck JM. Single nucleotide polymorphisms in the apoptosis receptor gene *TNFRSF6*. Mol Cell Probes. 2006;20:21-26.)

Supplemental Table 2: Whole-exome sequencing statistics

Sample	Raw reads	Mapped reads	Mapped reads (without duplicates)	Coverage (30x)	SNVs (total)
Patient	197,169,832	83,026,158	80,648,463	93%	95,794
Father	187,440,556	78,455,166	76,447,940	92%	93,972
Mother	172,370,306	83,372,182	81,260,764	92%	95,198

Supplemental Table 3: Genes implicated in the Fas interacting network

Ensembl GeneID	Gene Description
ENSG00000175899	alpha-2-macroglobulin [Source:HGNC Symbol;Acc:7]
ENSG00000097007	c-abl oncogene 1, non-receptor tyrosine kinase [Source:HGNC Symbol;Acc:76]
ENSG00000130402	actinin, alpha 4 [Source:HGNC Symbol;Acc:166]
ENSG00000072110	actinin, alpha 1 [Source:HGNC Symbol;Acc:163]
ENSG00000077522	actinin, alpha 2 [Source:HGNC Symbol;Acc:164]
ENSG00000087274	adducin 1 (alpha) [Source:HGNC Symbol;Acc:243]
ENSG00000143799	poly (ADP-ribose) polymerase 1 [Source:HGNC Symbol;Acc:270]
ENSG00000006125	adaptor-related protein complex 2, beta 1 subunit [Source:HGNC Symbol;Acc:563]
ENSG00000081051	alpha-fetoprotein [Source:HGNC Symbol;Acc:317]
ENSG00000106546	aryl hydrocarbon receptor [Source:HGNC Symbol;Acc:348]
ENSG00000142208	v-akt murine thymoma viral oncogene homolog 1 [Source:HGNC Symbol;Acc:391]
ENSG00000105221	v-akt murine thymoma viral oncogene homolog 2 [Source:HGNC Symbol;Acc:392]
ENSG00000108839	arachidonate 12-lipoxygenase [Source:HGNC Symbol;Acc:429]
ENSG00000154188	angiopoietin 1 [Source:HGNC Symbol;Acc:484]
ENSG00000029534	ankyrin 1, erythrocytic [Source:HGNC Symbol;Acc:492]
ENSG00000145362	ankyrin 2, neuronal [Source:HGNC Symbol;Acc:493]
ENSG00000151729	solute carrier family 25 (mitochondrial carrier; adenine nucleotide translocator), member 4 [Source:HGNC Symbol;Acc:10990]
ENSG00000120868	apoptotic peptidase activating factor 1 [Source:HGNC Symbol;Acc:576]
ENSG00000134982	adenomatous polyposis coli [Source:HGNC Symbol;Acc:583]
ENSG00000100823	APEX nuclease (multifunctional DNA repair enzyme) 1 [Source:HGNC Symbol;Acc:587]
ENSG00000110330	baculoviral IAP repeat containing 2 [Source:HGNC Symbol;Acc:590]
ENSG00000023445	baculoviral IAP repeat containing 3 [Source:HGNC Symbol;Acc:591]
ENSG00000101966	X-linked inhibitor of apoptosis [Source:HGNC Symbol;Acc:592]
ENSG00000089685	baculoviral IAP repeat containing 5 [Source:HGNC Symbol;Acc:593]
ENSG00000142192	amyloid beta (A4) precursor protein [Source:HGNC Symbol;Acc:620]
ENSG00000026103	Fas (TNF receptor superfamily, member 6) [Source:HGNC Symbol;Acc:11920]
ENSG00000117560	Fas ligand (TNF superfamily, member 6) [Source:HGNC Symbol;Acc:11936]
ENSG00000169083	androgen receptor [Source:HGNC Symbol;Acc:644]
ENSG00000067560	ras homolog gene family, member A [Source:HGNC Symbol;Acc:667]
ENSG00000143878	ras homolog gene family, member B [Source:HGNC Symbol;Acc:668]
ENSG00000155366	ras homolog gene family, member C [Source:HGNC Symbol;Acc:669]
ENSG00000177105	ras homolog gene family, member G (rho G) [Source:HGNC Symbol;Acc:672]
ENSG00000141522	Rho GDP dissociation inhibitor (GDI) alpha [Source:HGNC Symbol;Acc:678]
ENSG00000111348	Rho GDP dissociation inhibitor (GDI) beta [Source:HGNC Symbol;Acc:679]
ENSG00000242173	Rho GDP dissociation inhibitor (GDI) gamma [Source:HGNC Symbol;Acc:680]
ENSG00000168421	ras homolog gene family, member H [Source:HGNC Symbol;Acc:686]
ENSG00000137486	arrestin, beta 1 [Source:HGNC Symbol;Acc:711]
ENSG00000141480	arrestin, beta 2 [Source:HGNC Symbol;Acc:712]
ENSG00000123268	activating transcription factor 1 [Source:HGNC Symbol;Acc:783]
ENSG00000162772	activating transcription factor 3 [Source:HGNC Symbol;Acc:785]
ENSG00000128272	activating transcription factor 4 (tax-responsive enhancer element B67) [Source:HGNC Symbol;Acc:786]
ENSG00000149311	ataxia telangiectasia mutated [Source:HGNC Symbol;Acc:795]
ENSG00000175054	ataxia telangiectasia and Rad3 related [Source:HGNC Symbol;Acc:882]
ENSG00000085224	alpha thalassemia/mental retardation syndrome X-linked [Source:HGNC Symbol;Acc:886]
ENSG00000002330	BCL2-associated agonist of cell death [Source:HGNC Symbol;Acc:936]
ENSG00000107262	BCL2-associated athanogene [Source:HGNC Symbol;Acc:937]
ENSG00000030110	BCL2-antagonist/killer 1 [Source:HGNC Symbol;Acc:949]
ENSG00000138376	BRCA1 associated RING domain 1 [Source:HGNC Symbol;Acc:952]
ENSG00000087088	BCL2-associated X protein [Source:HGNC Symbol;Acc:959]
ENSG00000110092	cyclin D1 [Source:HGNC Symbol;Acc:1582]
ENSG00000171791	B-cell CLL/lymphoma 2 [Source:HGNC Symbol;Acc:990]
ENSG00000140379	BCL2-related protein A1 [Source:HGNC Symbol;Acc:991]
ENSG00000171552	BCL2-like 1 [Source:HGNC Symbol;Acc:992]
ENSG00000129473	BCL2-like 2 [Source:HGNC Symbol;Acc:995]
ENSG00000069399	B-cell CLL/lymphoma 3 [Source:HGNC Symbol;Acc:998]
ENSG00000113916	B-cell CLL/lymphoma 6 [Source:HGNC Symbol;Acc:1001]
ENSG00000186716	breakpoint cluster region [Source:HGNC Symbol;Acc:1014]
ENSG00000168398	bradykinin receptor B2 [Source:HGNC Symbol;Acc:1030]
ENSG00000176697	brain-derived neurotrophic factor [Source:HGNC Symbol;Acc:1033]
ENSG00000242252	bone gamma-carboxyglutamate (gla) protein [Source:HGNC Symbol;Acc:1043]
ENSG00000015475	BH3 interacting domain death agonist [Source:HGNC Symbol;Acc:1050]
ENSG00000100290	BCL2-interacting killer (apoptosis-inducing) [Source:HGNC Symbol;Acc:1051]
ENSG00000057657	PR domain containing 1, with ZNF domain [Source:HGNC Symbol;Acc:9346]
ENSG00000197299	Bloom syndrome, RecQ helicase-like [Source:HGNC Symbol;Acc:1058]
ENSG00000107779	bone morphogenetic protein receptor, type IA [Source:HGNC Symbol;Acc:1076]
ENSG00000138696	bone morphogenetic protein receptor, type IB [Source:HGNC Symbol;Acc:1077]
ENSG00000204217	bone morphogenetic protein receptor, type II (serine/threonine kinase) [Source:HGNC Symbol;Acc:1078]
ENSG00000102010	BMX non-receptor tyrosine kinase [Source:HGNC Symbol;Acc:1079]
ENSG00000113734	BCL2/adenovirus E1B 19kDa interacting protein 1 [Source:HGNC Symbol;Acc:1082]
ENSG00000140299	BCL2/adenovirus E1B 19kDa interacting protein 2 [Source:HGNC Symbol;Acc:1083]
ENSG00000176171	BCL2/adenovirus E1B 19kDa interacting protein 3 [Source:HGNC Symbol;Acc:1084]
ENSG00000104765	BCL2/adenovirus E1B 19kDa interacting protein 3-like [Source:HGNC Symbol;Acc:1085]
ENSG00000012048	breast cancer 1, early onset [Source:HGNC Symbol;Acc:1100]
ENSG00000157764	v-raf murine sarcoma viral oncogene homolog B1 [Source:HGNC Symbol;Acc:1097]
ENSG00000139618	breast cancer 2, early onset [Source:HGNC Symbol;Acc:1101]
ENSG00000010671	Bruton agammaglobulinemia tyrosine kinase [Source:HGNC Symbol;Acc:1133]
ENSG00000198668	calmodulin 1 (phosphorylase kinase, delta) [Source:HGNC Symbol;Acc:1442]
ENSG00000160014	calmodulin 3 (phosphorylase kinase, delta) [Source:HGNC Symbol;Acc:1449]
ENSG00000143933	calmodulin 2 (phosphorylase kinase, delta) [Source:HGNC Symbol;Acc:1445]
ENSG00000198668	calmodulin 1 (phosphorylase kinase, delta) [Source:HGNC Symbol;Acc:1442]
ENSG00000160014	calmodulin 3 (phosphorylase kinase, delta) [Source:HGNC Symbol;Acc:1449]
ENSG00000143933	calmodulin 2 (phosphorylase kinase, delta) [Source:HGNC Symbol;Acc:1445]
ENSG00000198668	calmodulin 1 (phosphorylase kinase, delta) [Source:HGNC Symbol;Acc:1442]
ENSG00000160014	calmodulin 3 (phosphorylase kinase, delta) [Source:HGNC Symbol;Acc:1449]
ENSG00000143933	calmodulin 2 (phosphorylase kinase, delta) [Source:HGNC Symbol;Acc:1445]
ENSG00000014216	calpain 1, (mu/I) large subunit [Source:HGNC Symbol;Acc:1476]
ENSG00000162909	calpain 2, (m/II) large subunit [Source:HGNC Symbol;Acc:1479]
ENSG00000126247	calpain, small subunit 1 [Source:HGNC Symbol;Acc:1481]
ENSG00000153113	calpastatin [Source:HGNC Symbol;Acc:1515]
ENSG00000137752	caspase 1, apoptosis-related cysteine peptidase (interleukin 1, beta, convertase) [Source:HGNC Symbol;Acc:1499]
ENSG00000106144	caspase 2, apoptosis-related cysteine peptidase [Source:HGNC Symbol;Acc:1503]
ENSG00000164305	caspase 3, apoptosis-related cysteine peptidase [Source:HGNC Symbol;Acc:1504]
ENSG00000138794	caspase 6, apoptosis-related cysteine peptidase [Source:HGNC Symbol;Acc:1507]
ENSG00000165806	caspase 7, apoptosis-related cysteine peptidase [Source:HGNC Symbol;Acc:1508]
ENSG00000064012	caspase 8, apoptosis-related cysteine peptidase [Source:HGNC Symbol;Acc:1509]
ENSG00000132906	caspase 9, apoptosis-related cysteine peptidase [Source:HGNC Symbol;Acc:1511]
ENSG00000003400	caspase 10, apoptosis-related cysteine peptidase [Source:HGNC Symbol;Acc:1500]
ENSG00000105974	caveolin 1, caveolae protein, 22kDa [Source:HGNC Symbol;Acc:1527]
ENSG00000124813	runt-related transcription factor 2 [Source:HGNC Symbol;Acc:10472]

ENSG00000145386 cyclin A2 [Source:HGNC Symbol;Acc:1578]
ENSG00000134057 cyclin B1 [Source:HGNC Symbol;Acc:1579]
ENSG00000118971 cyclin D2 [Source:HGNC Symbol;Acc:1583]
ENSG00000112576 cyclin D3 [Source:HGNC Symbol;Acc:1585]
ENSG00000105173 cyclin E1 [Source:HGNC Symbol;Acc:1589]
ENSG00000113328 cyclin G1 [Source:HGNC Symbol;Acc:1592]
ENSG00000138764 cyclin G2 [Source:HGNC Symbol;Acc:1593]
ENSG00000134480 cyclin H [Source:HGNC Symbol;Acc:1594]
ENSG00000167286 CD3d molecule, delta (CD3-TCR complex) [Source:HGNC Symbol;Acc:1673]
ENSG00000198821 CD247 molecule [Source:HGNC Symbol;Acc:1677]
ENSG00000153563 CD8a molecule [Source:HGNC Symbol;Acc:1706]
ENSG00000170458 CD14 molecule [Source:HGNC Symbol;Acc:1628]
ENSG00000139193 CD27 molecule [Source:HGNC Symbol;Acc:11922]
ENSG00000120949 tumor necrosis factor receptor superfamily, member 8 [Source:HGNC Symbol;Acc:11923]
ENSG00000101017 CD40 molecule, TNF receptor superfamily member 5 [Source:HGNC Symbol;Acc:11919]
ENSG00000102245 CD40 ligand [Source:HGNC Symbol;Acc:11935]
ENSG00000170312 cyclin-dependent kinase 1 [Source:HGNC Symbol;Acc:1722]
ENSG00000094804 cell division cycle 6 homolog (S. cerevisiae) [Source:HGNC Symbol;Acc:1744]
ENSG00000158402 cell division cycle 25 homolog C (S. pombe) [Source:HGNC Symbol;Acc:1727]
ENSG00000099804 cell division cycle 34 homolog (S. cerevisiae) [Source:HGNC Symbol;Acc:1734]
ENSG00000070831 cell division cycle 42 (GTP binding protein, 25kDa) [Source:HGNC Symbol;Acc:1736]
ENSG00000123374 cyclin-dependent kinase 2 [Source:HGNC Symbol;Acc:1771]
ENSG00000135446 cyclin-dependent kinase 4 [Source:HGNC Symbol;Acc:1773]
ENSG00000164885 cyclin-dependent kinase 5 [Source:HGNC Symbol;Acc:1774]
ENSG00000105810 cyclin-dependent kinase 6 [Source:HGNC Symbol;Acc:1777]
ENSG00000134058 cyclin-dependent kinase 7 [Source:HGNC Symbol;Acc:1778]
ENSG00000136807 cyclin-dependent kinase 9 [Source:HGNC Symbol;Acc:1780]
ENSG00000124762 cyclin-dependent kinase inhibitor 1A (p21, Cip1) [Source:HGNC Symbol;Acc:1784]
ENSG00000111276 cyclin-dependent kinase inhibitor 1B (p27, Kip1) [Source:HGNC Symbol;Acc:1785]
ENSG00000147889 cyclin-dependent kinase inhibitor 2A (melanoma, p16, inhibits CDK4) [Source:HGNC Symbol;Acc:1787]
ENSG00000172216 CCAAT/enhancer binding protein (C/EBP), beta [Source:HGNC Symbol;Acc:1834]
ENSG00000149554 checkpoint kinase 1 [Source:HGNC Symbol;Acc:1925]
ENSG00000213341 conserved helix-loop-helix ubiquitous kinase [Source:HGNC Symbol;Acc:1974]
ENSG00000166340 tripeptidyl peptidase I [Source:HGNC Symbol;Acc:2073]
ENSG00000141367 clathrin, heavy chain (Hc) [Source:HGNC Symbol;Acc:2092]
ENSG00000173846 polo-like kinase 3 [Source:HGNC Symbol;Acc:2154]
ENSG00000107968 mitogen-activated protein kinase kinase kinase 8 [Source:HGNC Symbol;Acc:6860]
ENSG00000110090 carnitine palmitoyltransferase 1A (liver) [Source:HGNC Symbol;Acc:2328]
ENSG00000117322 complement component (3d/Epstein Barr virus) receptor 2 [Source:HGNC Symbol;Acc:2336]
ENSG00000118260 cAMP responsive element binding protein 1 [Source:HGNC Symbol;Acc:2345]
ENSG00000115966 activating transcription factor 2 [Source:HGNC Symbol;Acc:784]
ENSG00000005339 CREB binding protein [Source:HGNC Symbol;Acc:2348]
ENSG00000095794 cAMP responsive element modulator [Source:HGNC Symbol;Acc:2352]
ENSG00000167193 v-crk sarcoma virus CT10 oncogene homolog (avian) [Source:HGNC Symbol;Acc:2362]
ENSG00000099942 v-crk sarcoma virus CT10 oncogene homolog (avian)-like [Source:HGNC Symbol;Acc:2363]
ENSG00000112062 mitogen-activated protein kinase 14 [Source:HGNC Symbol;Acc:6876]
ENSG00000164400 colony stimulating factor 2 (granulocyte-macrophage) [Source:HGNC Symbol;Acc:2434]
ENSG00000198223 colony stimulating factor 2 receptor, alpha, low-affinity (granulocyte-macrophage) [Source:HGNC Symbol;Acc:2435]
ENSG00000100368 colony stimulating factor 2 receptor, beta, low-affinity (granulocyte-macrophage) [Source:HGNC Symbol;Acc:2436]
ENSG00000171209 casein kappa [Source:HGNC Symbol;Acc:2446]
ENSG00000113712 casein kinase 1, alpha 1 [Source:HGNC Symbol;Acc:2451]
ENSG00000141551 casein kinase 1, delta [Source:HGNC Symbol;Acc:2452]
ENSG00000213923 casein kinase 1, epsilon [Source:HGNC Symbol;Acc:2453]
ENSG00000133275 casein kinase 1, gamma 2 [Source:HGNC Symbol;Acc:2455]
ENSG00000101266 casein kinase 2, alpha 1 polypeptide [Source:HGNC Symbol;Acc:2457]
ENSG00000038427 versican [Source:HGNC Symbol;Acc:2464]
ENSG00000159692 C-terminal binding protein 1 [Source:HGNC Symbol;Acc:2494]
ENSG00000168036 catenin (cadherin-associated protein), beta 1, 88kDa [Source:HGNC Symbol;Acc:2514]
ENSG00000117984 cathepsin D [Source:HGNC Symbol;Acc:2529]
ENSG00000083799 cylindromatosis (turban tumor syndrome) [Source:HGNC Symbol;Acc:2584]
ENSG00000196730 death-associated protein kinase 1 [Source:HGNC Symbol;Acc:2674]
ENSG00000231617 death-domain associated protein [Source:HGNC Symbol;Acc:2681]
ENSG00000204209 death-domain associated protein [Source:HGNC Symbol;Acc:2681]
ENSG00000187323 deleted in colorectal carcinoma [Source:HGNC Symbol;Acc:2701]
ENSG00000134574 damage-specific DNA binding protein 2, 48kDa [Source:HGNC Symbol;Acc:2718]
ENSG00000116717 growth arrest and DNA-damage-inducible, alpha [Source:HGNC Symbol;Acc:4095]
ENSG00000175197 DNA-damage-inducible transcript 3 [Source:HGNC Symbol;Acc:2726]
ENSG00000079785 DEAD (Asp-Glu-Ala-Asp) box polypeptide 1 [Source:HGNC Symbol;Acc:2734]
ENSG00000108654 DEAD (Asp-Glu-Ala-Asp) box polypeptide 5 [Source:HGNC Symbol;Acc:2746]
ENSG00000175084 desmin [Source:HGNC Symbol;Acc:2770]
ENSG00000160049 DNA fragmentation factor, 45kDa, alpha polypeptide [Source:HGNC Symbol;Acc:2772]
ENSG00000169598 DNA fragmentation factor, 40kDa, beta polypeptide (caspase-activated DNase) [Source:HGNC Symbol;Acc:2773]
ENSG00000116133 24-dehydrocholesterol reductase [Source:HGNC Symbol;Acc:2859]
ENSG00000181019 NAD(P)H dehydrogenase, quinone 1 [Source:HGNC Symbol;Acc:2874]
ENSG00000130816 DNA (cytosine-5-)-methyltransferase 1 [Source:HGNC Symbol;Acc:2976]
ENSG00000117505 down-regulator of transcription 1, TBP-binding (negative cofactor 2) [Source:HGNC Symbol;Acc:3017]
ENSG00000116017 AT rich interactive domain 3A (BRIGHT-like) [Source:HGNC Symbol;Acc:3031]
ENSG00000171587 Down syndrome cell adhesion molecule [Source:HGNC Symbol;Acc:3039]
ENSG00000134760 desmoglein 1 [Source:HGNC Symbol;Acc:3048]
ENSG00000046604 desmoglein 2 [Source:HGNC Symbol;Acc:3049]
ENSG00000134757 desmoglein 3 [Source:HGNC Symbol;Acc:3050]
ENSG00000120129 dual specificity phosphatase 1 [Source:HGNC Symbol;Acc:3064]
ENSG00000108861 dual specificity phosphatase 3 [Source:HGNC Symbol;Acc:3069]
ENSG00000120875 dual specificity phosphatase 4 [Source:HGNC Symbol;Acc:3070]
ENSG00000138166 dual specificity phosphatase 5 [Source:HGNC Symbol;Acc:3071]
ENSG00000139318 dual specificity phosphatase 6 [Source:HGNC Symbol;Acc:3072]
ENSG00000164086 dual specificity phosphatase 7 [Source:HGNC Symbol;Acc:3073]
ENSG00000161202 dishevelled, dsh homolog 3 (Drosophila) [Source:HGNC Symbol;Acc:3087]
ENSG00000101412 E2F transcription factor 1 [Source:HGNC Symbol;Acc:3113]
ENSG00000007968 E2F transcription factor 2 [Source:HGNC Symbol;Acc:3114]
ENSG00000112242 E2F transcription factor 3 [Source:HGNC Symbol;Acc:3115]
ENSG00000205250 E2F transcription factor 4, p107/p130-binding [Source:HGNC Symbol;Acc:3118]
ENSG00000133740 E2F transcription factor 5, p130-binding [Source:HGNC Symbol;Acc:3119]
ENSG00000167967 E4F transcription factor 1 [Source:HGNC Symbol;Acc:3121]
ENSG00000198121 lysophosphatidic acid receptor 1 [Source:HGNC Symbol;Acc:3166]
ENSG00000078401 endothelin 1 [Source:HGNC Symbol;Acc:3176]
ENSG00000143590 ephrin-A3 [Source:HGNC Symbol;Acc:3223]
ENSG00000243364 ephrin-A4 [Source:HGNC Symbol;Acc:3224]
ENSG00000090776 ephrin-B1 [Source:HGNC Symbol;Acc:3226]
ENSG00000138798 epidermal growth factor [Source:HGNC Symbol;Acc:3229]

ENSG00000146648 epidermal growth factor receptor [Source:HGNC Symbol;Acc:3236]
ENSG00000120738 early growth response 1 [Source:HGNC Symbol;Acc:3238]
ENSG00000122877 early growth response 2 [Source:HGNC Symbol;Acc:3239]
ENSG00000179388 early growth response 3 [Source:HGNC Symbol;Acc:3240]
ENSG00000142627 EPH receptor A2 [Source:HGNC Symbol;Acc:3386]
ENSG00000126767 ELK1, member of ETS oncogene family [Source:HGNC Symbol;Acc:3321]
ENSG00000102119 emerin [Source:HGNC Symbol;Acc:3331]
ENSG00000072518 MAP/microtubule affinity-regulating kinase 2 [Source:HGNC Symbol;Acc:3332]
ENSG00000167136 endonuclease G [Source:HGNC Symbol;Acc:3346]
ENSG00000100393 E1A binding protein p300 [Source:HGNC Symbol;Acc:3373]
ENSG00000116016 endothelial PAS domain protein 1 [Source:HGNC Symbol;Acc:3374]
ENSG00000159023 erythrocyte membrane protein band 4.1 (elliptocytosis 1, RH-linked) [Source:HGNC Symbol;Acc:3377]
ENSG00000154928 EPH receptor B1 [Source:HGNC Symbol;Acc:3392]
ENSG00000133216 EPH receptor B2 [Source:HGNC Symbol;Acc:3393]
ENSG00000187266 erythropoietin receptor [Source:HGNC Symbol;Acc:3416]
ENSG00000104884 excision repair cross-complementing rodent repair deficiency, complementation group 2 [Source:HGNC Symbol;Acc:3434]
ENSG00000163161 excision repair cross-complementing rodent repair deficiency, complementation group 3 (xeroderma pigmentosum group B complementing) [Source:HGNC Syn
ENSG00000134899 excision repair cross-complementing rodent repair deficiency, complementation group 5 [Source:HGNC Symbol;Acc:3437]
ENSG00000157554 v-ets erythroblastosis virus E26 oncogene homolog (avian) [Source:HGNC Symbol;Acc:3446]
ENSG00000178607 endoplasmic reticulum to nucleus signaling 1 [Source:HGNC Symbol;Acc:3449]
ENSG00000091831 estrogen receptor 1 [Source:HGNC Symbol;Acc:3467]
ENSG00000134954 v-ets erythroblastosis virus E26 oncogene homolog 1 (avian) [Source:HGNC Symbol;Acc:3488]
ENSG00000157557 v-ets erythroblastosis virus E26 oncogene homolog 2 (avian) [Source:HGNC Symbol;Acc:3489]
ENSG00000187741 Fanconi anemia, complementation group A [Source:HGNC Symbol;Acc:3582]
ENSG00000144554 Fanconi anemia, complementation group D2 [Source:HGNC Symbol;Acc:3585]
ENSG00000161513 ferredoxin reductase [Source:HGNC Symbol;Acc:3642]
ENSG00000182511 feline sarcoma oncogene [Source:HGNC Symbol;Acc:3657]
ENSG00000000938 Gardner-Rasheed feline sarcoma viral (v-fgr) oncogene homolog [Source:HGNC Symbol;Acc:3697]
ENSG00000118689 forkhead box O3 [Source:HGNC Symbol;Acc:3821]
ENSG00000196924 filamin A, alpha [Source:HGNC Symbol;Acc:3754]
ENSG00000037280 fms-related tyrosine kinase 4 [Source:HGNC Symbol;Acc:3767]
ENSG00000115414 fibronectin 1 [Source:HGNC Symbol;Acc:3778]
ENSG00000168522 farnesyltransferase, CAAX box, alpha [Source:HGNC Symbol;Acc:3782]
ENSG00000170345 FBJ murine osteosarcoma viral oncogene homolog [Source:HGNC Symbol;Acc:3796]
ENSG00000125740 FBJ murine osteosarcoma viral oncogene homolog B [Source:HGNC Symbol;Acc:3797]
ENSG00000075426 FOS-like antigen 2 [Source:HGNC Symbol;Acc:3798]
ENSG00000198793 mechanistic target of rapamycin (serine/threonine kinase) [Source:HGNC Symbol;Acc:3942]
ENSG00000136931 nuclear receptor subfamily 5, group A, member 1 [Source:HGNC Symbol;Acc:7983]
ENSG00000010810 FYN oncogene related to SRC, FGR, YES [Source:HGNC Symbol;Acc:4037]
ENSG00000196419 X-ray repair complementing defective repair in Chinese hamster cells 6 [Source:HGNC Symbol;Acc:4055]
ENSG00000148935 growth arrest-specific 2 [Source:HGNC Symbol;Acc:4167]
ENSG00000108773 K(lysine) acetyltransferase 2A [Source:HGNC Symbol;Acc:4201]
ENSG00000203879 GDP dissociation inhibitor 1 [Source:HGNC Symbol;Acc:4226]
ENSG00000057608 GDP dissociation inhibitor 2 [Source:HGNC Symbol;Acc:4227]
ENSG00000112964 growth hormone receptor [Source:HGNC Symbol;Acc:4263]
ENSG00000175793 stratifin [Source:HGNC Symbol;Acc:10773]
ENSG00000177885 growth factor receptor-bound protein 2 [Source:HGNC Symbol;Acc:4566]
ENSG00000113580 nuclear receptor subfamily 3, group C, member 1 (glucocorticoid receptor) [Source:HGNC Symbol;Acc:7978]
ENSG00000082701 glycogen synthase kinase 3 beta [Source:HGNC Symbol;Acc:4617]
ENSG00000148180 gelsolin [Source:HGNC Symbol;Acc:4620]
ENSG00000084207 glutathione S-transferase pi 1 [Source:HGNC Symbol;Acc:4638]
ENSG00000165417 general transcription factor IIA, 1, 19/37kDa [Source:HGNC Symbol;Acc:4646]
ENSG00000140307 general transcription factor IIA, 2, 12kDa [Source:HGNC Symbol;Acc:4647]
ENSG00000137947 general transcription factor IIB [Source:HGNC Symbol;Acc:4648]
ENSG00000110768 general transcription factor IIH, polypeptide 1, 62kDa [Source:HGNC Symbol;Acc:4655]
ENSG00000145736 general transcription factor IIH, polypeptide 2, 44kDa [Source:HGNC Symbol;Acc:4656]
ENSG00000111358 general transcription factor IIH, polypeptide 3, 34kDa [Source:HGNC Symbol;Acc:4657]
ENSG00000213780 general transcription factor IIH, polypeptide 4, 52kDa [Source:HGNC Symbol;Acc:4658]
ENSG00000185024 BRF1 homolog, subunit of RNA polymerase III transcription initiation factor IIIB (S. cerevisiae) [Source:HGNC Symbol;Acc:11551]
ENSG00000100453 granzyme B (granzyme 2, cytotoxic T-lymphocyte-associated serine esterase 1) [Source:HGNC Symbol;Acc:4709]
ENSG00000188486 H2A histone family, member X [Source:HGNC Symbol;Acc:4739]
ENSG00000116478 histone deacetylase 1 [Source:HGNC Symbol;Acc:4852]
ENSG00000196591 histone deacetylase 2 [Source:HGNC Symbol;Acc:4853]
ENSG00000177374 hypermethylated in cancer 1 [Source:HGNC Symbol;Acc:4909]
ENSG00000100644 hypoxia inducible factor 1, alpha subunit (basic helix-loop-helix transcription factor) [Source:HGNC Symbol;Acc:4910]
ENSG00000127946 huntingtin interacting protein 1 [Source:HGNC Symbol;Acc:4913]
ENSG00000189403 high mobility group box 1 [Source:HGNC Symbol;Acc:4983]
ENSG00000137309 high mobility group AT-hook 1 [Source:HGNC Symbol;Acc:5010]
ENSG00000123358 nuclear receptor subfamily 4, group A, member 1 [Source:HGNC Symbol;Acc:7980]
ENSG00000101076 hepatocyte nuclear factor 4, alpha [Source:HGNC Symbol;Acc:5024]
ENSG00000174775 v-Ha-ras Harvey rat sarcoma viral oncogene homolog [Source:HGNC Symbol;Acc:5173]
ENSG00000126457 protein arginine methyltransferase 1 [Source:HGNC Symbol;Acc:5187]
ENSG00000185122 heat shock transcription factor 1 [Source:HGNC Symbol;Acc:5224]
ENSG00000126803 heat shock 70kDa protein 2 [Source:HGNC Symbol;Acc:5235]
ENSG00000170606 heat shock 70kDa protein 4 [Source:HGNC Symbol;Acc:5237]
ENSG00000109971 heat shock 70kDa protein 8 [Source:HGNC Symbol;Acc:5241]
ENSG00000113013 heat shock 70kDa protein 9 (mortalin) [Source:HGNC Symbol;Acc:5244]
ENSG00000106211 heat shock 27kDa protein 1 [Source:HGNC Symbol;Acc:5246]
ENSG00000080824 heat shock protein 90kDa alpha (cytosolic), class A member 1 [Source:HGNC Symbol;Acc:5253]
ENSG00000090339 intercellular adhesion molecule 1 [Source:HGNC Symbol;Acc:5344]
ENSG00000163565 interferon, gamma-inducible protein 16 [Source:HGNC Symbol;Acc:5395]
ENSG00000111537 interferon, gamma [Source:HGNC Symbol;Acc:5438]
ENSG00000146674 insulin-like growth factor binding protein 3 [Source:HGNC Symbol;Acc:5472]
ENSG00000104365 inhibitor of kappa light polypeptide gene enhancer in B-cells, kinase beta [Source:HGNC Symbol;Acc:5960]
ENSG00000115008 interleukin 1, alpha [Source:HGNC Symbol;Acc:5991]
ENSG00000125538 interleukin 1, beta [Source:HGNC Symbol;Acc:5992]
ENSG00000115594 interleukin 1 receptor, type I [Source:HGNC Symbol;Acc:5993]
ENSG00000196083 interleukin 1 receptor accessory protein [Source:HGNC Symbol;Acc:5995]
ENSG00000136689 interleukin 1 receptor antagonist [Source:HGNC Symbol;Acc:6000]
ENSG00000109471 interleukin 2 [Source:HGNC Symbol;Acc:6001]
ENSG00000134460 interleukin 2 receptor, alpha [Source:HGNC Symbol;Acc:6008]
ENSG00000100385 interleukin 2 receptor, beta [Source:HGNC Symbol;Acc:6009]
ENSG00000147168 interleukin 2 receptor, gamma [Source:HGNC Symbol;Acc:6010]
ENSG00000164399 interleukin 3 (colony-stimulating factor, multiple) [Source:HGNC Symbol;Acc:6011]
ENSG00000185291 interleukin 3 receptor, alpha (low affinity) [Source:HGNC Symbol;Acc:6012]
ENSG00000113520 interleukin 4 [Source:HGNC Symbol;Acc:6014]
ENSG00000113525 interleukin 5 (colony-stimulating factor, eosinophil) [Source:HGNC Symbol;Acc:6016]
ENSG00000091181 interleukin 5 receptor, alpha [Source:HGNC Symbol;Acc:6017]
ENSG00000136244 interleukin 6 (interferon, beta 2) [Source:HGNC Symbol;Acc:6018]
ENSG00000104432 interleukin 7 [Source:HGNC Symbol;Acc:6023]

ENSG00000169429 interleukin 8 [Source:HGNC Symbol;Acc:6025]
ENSG00000145839 interleukin 9 [Source:HGNC Symbol;Acc:6029]
ENSG00000168811 interleukin 12A (natural killer cell stimulatory factor 1, cytotoxic lymphocyte maturation factor 1, p35) [Source:HGNC Symbol;Acc:5969]
ENSG00000113302 interleukin 12B (natural killer cell stimulatory factor 2, cytotoxic lymphocyte maturation factor 2, p40) [Source:HGNC Symbol;Acc:5970]
ENSG00000096996 interleukin 12 receptor, beta 1 [Source:HGNC Symbol;Acc:5971]
ENSG00000081985 interleukin 12 receptor, beta 2 [Source:HGNC Symbol;Acc:5972]
ENSG00000169194 interleukin 13 [Source:HGNC Symbol;Acc:5973]
ENSG00000049249 tumor necrosis factor receptor superfamily, member 9 [Source:HGNC Symbol;Acc:11924]
ENSG00000112115 interleukin 17A [Source:HGNC Symbol;Acc:5981]
ENSG00000150782 interleukin 18 (interferon-gamma-inducing factor) [Source:HGNC Symbol;Acc:5986]
ENSG00000166333 integrin-linked kinase [Source:HGNC Symbol;Acc:6040]
ENSG00000153487 inhibitor of growth family, member 1 [Source:HGNC Symbol;Acc:6062]
ENSG00000168556 inhibitor of growth family, member 2 [Source:HGNC Symbol;Acc:6063]
ENSG00000184216 interleukin-1 receptor-associated kinase 1 [Source:HGNC Symbol;Acc:6112]
ENSG00000091409 integrin, alpha 6 [Source:HGNC Symbol;Acc:6142]
ENSG00000134070 interleukin-1 receptor-associated kinase 2 [Source:HGNC Symbol;Acc:6113]
ENSG00000125347 interferon regulatory factor 1 [Source:HGNC Symbol;Acc:6116]
ENSG00000126456 interferon regulatory factor 3 [Source:HGNC Symbol;Acc:6118]
ENSG00000128604 interferon regulatory factor 5 [Source:HGNC Symbol;Acc:6120]
ENSG00000185507 interferon regulatory factor 7 [Source:HGNC Symbol;Acc:6122]
ENSG00000169047 insulin receptor substrate 1 [Source:HGNC Symbol;Acc:6125]
ENSG00000169896 integrin, alpha M (complement component 3 receptor 3 subunit) [Source:HGNC Symbol;Acc:6149]
ENSG00000138448 integrin, alpha V (vitronectin receptor, alpha polypeptide, antigen CD51) [Source:HGNC Symbol;Acc:6150]
ENSG00000160255 integrin, beta 2 (complement component 3 receptor 3 and 4 subunit) [Source:HGNC Symbol;Acc:6155]
ENSG00000150995 inositol 1,4,5-trisphosphate receptor, type 1 [Source:HGNC Symbol;Acc:6180]
ENSG00000162434 Janus kinase 1 [Source:HGNC Symbol;Acc:6190]
ENSG00000096968 Janus kinase 2 [Source:HGNC Symbol;Acc:6192]
ENSG00000105639 Janus kinase 3 [Source:HGNC Symbol;Acc:6193]
ENSG00000177606 jun proto-oncogene [Source:HGNC Symbol;Acc:6204]
ENSG00000171223 jun B proto-oncogene [Source:HGNC Symbol;Acc:6205]
ENSG00000130522 jun D proto-oncogene [Source:HGNC Symbol;Acc:6206]
ENSG00000085117 CD82 molecule [Source:HGNC Symbol;Acc:6210]
ENSG00000177272 potassium voltage-gated channel, shaker-related subfamily, member 3 [Source:HGNC Symbol;Acc:6221]
ENSG00000075043 potassium voltage-gated channel, KQT-like subfamily, member 2 [Source:HGNC Symbol;Acc:6296]
ENSG00000167768 keratin 1 [Source:HGNC Symbol;Acc:6412]
ENSG00000186081 keratin 5 [Source:HGNC Symbol;Acc:6442]
ENSG00000135480 keratin 7 [Source:HGNC Symbol;Acc:6445]
ENSG00000170421 keratin 8 [Source:HGNC Symbol;Acc:6446]
ENSG00000186847 keratin 14 [Source:HGNC Symbol;Acc:6416]
ENSG00000111057 keratin 18 [Source:HGNC Symbol;Acc:6430]
ENSG00000198910 L1 cell adhesion molecule [Source:HGNC Symbol;Acc:6470]
ENSG00000143815 lamin B receptor [Source:HGNC Symbol;Acc:6518]
ENSG00000182866 lymphocyte-specific protein tyrosine kinase [Source:HGNC Symbol;Acc:6524]
ENSG00000128342 leukemia inhibitory factor (cholinergic differentiation factor) [Source:HGNC Symbol;Acc:6596]
ENSG00000174405 ligase IV, DNA, ATP-dependent [Source:HGNC Symbol;Acc:6601]
ENSG00000106683 LIM domain kinase 1 [Source:HGNC Symbol;Acc:6613]
ENSG00000160789 lamin A/C [Source:HGNC Symbol;Acc:6636]
ENSG00000113368 lamin B1 [Source:HGNC Symbol;Acc:6637]
ENSG00000238130 lymphotoxin alpha (TNF superfamily, member 1) [Source:HGNC Symbol;Acc:6709]
ENSG00000111321 lymphotoxin beta receptor (TNFR superfamily, member 3) [Source:HGNC Symbol;Acc:6718]
ENSG00000183918 SH2 domain containing 1A [Source:HGNC Symbol;Acc:10820]
ENSG00000175387 SMAD family member 2 [Source:HGNC Symbol;Acc:6768]
ENSG00000166949 SMAD family member 3 [Source:HGNC Symbol;Acc:6769]
ENSG00000141646 SMAD family member 4 [Source:HGNC Symbol;Acc:6770]
ENSG00000137834 SMAD family member 6 [Source:HGNC Symbol;Acc:6772]
ENSG00000101665 SMAD family member 7 [Source:HGNC Symbol;Acc:6773]
ENSG00000105695 myelin associated glycoprotein [Source:HGNC Symbol;Acc:6783]
ENSG00000183305 melanoma antigen family A, 2B [Source:HGNC Symbol;Acc:19340]
ENSG00000184750 melanoma antigen family A, 2 [Source:HGNC Symbol;Acc:6800]
ENSG00000131711 microtubule-associated protein 1B [Source:HGNC Symbol;Acc:6836]
ENSG00000125952 MYC associated factor X [Source:HGNC Symbol;Acc:6913]
ENSG00000197971 myelin basic protein [Source:HGNC Symbol;Acc:6925]
ENSG00000143384 myeloid cell leukemia sequence 1 (BCL2-related) [Source:HGNC Symbol;Acc:6943]
ENSG00000100297 minichromosome maintenance complex component 5 [Source:HGNC Symbol;Acc:6948]
ENSG00000166508 minichromosome maintenance complex component 7 [Source:HGNC Symbol;Acc:6950]
ENSG00000135679 Mdm2 p53 binding protein homolog (mouse) [Source:HGNC Symbol;Acc:6973]
ENSG00000198625 Mdm4 p53 binding protein homolog (mouse) [Source:HGNC Symbol;Acc:6974]
ENSG00000081189 myocyte enhancer factor 2C [Source:HGNC Symbol;Acc:6996]
ENSG00000095015 mitogen-activated protein kinase kinase kinase 1 [Source:HGNC Symbol;Acc:6848]
ENSG00000198909 mitogen-activated protein kinase kinase kinase 3 [Source:HGNC Symbol;Acc:6855]
ENSG00000197442 mitogen-activated protein kinase kinase kinase 5 [Source:HGNC Symbol;Acc:6857]
ENSG00000133895 multiple endocrine neoplasia I [Source:HGNC Symbol;Acc:7010]
ENSG00000105976 met proto-oncogene (hepatocyte growth factor receptor) [Source:HGNC Symbol;Acc:7029]
ENSG00000076242 mutL homolog 1, colon cancer, nonpolyposis type 2 (E. coli) [Source:HGNC Symbol;Acc:7127]
ENSG00000173327 mitogen-activated protein kinase kinase kinase 11 [Source:HGNC Symbol;Acc:6850]
ENSG00000196611 matrix metallopeptidase 1 (interstitial collagenase) [Source:HGNC Symbol;Acc:7155]
ENSG00000087245 matrix metallopeptidase 2 (gelatinase A, 72kDa gelatinase, 72kDa type IV collagenase) [Source:HGNC Symbol;Acc:7166]
ENSG00000137673 matrix metallopeptidase 7 (matrilysin, uterine) [Source:HGNC Symbol;Acc:7174]
ENSG00000100985 matrix metallopeptidase 9 (gelatinase B, 92kDa gelatinase, 92kDa type IV collagenase) [Source:HGNC Symbol;Acc:7176]
ENSG00000020426 menage a trois homolog 1, cyclin H assembly factor (Xenopus laevis) [Source:HGNC Symbol;Acc:7181]
ENSG00000020922 MRE11 meiotic recombination 11 homolog A (S. cerevisiae) [Source:HGNC Symbol;Acc:7230]
ENSG00000095002 mutS homolog 2, colon cancer, nonpolyposis type 1 (E. coli) [Source:HGNC Symbol;Acc:7325]
ENSG00000173531 macrophage stimulating 1 (hepatocyte growth factor-like) [Source:HGNC Symbol;Acc:7380]
ENSG00000164078 macrophage stimulating 1 receptor (c-met-related tyrosine kinase) [Source:HGNC Symbol;Acc:7381]
ENSG00000163132 msh homeobox 1 [Source:HGNC Symbol;Acc:7391]
ENSG00000118513 v-myb myeloblastosis viral oncogene homolog (avian) [Source:HGNC Symbol;Acc:7545]
ENSG00000136997 v-myc myelocytomatosis viral oncogene homolog (avian) [Source:HGNC Symbol;Acc:7553]
ENSG00000172936 myeloid differentiation primary response gene (88) [Source:HGNC Symbol;Acc:7562]
ENSG00000065534 myosin light chain kinase [Source:HGNC Symbol;Acc:7590]
ENSG00000129152 myogenic differentiation 1 [Source:HGNC Symbol;Acc:7611]
ENSG00000104320 nibrin [Source:HGNC Symbol;Acc:7652]
ENSG00000149294 neural cell adhesion molecule 1 [Source:HGNC Symbol;Acc:7656]
ENSG00000158092 NCK adaptor protein 1 [Source:HGNC Symbol;Acc:7664]
ENSG00000069869 neural precursor cell expressed, developmentally down-regulated 4 [Source:HGNC Symbol;Acc:7727]
ENSG00000129559 neural precursor cell expressed, developmentally down-regulated 8 [Source:HGNC Symbol;Acc:7732]
ENSG00000131196 nuclear factor of activated T-cells, cytoplasmic, calcineurin-dependent 1 [Source:HGNC Symbol;Acc:7775]
ENSG00000101096 nuclear factor of activated T-cells, cytoplasmic, calcineurin-dependent 2 [Source:HGNC Symbol;Acc:7776]
ENSG00000072736 nuclear factor of activated T-cells, cytoplasmic, calcineurin-dependent 3 [Source:HGNC Symbol;Acc:7777]
ENSG00000109320 nuclear factor of kappa light polypeptide gene enhancer in B-cells 1 [Source:HGNC Symbol;Acc:7794]
ENSG00000077150 nuclear factor of kappa light polypeptide gene enhancer in B-cells 2 (p49/p100) [Source:HGNC Symbol;Acc:7795]

ENSG00000100906 nuclear factor of kappa light polypeptide gene enhancer in B-cells inhibitor, alpha [Source:HGNC Symbol;Acc:7797]
ENSG00000104825 nuclear factor of kappa light polypeptide gene enhancer in B-cells inhibitor, beta [Source:HGNC Symbol;Acc:7798]
ENSG00000146232 nuclear factor of kappa light polypeptide gene enhancer in B-cells inhibitor, epsilon [Source:HGNC Symbol;Acc:7799]
ENSG00000001167 nuclear transcription factor Y, alpha [Source:HGNC Symbol;Acc:7804]
ENSG00000120837 nuclear transcription factor Y, beta [Source:HGNC Symbol;Acc:7805]
ENSG00000066136 nuclear transcription factor Y, gamma [Source:HGNC Symbol;Acc:7806]
ENSG00000134259 nerve growth factor (beta polypeptide) [Source:HGNC Symbol;Acc:7808]
ENSG00000064300 nerve growth factor receptor [Source:HGNC Symbol;Acc:7809]
ENSG00000136448 N-myristoyltransferase 1 [Source:HGNC Symbol;Acc:7857]
ENSG00000007171 nitric oxide synthase 2, inducible [Source:HGNC Symbol;Acc:7873]
ENSG00000148400 notch 1 [Source:HGNC Symbol;Acc:7881]
ENSG00000181163 nucleophosmin (nucleolar phosphoprotein B23, numatrin) [Source:HGNC Symbol;Acc:7910]
ENSG00000091129 neuronal cell adhesion molecule [Source:HGNC Symbol;Acc:7994]
ENSG00000065978 Y box binding protein 1 [Source:HGNC Symbol;Acc:8014]
ENSG00000185652 neurotrophin 3 [Source:HGNC Symbol;Acc:8023]
ENSG00000167744 neurotrophin 4 [Source:HGNC Symbol;Acc:8024]
ENSG00000198400 neurotrophic tyrosine kinase, receptor, type 1 [Source:HGNC Symbol;Acc:8031]
ENSG00000137497 nuclear mitotic apparatus protein 1 [Source:HGNC Symbol;Acc:8059]
ENSG00000164761 tumor necrosis factor receptor superfamily, member 11b [Source:HGNC Symbol;Acc:11909]
ENSG00000115942 origin recognition complex, subunit 2 [Source:HGNC Symbol;Acc:8488]
ENSG00000106366 serpin peptidase inhibitor, clade E (nexin, plasminogen activator inhibitor type 1), member 1 [Source:HGNC Symbol;Acc:8583]
ENSG00000149269 p21 protein (Cdc42/Rac)-activated kinase 1 [Source:HGNC Symbol;Acc:8590]
ENSG00000180370 p21 protein (Cdc42/Rac)-activated kinase 2 [Source:HGNC Symbol;Acc:8591]
ENSG00000077264 p21 protein (Cdc42/Rac)-activated kinase 3 [Source:HGNC Symbol;Acc:8592]
ENSG00000177425 PRKC, apoptosis, WT1, regulator [Source:HGNC Symbol;Acc:8614]
ENSG00000075891 paired box 2 [Source:HGNC Symbol;Acc:8616]
ENSG00000169564 poly(rC) binding protein 1 [Source:HGNC Symbol;Acc:8647]
ENSG00000132646 proliferating cell nuclear antigen [Source:HGNC Symbol;Acc:8729]
ENSG00000167085 prohibitin [Source:HGNC Symbol;Acc:8912]
ENSG00000206075 serpin peptidase inhibitor, clade B (ovalbumin), member 5 [Source:HGNC Symbol;Acc:8949]
ENSG00000121879 phosphoinositide-3-kinase, catalytic, alpha polypeptide [Source:HGNC Symbol;Acc:8975]
ENSG00000137193 pim-1 oncogene [Source:HGNC Symbol;Acc:8986]
ENSG00000145675 phosphoinositide-3-kinase, regulatory subunit 1 (alpha) [Source:HGNC Symbol;Acc:8979]
ENSG00000127445 peptidylprolyl cis/trans isomerase, NIMA-interacting 1 [Source:HGNC Symbol;Acc:8988]
ENSG00000164093 paired-like homeodomain 2 [Source:HGNC Symbol;Acc:9005]
ENSG00000122861 plasminogen activator, urokinase [Source:HGNC Symbol;Acc:9052]
ENSG00000124181 phospholipase C, gamma 1 [Source:HGNC Symbol;Acc:9065]
ENSG00000178209 plectin [Source:HGNC Symbol;Acc:9069]
ENSG00000166851 polo-like kinase 1 [Source:HGNC Symbol;Acc:9077]
ENSG00000141682 phorbol-12-myristate-13-acetate-induced protein 1 [Source:HGNC Symbol;Acc:9108]
ENSG00000140464 promyelocytic leukemia [Source:HGNC Symbol;Acc:9113]
ENSG00000181222 polymerase (RNA) II (DNA directed) polypeptide A, 220kDa [Source:HGNC Symbol;Acc:9187]
ENSG00000047315 polymerase (RNA) II (DNA directed) polypeptide B, 140kDa [Source:HGNC Symbol;Acc:9188]
ENSG00000102978 polymerase (RNA) II (DNA directed) polypeptide C, 33kDa [Source:HGNC Symbol;Acc:9189]
ENSG00000099817 polymerase (RNA) II (DNA directed) polypeptide E, 25kDa [Source:HGNC Symbol;Acc:9192]
ENSG00000100142 polymerase (RNA) II (DNA directed) polypeptide F [Source:HGNC Symbol;Acc:9193]
ENSG00000168002 polymerase (RNA) II (DNA directed) polypeptide G [Source:HGNC Symbol;Acc:9194]
ENSG00000163882 polymerase (RNA) II (DNA directed) polypeptide H [Source:HGNC Symbol;Acc:9195]
ENSG00000005075 polymerase (RNA) II (DNA directed) polypeptide J, 13.3kDa [Source:HGNC Symbol;Acc:9197]
ENSG00000177700 polymerase (RNA) II (DNA directed) polypeptide L, 7.6kDa [Source:HGNC Symbol;Acc:9199]
ENSG00000028277 POU class 2 homeobox 2 [Source:HGNC Symbol;Acc:9213]
ENSG00000152192 POU class 4 homeobox 1 [Source:HGNC Symbol;Acc:9218]
ENSG00000151615 POU class 4 homeobox 2 [Source:HGNC Symbol;Acc:9219]
ENSG00000235068 POU class 5 homeobox 1 [Source:HGNC Symbol;Acc:9221]
ENSG00000204531 POU class 5 homeobox 1 [Source:HGNC Symbol;Acc:9221]
ENSG00000132170 peroxisome proliferator-activated receptor gamma [Source:HGNC Symbol;Acc:9236]
ENSG00000125686 mediator complex subunit 1 [Source:HGNC Symbol;Acc:9234]
ENSG00000100614 protein phosphatase, Mg2+/Mn2+ dependent, 1A [Source:HGNC Symbol;Acc:9275]
ENSG00000138032 protein phosphatase, Mg2+/Mn2+ dependent, 1B [Source:HGNC Symbol;Acc:9276]
ENSG00000172531 protein phosphatase 1, catalytic subunit, alpha isozyme [Source:HGNC Symbol;Acc:9281]
ENSG00000113575 protein phosphatase 2, catalytic subunit, alpha isozyme [Source:HGNC Symbol;Acc:9299]
ENSG00000104695 protein phosphatase 2, catalytic subunit, beta isozyme [Source:HGNC Symbol;Acc:9300]
ENSG00000119383 protein phosphatase 2A activator, regulatory subunit 4 [Source:HGNC Symbol;Acc:9308]
ENSG00000138814 protein phosphatase 3, catalytic subunit, alpha isozyme [Source:HGNC Symbol;Acc:9314]
ENSG00000120910 protein phosphatase 3, catalytic subunit, gamma isozyme [Source:HGNC Symbol;Acc:9316]
ENSG00000221823 protein phosphatase 3, regulatory subunit B, alpha [Source:HGNC Symbol;Acc:9317]
ENSG00000114302 protein kinase, cAMP-dependent, regulatory, type II, alpha [Source:HGNC Symbol;Acc:9391]
ENSG00000154229 protein kinase C, alpha [Source:HGNC Symbol;Acc:9393]
ENSG00000166501 protein kinase C, beta [Source:HGNC Symbol;Acc:9395]
ENSG00000163932 protein kinase C, delta [Source:HGNC Symbol;Acc:9399]
ENSG00000171132 protein kinase C, epsilon [Source:HGNC Symbol;Acc:9401]
ENSG00000163558 protein kinase C, iota [Source:HGNC Symbol;Acc:9404]
ENSG00000065243 protein kinase N2 [Source:HGNC Symbol;Acc:9406]
ENSG00000184304 protein kinase D1 [Source:HGNC Symbol;Acc:9407]
ENSG00000065675 protein kinase C, theta [Source:HGNC Symbol;Acc:9410]
ENSG00000067606 protein kinase C, zeta [Source:HGNC Symbol;Acc:9412]
ENSG00000100030 mitogen-activated protein kinase 1 [Source:HGNC Symbol;Acc:6871]
ENSG00000102882 mitogen-activated protein kinase 3 [Source:HGNC Symbol;Acc:6877]
ENSG00000107643 mitogen-activated protein kinase 8 [Source:HGNC Symbol;Acc:6881]
ENSG00000185386 mitogen-activated protein kinase 11 [Source:HGNC Symbol;Acc:6873]
ENSG00000050748 mitogen-activated protein kinase 9 [Source:HGNC Symbol;Acc:6886]
ENSG00000109339 mitogen-activated protein kinase 10 [Source:HGNC Symbol;Acc:6872]
ENSG00000156711 mitogen-activated protein kinase 13 [Source:HGNC Symbol;Acc:6875]
ENSG00000169032 mitogen-activated protein kinase kinase 1 [Source:HGNC Symbol;Acc:6840]
ENSG00000126934 mitogen-activated protein kinase kinase 2 [Source:HGNC Symbol;Acc:6842]
ENSG00000034152 mitogen-activated protein kinase kinase 3 [Source:HGNC Symbol;Acc:6843]
ENSG00000108984 mitogen-activated protein kinase kinase 6 [Source:HGNC Symbol;Acc:6846]
ENSG00000076984 mitogen-activated protein kinase kinase 7 [Source:HGNC Symbol;Acc:6847]
ENSG00000055332 eukaryotic translation initiation factor 2-alpha kinase 2 [Source:HGNC Symbol;Acc:9437]
ENSG00000080815 presenilin 1 [Source:HGNC Symbol;Acc:9508]
ENSG00000129084 proteasome (prosome, macropain) subunit, alpha type, 1 [Source:HGNC Symbol;Acc:9530]
ENSG00000106588 proteasome (prosome, macropain) subunit, alpha type, 2 [Source:HGNC Symbol;Acc:9531]
ENSG00000136930 proteasome (prosome, macropain) subunit, beta type, 7 [Source:HGNC Symbol;Acc:9544]
ENSG00000101843 proteasome (prosome, macropain) 26S subunit, non-ATPase, 10 [Source:HGNC Symbol;Acc:9555]
ENSG00000185627 proteasome (prosome, macropain) 26S subunit, non-ATPase, 13 [Source:HGNC Symbol;Acc:9558]
ENSG00000171862 phosphatase and tensin homolog [Source:HGNC Symbol;Acc:9588]
ENSG00000073756 prostaglandin-endoperoxide synthase 2 (prostaglandin G/H synthase and cyclooxygenase) [Source:HGNC Symbol;Acc:9605]
ENSG00000169398 PTK2 protein tyrosine kinase 2 [Source:HGNC Symbol;Acc:9611]
ENSG00000196396 protein tyrosine phosphatase, non-receptor type 1 [Source:HGNC Symbol;Acc:9642]
ENSG00000111679 protein tyrosine phosphatase, non-receptor type 6 [Source:HGNC Symbol;Acc:9658]

ENSG00000179295 protein tyrosine phosphatase, non-receptor type 11 [Source:HGNC Symbol;Acc:9644]
ENSG00000163629 protein tyrosine phosphatase, non-receptor type 13 (APO-1/CD95 (Fas)-associated phosphatase) [Source:HGNC Symbol;Acc:9646]
ENSG00000089159 paxillin [Source:HGNC Symbol;Acc:9718]
ENSG00000168067 mitogen-activated protein kinase kinase kinase 2 [Source:HGNC Symbol;Acc:6864]
ENSG00000136238 ras-related C3 botulinum toxin substrate 1 (rho family, small GTP binding protein Rac1) [Source:HGNC Symbol;Acc:9801]
ENSG00000128340 ras-related C3 botulinum toxin substrate 2 (rho family, small GTP binding protein Rac2) [Source:HGNC Symbol;Acc:9802]
ENSG00000169750 ras-related C3 botulinum toxin substrate 3 (rho family, small GTP binding protein Rac3) [Source:HGNC Symbol;Acc:9803]
ENSG00000172613 RAD9 homolog A (S. pombe) [Source:HGNC Symbol;Acc:9827]
ENSG00000152942 RAD17 homolog (S. pombe) [Source:HGNC Symbol;Acc:9807]
ENSG00000051180 RAD51 homolog (S. cerevisiae) [Source:HGNC Symbol;Acc:9817]
ENSG00000132155 v-raf-1 murine leukemia viral oncogene homolog 1 [Source:HGNC Symbol;Acc:9829]
ENSG00000132341 RAN, member RAS oncogene family [Source:HGNC Symbol;Acc:9846]
ENSG00000139687 retinoblastoma 1 [Source:HGNC Symbol;Acc:9884]
ENSG00000032219 AT rich interactive domain 4A (RBP1-like) [Source:HGNC Symbol;Acc:9885]
ENSG00000073614 lysine (K)-specific demethylase 5A [Source:HGNC Symbol;Acc:9886]
ENSG00000162521 retinoblastoma binding protein 4 [Source:HGNC Symbol;Acc:9887]
ENSG00000117222 retinoblastoma binding protein 5 [Source:HGNC Symbol;Acc:9888]
ENSG00000122257 retinoblastoma binding protein 6 [Source:HGNC Symbol;Acc:9889]
ENSG00000102054 retinoblastoma binding protein 7 [Source:HGNC Symbol;Acc:9890]
ENSG00000101773 retinoblastoma binding protein 8 [Source:HGNC Symbol;Acc:9891]
ENSG00000080839 retinoblastoma-like 1 (p107) [Source:HGNC Symbol;Acc:9893]
ENSG00000107618 retinol binding protein 3, interstitial [Source:HGNC Symbol;Acc:9921]
ENSG00000162924 v-rel reticuloendotheliosis viral oncogene homolog (avian) [Source:HGNC Symbol;Acc:9954]
ENSG00000173039 v-rel reticuloendotheliosis viral oncogene homolog A (avian) [Source:HGNC Symbol;Acc:9955]
ENSG00000104856 v-rel reticuloendotheliosis viral oncogene homolog B [Source:HGNC Symbol;Acc:9956]
ENSG00000035928 replication factor C (activator 1) 1, 145kDa [Source:HGNC Symbol;Acc:9969]
ENSG00000132383 replication protein A1, 70kDa [Source:HGNC Symbol;Acc:10289]
ENSG00000122406 ribosomal protein L5 [Source:HGNC Symbol;Acc:10360]
ENSG00000142676 ribosomal protein L11 [Source:HGNC Symbol;Acc:10301]
ENSG00000105640 ribosomal protein L18a [Source:HGNC Symbol;Acc:10311]
ENSG00000117676 ribosomal protein S6 kinase, 90kDa, polypeptide 1 [Source:HGNC Symbol;Acc:10430]
ENSG00000143947 ribosomal protein S27a [Source:HGNC Symbol;Acc:10417]
ENSG00000186350 retinoid X receptor, alpha [Source:HGNC Symbol;Acc:10477]
ENSG00000143171 retinoid X receptor, gamma [Source:HGNC Symbol;Acc:10479]
ENSG00000160678 S100 calcium binding protein A1 [Source:HGNC Symbol;Acc:10486]
ENSG00000134243 sortilin 1 [Source:HGNC Symbol;Acc:11186]
ENSG00000196754 S100 calcium binding protein A2 [Source:HGNC Symbol;Acc:10492]
ENSG00000196154 S100 calcium binding protein A4 [Source:HGNC Symbol;Acc:10494]
ENSG00000197956 S100 calcium binding protein A6 [Source:HGNC Symbol;Acc:10496]
ENSG00000160307 S100 calcium binding protein B [Source:HGNC Symbol;Acc:10500]
ENSG00000188130 mitogen-activated protein kinase 12 [Source:HGNC Symbol;Acc:6874]
ENSG00000182568 SATB homeobox 1 [Source:HGNC Symbol;Acc:10541]
ENSG00000161570 chemokine (C-C motif) ligand 5 [Source:HGNC Symbol;Acc:10632]
ENSG00000007908 selectin E [Source:HGNC Symbol;Acc:10718]
ENSG00000065559 mitogen-activated protein kinase kinase 4 [Source:HGNC Symbol;Acc:6844]
ENSG00000160691 SHC (Src homology 2 domain containing) transforming protein 1 [Source:HGNC Symbol;Acc:10840]
ENSG00000196470 seven in absentia homolog 1 (Drosophila) [Source:HGNC Symbol;Acc:10857]
ENSG00000113558 S-phase kinase-associated protein 1 [Source:HGNC Symbol;Acc:10899]
ENSG00000145604 S-phase kinase-associated protein 2 (p45) [Source:HGNC Symbol;Acc:10901]
ENSG00000019549 snail homolog 2 (Drosophila) [Source:HGNC Symbol;Acc:11094]
ENSG00000080503 SWI/SNF related, matrix associated, actin dependent regulator of chromatin, subfamily a, member 2 [Source:HGNC Symbol;Acc:11098]
ENSG00000127616 SWI/SNF related, matrix associated, actin dependent regulator of chromatin, subfamily a, member 4 [Source:HGNC Symbol;Acc:11100]
ENSG00000099956 SWI/SNF related, matrix associated, actin dependent regulator of chromatin, subfamily b, member 1 [Source:HGNC Symbol;Acc:11103]
ENSG00000205571 survival of motor neuron 2, centromeric [Source:HGNC Symbol;Acc:11118]
ENSG00000172062 survival of motor neuron 1, telomeric [Source:HGNC Symbol;Acc:11117]
ENSG00000205571 survival of motor neuron 2, centromeric [Source:HGNC Symbol;Acc:11118]
ENSG00000172062 survival of motor neuron 1, telomeric [Source:HGNC Symbol;Acc:11117]
ENSG00000166311 sphingomyelin phosphodiesterase 1, acid lysosomal [Source:HGNC Symbol;Acc:11120]
ENSG00000135587 sphingomyelin phosphodiesterase 2, neutral membrane (neutral sphingomyelinase) [Source:HGNC Symbol;Acc:11121]
ENSG00000145335 synuclein, alpha (non A4 component of amyloid precursor) [Source:HGNC Symbol;Acc:11138]
ENSG00000142168 superoxide dismutase 1, soluble [Source:HGNC Symbol;Acc:11179]
ENSG00000115904 son of sevenless homolog 1 (Drosophila) [Source:HGNC Symbol;Acc:11187]
ENSG00000185591 Sp1 transcription factor [Source:HGNC Symbol;Acc:11205]
ENSG00000066336 spleen focus forming virus (SFFV) proviral integration oncogene spi1 [Source:HGNC Symbol;Acc:11241]
ENSG00000163554 spectrin, alpha, erythrocytic 1 (elliptocytosis 2) [Source:HGNC Symbol;Acc:11272]
ENSG00000197694 spectrin, alpha, non-erythrocytic 1 (alpha-fodrin) [Source:HGNC Symbol;Acc:11273]
ENSG00000070182 spectrin, beta, erythrocytic [Source:HGNC Symbol;Acc:11274]
ENSG00000115306 spectrin, beta, non-erythrocytic 1 [Source:HGNC Symbol;Acc:11275]
ENSG00000173898 spectrin, beta, non-erythrocytic 2 [Source:HGNC Symbol;Acc:11276]
ENSG00000197122 v-src sarcoma (Schmidt-Ruppin A-2) viral oncogene homolog (avian) [Source:HGNC Symbol;Acc:11283]
ENSG00000072310 sterol regulatory element binding transcription factor 1 [Source:HGNC Symbol;Acc:11289]
ENSG00000115415 signal transducer and activator of transcription 1, 91kDa [Source:HGNC Symbol;Acc:11362]
ENSG00000168610 signal transducer and activator of transcription 3 (acute-phase response factor) [Source:HGNC Symbol;Acc:11364]
ENSG00000138378 signal transducer and activator of transcription 4 [Source:HGNC Symbol;Acc:11365]
ENSG00000166888 signal transducer and activator of transcription 6, interleukin-4 induced [Source:HGNC Symbol;Acc:11368]
ENSG00000101109 serine/threonine kinase 4 [Source:HGNC Symbol;Acc:11408]
ENSG00000087586 aurora kinase A [Source:HGNC Symbol;Acc:11393]
ENSG00000118046 serine/threonine kinase 11 [Source:HGNC Symbol;Acc:11389]
ENSG00000101945 suppressor of variegation 3-9 homolog 1 (Drosophila) [Source:HGNC Symbol;Acc:11479]
ENSG00000165025 spleen tyrosine kinase [Source:HGNC Symbol;Acc:11491]
ENSG00000147133 TAF1 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 250kDa [Source:HGNC Symbol;Acc:11535]
ENSG00000130699 TAF4 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 135kDa [Source:HGNC Symbol;Acc:11537]
ENSG00000148835 TAF5 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 100kDa [Source:HGNC Symbol;Acc:11539]
ENSG00000106290 TAF6 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 80kDa [Source:HGNC Symbol;Acc:11540]
ENSG00000178913 TAF7 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 55kDa [Source:HGNC Symbol;Acc:11541]
ENSG00000085231 TAF9 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 32kDa [Source:HGNC Symbol;Acc:11542]
ENSG00000166337 TAF10 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 30kDa [Source:HGNC Symbol;Acc:11543]
ENSG00000135341 mitogen-activated protein kinase kinase kinase 7 [Source:HGNC Symbol;Acc:6859]
ENSG00000184144 contactin 2 (axonal) [Source:HGNC Symbol;Acc:2172]
ENSG00000112592 TATA box binding protein [Source:HGNC Symbol;Acc:11588]
ENSG00000196628 transcription factor 4 [Source:HGNC Symbol;Acc:11634]
ENSG00000071564 transcription factor 3 (E2A immunoglobulin enhancer binding factors E12/E47) [Source:HGNC Symbol;Acc:11633]
ENSG00000148737 transcription factor 7-like 2 (T-cell specific, HMG-box) [Source:HGNC Symbol;Acc:11641]
ENSG00000139644 transmembrane BAX inhibitor motif containing 6 [Source:HGNC Symbol;Acc:11723]
ENSG00000132604 telomeric repeat binding factor 2 [Source:HGNC Symbol;Acc:11729]
ENSG00000164362 telomerase reverse transcriptase [Source:HGNC Symbol;Acc:11730]
ENSG00000137203 transcription factor AP-2 alpha (activating enhancer binding protein 2 alpha) [Source:HGNC Symbol;Acc:11742]
ENSG00000198176 transcription factor Dp-1 [Source:HGNC Symbol;Acc:11749]
ENSG00000114126 transcription factor Dp-2 (E2F dimerization partner 2) [Source:HGNC Symbol;Acc:11751]
ENSG00000163235 transforming growth factor, alpha [Source:HGNC Symbol;Acc:11765]

ENSG00000106799 transforming growth factor, beta receptor 1 [Source:HGNC Symbol;Acc:11772]
ENSG00000163513 transforming growth factor, beta receptor II (70/80kDa) [Source:HGNC Symbol;Acc:11773]
ENSG00000102265 TIMP metallopeptidase inhibitor 1 [Source:HGNC Symbol;Acc:11820]
ENSG00000137462 toll-like receptor 2 [Source:HGNC Symbol;Acc:11848]
ENSG00000164342 toll-like receptor 3 [Source:HGNC Symbol;Acc:11849]
ENSG00000136869 toll-like receptor 4 [Source:HGNC Symbol;Acc:11850]
ENSG00000187554 toll-like receptor 5 [Source:HGNC Symbol;Acc:11851]
ENSG00000120802 thymopoietin [Source:HGNC Symbol;Acc:11875]
ENSG00000228321 tumor necrosis factor [Source:HGNC Symbol;Acc:11892]
ENSG00000232810 tumor necrosis factor [Source:HGNC Symbol;Acc:11892]
ENSG00000118503 tumor necrosis factor, alpha-induced protein 3 [Source:HGNC Symbol;Acc:11896]
ENSG00000067182 tumor necrosis factor receptor superfamily, member 1A [Source:HGNC Symbol;Acc:11916]
ENSG00000028137 tumor necrosis factor receptor superfamily, member 1B [Source:HGNC Symbol;Acc:11917]
ENSG00000198900 topoisomerase (DNA) I [Source:HGNC Symbol;Acc:11986]
ENSG00000131747 topoisomerase (DNA) II alpha 170kDa [Source:HGNC Symbol;Acc:11989]
ENSG00000141510 tumor protein p53 [Source:HGNC Symbol;Acc:11998]
ENSG00000067369 tumor protein p53 binding protein 1 [Source:HGNC Symbol;Acc:11999]
ENSG00000143514 tumor protein p53 binding protein, 2 [Source:HGNC Symbol;Acc:12000]
ENSG00000078900 tumor protein p73 [Source:HGNC Symbol;Acc:12003]
ENSG00000056558 TNF receptor-associated factor 1 [Source:HGNC Symbol;Acc:12031]
ENSG00000127191 TNF receptor-associated factor 2 [Source:HGNC Symbol;Acc:12032]
ENSG00000131323 TNF receptor-associated factor 3 [Source:HGNC Symbol;Acc:12033]
ENSG00000175104 TNF receptor-associated factor 6 [Source:HGNC Symbol;Acc:12036]
ENSG00000087077 thyroid hormone receptor interactor 6 [Source:HGNC Symbol;Acc:12311]
ENSG00000165699 tuberous sclerosis 1 [Source:HGNC Symbol;Acc:12362]
ENSG00000103197 tuberous sclerosis 2 [Source:HGNC Symbol;Acc:12363]
ENSG00000186827 tumor necrosis factor receptor superfamily, member 4 [Source:HGNC Symbol;Acc:11918]
ENSG00000136810 thioredoxin [Source:HGNC Symbol;Acc:12435]
ENSG00000105397 tyrosine kinase 2 [Source:HGNC Symbol;Acc:12440]
ENSG00000107165 tyrosinase-related protein 1 [Source:HGNC Symbol;Acc:12450]
ENSG00000221983 ubiquitin A-52 residue ribosomal protein fusion product 1 [Source:HGNC Symbol;Acc:12458]
ENSG00000170315 ubiquitin B [Source:HGNC Symbol;Acc:12463]
ENSG00000150991 ubiquitin C [Source:HGNC Symbol;Acc:12468]
ENSG00000131508 ubiquitin-conjugating enzyme E2D 2 [Source:HGNC Symbol;Acc:12475]
ENSG00000103275 ubiquitin-conjugating enzyme E2I [Source:HGNC Symbol;Acc:12485]
ENSG00000177889 ubiquitin-conjugating enzyme E2N [Source:HGNC Symbol;Acc:12492]
ENSG00000114062 ubiquitin protein ligase E3A [Source:HGNC Symbol;Acc:12496]
ENSG00000116030 SMT3 suppressor of mif two 3 homolog 1 (S. cerevisiae) [Source:HGNC Symbol;Acc:12502]
ENSG00000108312 upstream binding transcription factor, RNA polymerase I [Source:HGNC Symbol;Acc:12511]
ENSG00000154277 ubiquitin carboxyl-terminal esterase L1 (ubiquitin thiolesterase) [Source:HGNC Symbol;Acc:12513]
ENSG00000158773 upstream transcription factor 1 [Source:HGNC Symbol;Acc:12593]
ENSG00000141968 vav 1 guanine nucleotide exchange factor [Source:HGNC Symbol;Acc:12657]
ENSG00000213585 voltage-dependent anion channel 1 [Source:HGNC Symbol;Acc:12669]
ENSG00000111424 vitamin D (1,25- dihydroxyvitamin D3) receptor [Source:HGNC Symbol;Acc:12679]
ENSG00000150630 vascular endothelial growth factor C [Source:HGNC Symbol;Acc:12682]
ENSG00000134086 von Hippel-Lindau tumor suppressor [Source:HGNC Symbol;Acc:12687]
ENSG00000092820 ezrin [Source:HGNC Symbol;Acc:12691]
ENSG00000026025 vimentin [Source:HGNC Symbol;Acc:12692]
ENSG00000100749 vaccinia related kinase 1 [Source:HGNC Symbol;Acc:12718]
ENSG00000125084 wingless-type MMTV integration site family, member 1 [Source:HGNC Symbol;Acc:12774]
ENSG00000165392 Werner syndrome, RecQ helicase-like [Source:HGNC Symbol;Acc:12791]
ENSG00000184937 Wilms tumor 1 [Source:HGNC Symbol;Acc:12796]
ENSG00000082898 exportin 1 (CRM1 homolog, yeast) [Source:HGNC Symbol;Acc:12825]
ENSG00000073050 X-ray repair complementing defective repair in Chinese hamster cells 1 [Source:HGNC Symbol;Acc:12828]
ENSG00000079246 X-ray repair complementing defective repair in Chinese hamster cells 5 (double-strand-break rejoining) [Source:HGNC Symbol;Acc:12833]
ENSG00000176105 v-yes-1 Yamaguchi sarcoma viral oncogene homolog 1 [Source:HGNC Symbol;Acc:12841]
ENSG00000100811 YY1 transcription factor [Source:HGNC Symbol;Acc:12856]
ENSG00000166913 tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein, beta polypeptide [Source:HGNC Symbol;Acc:12849]
ENSG00000108953 tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein, epsilon polypeptide [Source:HGNC Symbol;Acc:12851]
ENSG00000170027 tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein, gamma polypeptide [Source:HGNC Symbol;Acc:12852]
ENSG00000128245 tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein, eta polypeptide [Source:HGNC Symbol;Acc:12853]
ENSG00000164924 tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein, zeta polypeptide [Source:HGNC Symbol;Acc:12855]
ENSG00000056661 polycomb group ring finger 2 [Source:HGNC Symbol;Acc:12929]
ENSG00000116809 zinc finger and BTB domain containing 17 [Source:HGNC Symbol;Acc:12936]
ENSG00000107372 zinc finger, AN1-type domain 5 [Source:HGNC Symbol;Acc:13008]
ENSG00000159388 BTG family, member 2 [Source:HGNC Symbol;Acc:1131]
ENSG00000115590 interleukin 1 receptor, type II [Source:HGNC Symbol;Acc:5994]
ENSG00000187555 ubiquitin specific peptidase 7 (herpes virus-associated) [Source:HGNC Symbol;Acc:12630]
ENSG00000127922 split hand/foot malformation (ectrodactyly) type 1 [Source:HGNC Symbol;Acc:10845]
ENSG00000175592 FOS-like antigen 1 [Source:HGNC Symbol;Acc:13718]
ENSG00000149948 high mobility group AT-hook 2 [Source:HGNC Symbol;Acc:5009]
ENSG00000196793 zinc finger protein 239 [Source:HGNC Symbol;Acc:13031]
ENSG00000124151 nuclear receptor coactivator 3 [Source:HGNC Symbol;Acc:7670]
ENSG00000180530 nuclear receptor interacting protein 1 [Source:HGNC Symbol;Acc:8001]
ENSG00000102226 ubiquitin specific peptidase 11 [Source:HGNC Symbol;Acc:12609]
ENSG00000072501 structural maintenance of chromosomes 1A [Source:HGNC Symbol;Acc:11111]
ENSG00000196367 transformation/transcription domain-associated protein [Source:HGNC Symbol;Acc:12347]
ENSG00000103126 axin 1 [Source:HGNC Symbol;Acc:903]
ENSG00000035681 neutral sphingomyelinase (N-SMase) activation associated factor [Source:HGNC Symbol;Acc:8017]
ENSG00000071051 NCK adaptor protein 2 [Source:HGNC Symbol;Acc:7665]
ENSG00000127334 dual-specificity tyrosine-(Y)-phosphorylation regulated kinase 2 [Source:HGNC Symbol;Acc:3093]
ENSG00000055130 cullin 1 [Source:HGNC Symbol;Acc:2551]
ENSG00000196284 suppressor of Ty 3 homolog (S. cerevisiae) [Source:HGNC Symbol;Acc:11466]
ENSG00000011566 mitogen-activated protein kinase kinase kinase kinase 3 [Source:HGNC Symbol;Acc:6865]
ENSG00000170836 protein phosphatase, Mg2+/Mn2+ dependent, 1D [Source:HGNC Symbol;Acc:9277]
ENSG00000073009 inhibitor of kappa light polypeptide gene enhancer in B-cells, kinase gamma [Source:HGNC Symbol;Acc:5961]
ENSG00000070061 inhibitor of kappa light polypeptide gene enhancer in B-cells, kinase complex-associated protein [Source:HGNC Symbol;Acc:5959]
ENSG00000149091 diacylglycerol kinase, zeta [Source:HGNC Symbol;Acc:2857]
ENSG00000141582 chromobox homolog 4 [Source:HGNC Symbol;Acc:1554]
ENSG00000033800 protein inhibitor of activated STAT, 1 [Source:HGNC Symbol;Acc:2752]
ENSG00000110514 MAP-kinase activating death domain [Source:HGNC Symbol;Acc:6766]
ENSG00000131435 PDZ and LIM domain 4 [Source:HGNC Symbol;Acc:16501]
ENSG00000120659 tumor necrosis factor (ligand) superfamily, member 11 [Source:HGNC Symbol;Acc:11926]
ENSG00000073282 tumor protein p63 [Source:HGNC Symbol;Acc:15979]
ENSG00000084676 nuclear receptor coactivator 1 [Source:HGNC Symbol;Acc:7668]
ENSG00000185338 suppressor of cytokine signaling 1 [Source:HGNC Symbol;Acc:19383]
ENSG00000088986 dynein, light chain, LC8-type 1 [Source:HGNC Symbol;Acc:15476]
ENSG00000185950 insulin receptor substrate 2 [Source:HGNC Symbol;Acc:6126]
ENSG00000126581 beclin 1, autophagy related [Source:HGNC Symbol;Acc:1034]
ENSG00000162734 phosphoprotein enriched in astrocytes 15 [Source:HGNC Symbol;Acc:8822]

ENSG00000102871 TNFRSF1A-associated via death domain [Source:HGNC Symbol;Acc:12030]
ENSG00000215788 tumor necrosis factor receptor superfamily, member 25 [Source:HGNC Symbol;Acc:11910]
ENSG00000137275 receptor (TNFRSF)-interacting serine-threonine kinase 1 [Source:HGNC Symbol;Acc:10019]
ENSG00000169372 CASP2 and RIPK1 domain containing adaptor with death domain [Source:HGNC Symbol;Acc:2340]
ENSG00000135116 harakiri, BCL2 interacting protein (contains only BH3 domain) [Source:HGNC Symbol;Acc:5185]
ENSG00000121858 tumor necrosis factor (ligand) superfamily, member 10 [Source:HGNC Symbol;Acc:11925]
ENSG00000157873 tumor necrosis factor receptor superfamily, member 14 [Source:HGNC Symbol;Acc:11912]
ENSG00000104312 receptor-interacting serine-threonine kinase 2 [Source:HGNC Symbol;Acc:10020]
ENSG00000243509 tumor necrosis factor receptor superfamily, member 6b, decoy [Source:HGNC Symbol;Acc:11921]
ENSG00000168040 Fas (TNFRSF6)-associated via death domain [Source:HGNC Symbol;Acc:3573]
ENSG00000141655 tumor necrosis factor receptor superfamily, member 11a, NFKB activator [Source:HGNC Symbol;Acc:11908]
ENSG00000173530 tumor necrosis factor receptor superfamily, member 10d, decoy with truncated death domain [Source:HGNC Symbol;Acc:11907]
ENSG00000173535 tumor necrosis factor receptor superfamily, member 10c, decoy without an intracellular domain [Source:HGNC Symbol;Acc:11906]
ENSG00000120889 tumor necrosis factor receptor superfamily, member 10b [Source:HGNC Symbol;Acc:11905]
ENSG00000104689 tumor necrosis factor receptor superfamily, member 10a [Source:HGNC Symbol;Acc:11904]
ENSG00000115607 interleukin 18 receptor accessory protein [Source:HGNC Symbol;Acc:5989]
ENSG00000115598 interleukin 1 receptor-like 2 [Source:HGNC Symbol;Acc:5999]
ENSG00000115604 interleukin 18 receptor 1 [Source:HGNC Symbol;Acc:5988]
ENSG00000090061 cyclin K [Source:HGNC Symbol;Acc:1596]
ENSG00000175334 barrier to autointegration factor 1 [Source:HGNC Symbol;Acc:17397]
ENSG00000003402 CASP8 and FADD-like apoptosis regulator [Source:HGNC Symbol;Acc:1876]
ENSG00000171720 histone deacetylase 3 [Source:HGNC Symbol;Acc:4854]
ENSG00000114166 K(lysine) acetyltransferase 2B [Source:HGNC Symbol;Acc:8638]
ENSG00000176749 cyclin-dependent kinase 5, regulatory subunit 1 (p35) [Source:HGNC Symbol;Acc:1775]
ENSG00000102606 Rho guanine nucleotide exchange factor (GEF) 7 [Source:HGNC Symbol;Acc:15607]
ENSG00000176170 sphingosine kinase 1 [Source:HGNC Symbol;Acc:11240]
ENSG00000161011 sequestosome 1 [Source:HGNC Symbol;Acc:11280]
ENSG00000133101 cyclin A1 [Source:HGNC Symbol;Acc:1577]
ENSG00000142867 B-cell CLL/lymphoma 10 [Source:HGNC Symbol;Acc:989]
ENSG00000160973 forkhead box H1 [Source:HGNC Symbol;Acc:3814]
ENSG00000129071 methyl-CpG binding domain protein 4 [Source:HGNC Symbol;Acc:6919]
ENSG00000112290 WAS protein family, member 1 [Source:HGNC Symbol;Acc:12732]
ENSG00000166167 beta-transducin repeat containing [Source:HGNC Symbol;Acc:1144]
ENSG00000140939 nucleolar protein 3 (apoptosis repressor with CARD domain) [Source:HGNC Symbol;Acc:7869]
ENSG00000006062 mitogen-activated protein kinase kinase kinase 14 [Source:HGNC Symbol;Acc:6853]
ENSG00000008294 sperm associated antigen 9 [Source:HGNC Symbol;Acc:14524]
ENSG00000103423 DnaJ (Hsp40) homolog, subfamily A, member 3 [Source:HGNC Symbol;Acc:11808]
ENSG00000182979 metastasis associated 1 [Source:HGNC Symbol;Acc:7410]
ENSG00000156709 apoptosis-inducing factor, mitochondrion-associated, 1 [Source:HGNC Symbol;Acc:8768]
ENSG00000175305 cyclin E2 [Source:HGNC Symbol;Acc:1590]
ENSG00000064547 lysophosphatidic acid receptor 2 [Source:HGNC Symbol;Acc:3168]
ENSG00000115602 interleukin 1 receptor-like 1 [Source:HGNC Symbol;Acc:5998]
ENSG00000158796 death effector domain containing [Source:HGNC Symbol;Acc:2755]
ENSG00000164611 pituitary tumor-transforming 1 [Source:HGNC Symbol;Acc:9690]
ENSG00000100784 ribosomal protein S6 kinase, 90kDa, polypeptide 5 [Source:HGNC Symbol;Acc:10434]
ENSG00000136826 Kruppel-like factor 4 (gut) [Source:HGNC Symbol;Acc:6348]
ENSG00000137962 Rho GTPase activating protein 29 [Source:HGNC Symbol;Acc:30207]
ENSG00000112282 mediator complex subunit 23 [Source:HGNC Symbol;Acc:2372]
ENSG00000042429 mediator complex subunit 17 [Source:HGNC Symbol;Acc:2375]
ENSG00000155868 mediator complex subunit 7 [Source:HGNC Symbol;Acc:2378]
ENSG00000071054 mitogen-activated protein kinase kinase kinase kinase 4 [Source:HGNC Symbol;Acc:6866]
ENSG00000129675 Rac/Cdc42 guanine nucleotide exchange factor (GEF) 6 [Source:HGNC Symbol;Acc:685]
ENSG00000057663 ATG5 autophagy related 5 homolog (S. cerevisiae) [Source:HGNC Symbol;Acc:589]
ENSG00000134318 Rho-associated, coiled-coil containing protein kinase 2 [Source:HGNC Symbol;Acc:10252]
ENSG00000121653 mitogen-activated protein kinase 8 interacting protein 1 [Source:HGNC Symbol;Acc:6882]
ENSG00000179222 melanoma antigen family D, 1 [Source:HGNC Symbol;Acc:6813]
ENSG00000130513 growth differentiation factor 15 [Source:HGNC Symbol;Acc:30142]
ENSG00000156735 BCL2-associated athanogene 4 [Source:HGNC Symbol;Acc:940]
ENSG00000151929 BCL2-associated athanogene 3 [Source:HGNC Symbol;Acc:939]
ENSG00000115129 tumor protein p53 inducible protein 3 [Source:HGNC Symbol;Acc:19373]
ENSG00000113648 H2A histone family, member Y [Source:HGNC Symbol;Acc:4740]
ENSG00000050820 breast cancer anti-estrogen resistance 1 [Source:HGNC Symbol;Acc:971]
ENSG00000196498 nuclear receptor corepressor 2 [Source:HGNC Symbol;Acc:7673]
ENSG00000143466 inhibitor of kappa light polypeptide gene enhancer in B-cells, kinase epsilon [Source:HGNC Symbol;Acc:14552]
ENSG00000206481 mediator of DNA-damage checkpoint 1 [Source:HGNC Symbol;Acc:21163]
ENSG00000075856 squamous cell carcinoma antigen recognized by T cells 3 [Source:HGNC Symbol;Acc:16860]
ENSG00000048052 histone deacetylase 9 [Source:HGNC Symbol;Acc:14065]
ENSG00000065613 STE20-like kinase [Source:HGNC Symbol;Acc:11088]
ENSG00000187391 membrane associated guanylate kinase, WW and PDZ domain containing 2 [Source:HGNC Symbol;Acc:18957]
ENSG00000100726 TEL2, telomere maintenance 2, homolog (S. cerevisiae) [Source:HGNC Symbol;Acc:29099]
ENSG00000204103 v-maf musculoaponeurotic fibrosarcoma oncogene homolog B (avian) [Source:HGNC Symbol;Acc:6408]
ENSG00000136560 TRAF family member-associated NFKB activator [Source:HGNC Symbol;Acc:11562]
ENSG00000137875 BCL2-like 10 (apoptosis facilitator) [Source:HGNC Symbol;Acc:993]
ENSG00000153094 BCL2-like 11 (apoptosis facilitator) [Source:HGNC Symbol;Acc:994]
ENSG00000130429 actin related protein 2/3 complex, subunit 1B, 41kDa [Source:HGNC Symbol;Acc:704]
ENSG00000113522 RAD50 homolog (S. cerevisiae) [Source:HGNC Symbol;Acc:9816]
ENSG00000185825 B-cell receptor-associated protein 31 [Source:HGNC Symbol;Acc:16695]
ENSG00000115816 CCAAT/enhancer binding protein (C/EBP), zeta [Source:HGNC Symbol;Acc:24218]
ENSG00000130726 tripartite motif containing 28 [Source:HGNC Symbol;Acc:16384]
ENSG00000197579 topoisomerase I binding, arginine/serine-rich, E3 ubiquitin protein ligase [Source:HGNC Symbol;Acc:21653]
ENSG00000171700 regulator of G-protein signaling 19 [Source:HGNC Symbol;Acc:13735]
ENSG00000114354 TRK-fused gene [Source:HGNC Symbol;Acc:11758]
ENSG00000106100 nucleotide-binding oligomerization domain containing 1 [Source:HGNC Symbol;Acc:16390]
ENSG00000104419 N-myc downstream regulated 1 [Source:HGNC Symbol;Acc:7679]
ENSG00000204628 guanine nucleotide binding protein (G protein), beta polypeptide 2-like 1 [Source:HGNC Symbol;Acc:4399]
ENSG00000100462 protein arginine methyltransferase 5 [Source:HGNC Symbol;Acc:10894]
ENSG00000100324 TGF-beta activated kinase 1/MAP3K7 binding protein 1 [Source:HGNC Symbol;Acc:18157]
ENSG00000171148 transcriptional adaptor 3 [Source:HGNC Symbol;Acc:19422]
ENSG00000170035 ubiquitin-conjugating enzyme E2E 3 [Source:HGNC Symbol;Acc:12479]
ENSG00000142453 coactivator-associated arginine methyltransferase 1 [Source:HGNC Symbol;Acc:23393]
ENSG00000172977 K(lysine) acetyltransferase 5 [Source:HGNC Symbol;Acc:5275]
ENSG00000156127 basic leucine zipper transcription factor, ATF-like [Source:HGNC Symbol;Acc:958]
ENSG00000241685 actin related protein 2/3 complex, subunit 1A, 41kDa [Source:HGNC Symbol;Acc:703]
ENSG00000184990 SIVA1, apoptosis-inducing factor [Source:HGNC Symbol;Acc:17712]
ENSG00000123159 GIPC PDZ domain containing family, member 1 [Source:HGNC Symbol;Acc:1226]
ENSG00000056972 TRAF3 interacting protein 2 [Source:HGNC Symbol;Acc:1343]
ENSG00000132688 nestin [Source:HGNC Symbol;Acc:7756]
ENSG00000166225 fibroblast growth factor receptor substrate 2 [Source:HGNC Symbol;Acc:16971]
ENSG00000104881 protein phosphatase 1, regulatory subunit 13 like [Source:HGNC Symbol;Acc:18838]
ENSG00000109819 peroxisome proliferator-activated receptor gamma, coactivator 1 alpha [Source:HGNC Symbol;Acc:9237]

ENSG00000172175 mucosa associated lymphoid tissue lymphoma translocation gene 1 [Source:HGNC Symbol;Acc:6819]
ENSG00000174851 Yip1 interacting factor homolog A (S. cerevisiae) [Source:HGNC Symbol;Acc:16688]
ENSG00000135960 ectodysplasin A receptor [Source:HGNC Symbol;Acc:2895]
ENSG00000134308 tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein, theta polypeptide [Source:HGNC Symbol;Acc:12854]
ENSG00000121022 COP9 constitutive photomorphogenic homolog subunit 5 (Arabidopsis) [Source:HGNC Symbol;Acc:2240]
ENSG00000129465 receptor-interacting serine-threonine kinase 3 [Source:HGNC Symbol;Acc:10021]
ENSG00000102096 pim-2 oncogene [Source:HGNC Symbol;Acc:8987]
ENSG00000161326 dual specificity phosphatase 14 [Source:HGNC Symbol;Acc:17007]
ENSG00000196363 WD repeat domain 5 [Source:HGNC Symbol;Acc:12757]
ENSG00000105323 heterogeneous nuclear ribonucleoprotein U-like 1 [Source:HGNC Symbol;Acc:17011]
ENSG00000185104 Fas (TNFRSF6) associated factor 1 [Source:HGNC Symbol;Acc:3578]
ENSG00000122952 ZW10 interactor [Source:HGNC Symbol;Acc:13195]
ENSG00000012983 mitogen-activated protein kinase kinase kinase kinase 5 [Source:HGNC Symbol;Acc:6867]
ENSG00000104814 mitogen-activated protein kinase kinase kinase kinase 1 [Source:HGNC Symbol;Acc:6863]
ENSG00000183765 checkpoint kinase 2 [Source:HGNC Symbol;Acc:16627]
ENSG00000090376 interleukin-1 receptor-associated kinase 3 [Source:HGNC Symbol;Acc:17020]
ENSG00000143507 dual specificity phosphatase 10 [Source:HGNC Symbol;Acc:3065]
ENSG00000114209 programmed cell death 10 [Source:HGNC Symbol;Acc:8761]
ENSG00000160783 polyamine-modulated factor 1 [Source:HGNC Symbol;Acc:9112]
ENSG00000161405 IKAROS family zinc finger 3 (Aiolos) [Source:HGNC Symbol;Acc:13178]
ENSG00000091592 NLR family, pyrin domain containing 1 [Source:HGNC Symbol;Acc:14374]
ENSG00000130956 hyaluronan binding protein 4 [Source:HGNC Symbol;Acc:17062]
ENSG00000107984 dickkopf 1 homolog (Xenopus laevis) [Source:HGNC Symbol;Acc:2891]
ENSG00000148843 programmed cell death 11 [Source:HGNC Symbol;Acc:13408]
ENSG00000100813 apoptotic chromatin condensation inducer 1 [Source:HGNC Symbol;Acc:17066]
ENSG00000154310 TRAF2 and NCK interacting kinase [Source:HGNC Symbol;Acc:30765]
ENSG00000187239 formin binding protein 1 [Source:HGNC Symbol;Acc:17069]
ENSG00000198646 nuclear receptor coactivator 6 [Source:HGNC Symbol;Acc:15936]
ENSG00000082805 ELKS/RAB6-interacting/CAST family member 1 [Source:HGNC Symbol;Acc:17072]
ENSG00000112659 cullin 9 [Source:HGNC Symbol;Acc:15982]
ENSG00000163531 neurofascin [Source:HGNC Symbol;Acc:29866]
ENSG00000055208 TGF-beta activated kinase 1/MAP3K7 binding protein 2 [Source:HGNC Symbol;Acc:17075]
ENSG00000138834 mitogen-activated protein kinase 8 interacting protein 3 [Source:HGNC Symbol;Acc:6884]
ENSG00000072803 F-box and WD repeat domain containing 11 [Source:HGNC Symbol;Acc:13607]
ENSG00000049759 neural precursor cell expressed, developmentally down-regulated 4-like [Source:HGNC Symbol;Acc:7728]
ENSG00000182253 synemin, intermediate filament protein [Source:HGNC Symbol;Acc:24466]
ENSG00000131018 spectrin repeat containing, nuclear envelope 1 [Source:HGNC Symbol;Acc:17089]
ENSG00000088808 protein phosphatase 1, regulatory subunit 13B [Source:HGNC Symbol;Acc:14950]
ENSG00000096717 sirtuin 1 [Source:HGNC Symbol;Acc:14929]
ENSG00000163602 RING1 and YY1 binding protein [Source:HGNC Symbol;Acc:10480]
ENSG00000119729 ras homolog gene family, member Q [Source:HGNC Symbol;Acc:17736]
ENSG00000008735 mitogen-activated protein kinase 8 interacting protein 2 [Source:HGNC Symbol;Acc:6883]
ENSG00000171517 lysophosphatidic acid receptor 3 [Source:HGNC Symbol;Acc:14298]
ENSG00000159339 peptidyl arginine deiminase, type IV [Source:HGNC Symbol;Acc:18368]
ENSG00000105701 FK506 binding protein 8, 38kDa [Source:HGNC Symbol;Acc:3724]
ENSG00000129946 SHC (Src homology 2 domain containing) transforming protein 2 [Source:HGNC Symbol;Acc:29869]
ENSG00000174744 breast cancer metastasis suppressor 1 [Source:HGNC Symbol;Acc:17262]
ENSG00000163743 ring finger and CHY zinc finger domain containing 1 [Source:HGNC Symbol;Acc:17479]
ENSG00000178188 SH2B adaptor protein 1 [Source:HGNC Symbol;Acc:30417]
ENSG00000163659 TCDD-inducible poly(ADP-ribose) polymerase [Source:HGNC Symbol;Acc:23696]
ENSG00000157500 adaptor protein, phosphotyrosine interaction, PH domain and leucine zipper containing 1 [Source:HGNC Symbol;Acc:24035]
ENSG00000100991 transient receptor potential cation channel, subfamily C, member 4 associated protein [Source:HGNC Symbol;Acc:16181]
ENSG00000141562 nuclear prelamin A recognition factor [Source:HGNC Symbol;Acc:29916]
ENSG00000108270 apoptosis antagonizing transcription factor [Source:HGNC Symbol;Acc:19235]
ENSG00000166681 nerve growth factor receptor (TNFRSF16) associated protein 1 [Source:HGNC Symbol;Acc:13388]
ENSG00000070190 dual adaptor of phosphotyrosine and 3-phosphoinositides [Source:HGNC Symbol;Acc:16500]
ENSG00000105327 BCL2 binding component 3 [Source:HGNC Symbol;Acc:17868]
ENSG00000136305 cell death-inducing DFFA-like effector b [Source:HGNC Symbol;Acc:1977]
ENSG00000146072 tumor necrosis factor receptor superfamily, member 21 [Source:HGNC Symbol;Acc:13469]
ENSG00000080546 sestrin 1 [Source:HGNC Symbol;Acc:21595]
ENSG00000168256 NFKB inhibitor interacting Ras-like 2 [Source:HGNC Symbol;Acc:17898]
ENSG00000197885 NFKB inhibitor interacting Ras-like 1 [Source:HGNC Symbol;Acc:17899]
ENSG00000102760 chromosome 13 open reading frame 15 [Source:HGNC Symbol;Acc:20369]
ENSG00000136279 drebrin-like [Source:HGNC Symbol;Acc:2696]
ENSG00000064393 homeodomain interacting protein kinase 2 [Source:HGNC Symbol;Acc:14402]
ENSG00000181555 SET domain containing 2 [Source:HGNC Symbol;Acc:18420]
ENSG00000113360 drosha, ribonuclease type III [Source:HGNC Symbol;Acc:17904]
ENSG00000103490 PYD and CARD domain containing [Source:HGNC Symbol;Acc:16608]
ENSG00000183735 TANK-binding kinase 1 [Source:HGNC Symbol;Acc:11584]
ENSG00000173581 coiled-coil domain containing 106 [Source:HGNC Symbol;Acc:30181]
ENSG00000173156 ras homolog gene family, member D [Source:HGNC Symbol;Acc:670]
ENSG00000048392 ribonucleotide reductase M2 B (TP53 inducible) [Source:HGNC Symbol;Acc:17296]
ENSG00000102981 par-6 partitioning defective 6 homolog alpha (C. elegans) [Source:HGNC Symbol;Acc:15943]
ENSG00000049768 forkhead box P3 [Source:HGNC Symbol;Acc:6106]
ENSG00000138303 activating signal cointegrator 1 complex subunit 1 [Source:HGNC Symbol;Acc:24268]
ENSG00000134970 transmembrane emp24 protein transport domain containing 7 [Source:HGNC Symbol;Acc:24253]
ENSG00000149089 APAF1 interacting protein [Source:HGNC Symbol;Acc:17581]
ENSG00000097033 SH3-domain GRB2-like endophilin B1 [Source:HGNC Symbol;Acc:10833]
ENSG00000198001 interleukin-1 receptor-associated kinase 4 [Source:HGNC Symbol;Acc:17967]
ENSG00000111653 inhibitor of growth family, member 4 [Source:HGNC Symbol;Acc:19423]
ENSG00000138795 lymphoid enhancer-binding factor 1 [Source:HGNC Symbol;Acc:6551]
ENSG00000196664 toll-like receptor 7 [Source:HGNC Symbol;Acc:15631]
ENSG00000101916 toll-like receptor 8 [Source:HGNC Symbol;Acc:15632]
ENSG00000006327 tumor necrosis factor receptor superfamily, member 12A [Source:HGNC Symbol;Acc:18152]
ENSG00000137877 spectrin, beta, non-erythrocytic 5 [Source:HGNC Symbol;Acc:15680]
ENSG00000135090 TAO kinase 3 [Source:HGNC Symbol;Acc:18133]
ENSG00000170855 TP53 regulated inhibitor of apoptosis 1 [Source:HGNC Symbol;Acc:26937]
ENSG00000077463 sirtuin 6 [Source:HGNC Symbol;Acc:14934]
ENSG00000110944 interleukin 23, alpha subunit p19 [Source:HGNC Symbol;Acc:15488]
ENSG00000151332 MAP3K12 binding inhibitory protein 1 [Source:HGNC Symbol;Acc:20427]
ENSG00000111802 tyrosyl-DNA phosphodiesterase 2 [Source:HGNC Symbol;Acc:17768]
ENSG00000105229 protein inhibitor of activated STAT, 4 [Source:HGNC Symbol;Acc:17002]
ENSG00000187325 TAF9B RNA polymerase II, TATA box binding protein (TBP)-associated factor, 31kDa [Source:HGNC Symbol;Acc:17306]
ENSG00000087095 nemo-like kinase [Source:HGNC Symbol;Acc:29858]
ENSG00000186153 WW domain containing oxidoreductase [Source:HGNC Symbol;Acc:12799]
ENSG00000164307 endoplasmic reticulum aminopeptidase 1 [Source:HGNC Symbol;Acc:18173]
ENSG00000148082 SHC (Src homology 2 domain containing) transforming protein 3 [Source:HGNC Symbol;Acc:18181]
ENSG00000169118 casein kinase 1, gamma 1 [Source:HGNC Symbol;Acc:2454]
ENSG00000239732 toll-like receptor 9 [Source:HGNC Symbol;Acc:15633]
ENSG00000148229 polymerase (DNA directed), epsilon 3 (p17 subunit) [Source:HGNC Symbol;Acc:13546]

ENSG00000172115 cytochrome c, somatic [Source:HGNC Symbol;Acc:19986]
ENSG00000078902 toll interacting protein [Source:HGNC Symbol;Acc:16476]
ENSG00000171431 keratin 20 [Source:HGNC Symbol;Acc:20412]
ENSG00000128191 DiGeorge syndrome critical region gene 8 [Source:HGNC Symbol;Acc:2847]
ENSG00000139725 ras homolog gene family, member F (in filopodia) [Source:HGNC Symbol;Acc:15703]
ENSG00000168209 DNA-damage-inducible transcript 4 [Source:HGNC Symbol;Acc:24944]
ENSG00000137074 aprataxin [Source:HGNC Symbol;Acc:15984]
ENSG00000172530 BTG3 associated nuclear protein [Source:HGNC Symbol;Acc:13450]
ENSG00000070540 WD repeat domain, phosphoinositide interacting 1 [Source:HGNC Symbol;Acc:25471]
ENSG00000134014 elongation protein 3 homolog (S. cerevisiae) [Source:HGNC Symbol;Acc:20696]
ENSG00000140525 Fanconi anemia, complementation group I [Source:HGNC Symbol;Acc:25568]
ENSG00000115107 STEAP family member 3, metalloreductase [Source:HGNC Symbol;Acc:24592]
ENSG00000109670 F-box and WD repeat domain containing 7 [Source:HGNC Symbol;Acc:16712]
ENSG00000177595 p53-induced death domain protein [Source:HGNC Symbol;Acc:16491]
ENSG00000123685 basic leucine zipper transcription factor, ATF-like 3 [Source:HGNC Symbol;Acc:28915]
ENSG00000068308 OTU domain containing 5 [Source:HGNC Symbol;Acc:25402]
ENSG00000178078 signal transducing adaptor family member 2 [Source:HGNC Symbol;Acc:30430]
ENSG00000163872 YEATS domain containing 2 [Source:HGNC Symbol;Acc:25489]
ENSG00000166257 sodium channel, voltage-gated, type III, beta [Source:HGNC Symbol;Acc:20665]
ENSG00000133169 brain expressed, X-linked 1 [Source:HGNC Symbol;Acc:1036]
ENSG00000168078 PDZ binding kinase [Source:HGNC Symbol;Acc:18282]
ENSG00000186416 NFKB repressing factor [Source:HGNC Symbol;Acc:19374]
ENSG00000155827 ring finger protein 20 [Source:HGNC Symbol;Acc:10062]
ENSG00000184047 diablo, IAP-binding mitochondrial protein [Source:HGNC Symbol;Acc:21528]
ENSG00000115350 polymerase (DNA-directed), epsilon 4 (p12 subunit) [Source:HGNC Symbol;Acc:18755]
ENSG00000112679 dual specificity phosphatase 22 [Source:HGNC Symbol;Acc:16077]
ENSG00000143499 SET and MYND domain containing 2 [Source:HGNC Symbol;Acc:20982]
ENSG00000090097 poly(rC) binding protein 4 [Source:HGNC Symbol;Acc:8652]
ENSG00000169857 apoptosis, caspase activation inhibitor [Source:HGNC Symbol;Acc:13509]
ENSG00000078237 chromosome 12 open reading frame 5 [Source:HGNC Symbol;Acc:1185]
ENSG00000139946 pellino homolog 2 (Drosophila) [Source:HGNC Symbol;Acc:8828]
ENSG00000197329 pellino homolog 1 (Drosophila) [Source:HGNC Symbol;Acc:8827]
ENSG00000103404 ubiquitin specific peptidase 31 [Source:HGNC Symbol;Acc:20060]
ENSG00000134313 kinase D-interacting substrate, 220kDa [Source:HGNC Symbol;Acc:29508]
ENSG00000088888 mitochondrial antiviral signaling protein [Source:HGNC Symbol;Acc:29233]
ENSG00000160460 spectrin, beta, non-erythrocytic 4 [Source:HGNC Symbol;Acc:14896]
ENSG00000116574 ras homolog gene family, member U [Source:HGNC Symbol;Acc:17794]
ENSG00000091106 NLR family, CARD domain containing 4 [Source:HGNC Symbol;Acc:16412]
ENSG00000185187 single immunoglobulin and toll-interleukin 1 receptor (TIR) domain [Source:HGNC Symbol;Acc:30575]
ENSG00000107679 pleckstrin homology domain containing, family A (phosphoinositide binding specific) member 1 [Source:HGNC Symbol;Acc:14335]
ENSG00000169499 pleckstrin homology domain containing, family A (phosphoinositide binding specific) member 2 [Source:HGNC Symbol;Acc:14336]
ENSG00000092853 claspin [Source:HGNC Symbol;Acc:19715]
ENSG00000120471 tumor protein p53 regulated apoptosis inducing protein 1 [Source:HGNC Symbol;Acc:29984]
ENSG00000112378 PERP, TP53 apoptosis effector [Source:HGNC Symbol;Acc:17637]
ENSG00000165943 modulator of apoptosis 1 [Source:HGNC Symbol;Acc:16658]
ENSG00000167207 nucleotide-binding oligomerization domain containing 2 [Source:HGNC Symbol;Acc:5331]
ENSG00000187796 caspase recruitment domain family, member 9 [Source:HGNC Symbol;Acc:16391]
ENSG00000143207 ring finger and WD repeat domain 2 [Source:HGNC Symbol;Acc:17440]
ENSG00000144802 nuclear factor of kappa light polypeptide gene enhancer in B-cells inhibitor, zeta [Source:HGNC Symbol;Acc:29805]
ENSG00000152457 DNA cross-link repair 1C [Source:HGNC Symbol;Acc:17642]
ENSG00000133878 dual specificity phosphatase 26 (putative) [Source:HGNC Symbol;Acc:28161]
ENSG00000168884 TNFAIP3 interacting protein 2 [Source:HGNC Symbol;Acc:19118]
ENSG00000121380 BCL2-like 14 (apoptosis facilitator) [Source:HGNC Symbol;Acc:16657]
ENSG00000101197 baculoviral IAP repeat containing 7 [Source:HGNC Symbol;Acc:13702]
ENSG00000134371 cell division cycle 73, Paf1/RNA polymerase II complex component, homolog (S. cerevisiae) [Source:HGNC Symbol;Acc:16783]
ENSG00000163154 tumor necrosis factor, alpha-induced protein 8-like 2 [Source:HGNC Symbol;Acc:26277]
ENSG00000138081 F-box protein 11 [Source:HGNC Symbol;Acc:13590]
ENSG00000108465 CDK5 regulatory subunit associated protein 3 [Source:HGNC Symbol;Acc:18673]
ENSG00000182871 collagen, type XVIII, alpha 1 [Source:HGNC Symbol;Acc:2195]
ENSG00000111266 dual specificity phosphatase 16 [Source:HGNC Symbol;Acc:17909]
ENSG00000145391 SET domain containing (lysine methyltransferase) 7 [Source:HGNC Symbol;Acc:30412]
ENSG00000174123 toll-like receptor 10 [Source:HGNC Symbol;Acc:15634]
ENSG00000078747 itchy E3 ubiquitin protein ligase homolog (mouse) [Source:HGNC Symbol;Acc:13890]
ENSG00000169682 spinster homolog 1 (Drosophila) [Source:HGNC Symbol;Acc:30621]
ENSG00000167930 integrin alpha FG-GAP repeat containing 3 [Source:HGNC Symbol;Acc:14163]
ENSG00000164053 ATR interacting protein [Source:HGNC Symbol;Acc:33499]
ENSG00000103510 K(lysine) acetyltransferase 8 [Source:HGNC Symbol;Acc:17933]
ENSG00000168395 inhibitor of growth family, member 5 [Source:HGNC Symbol;Acc:19421]
ENSG00000198286 caspase recruitment domain family, member 11 [Source:HGNC Symbol;Acc:16393]
ENSG00000132357 caspase recruitment domain family, member 6 [Source:HGNC Symbol;Acc:16394]
ENSG00000176619 lamin B2 [Source:HGNC Symbol;Acc:6638]
ENSG00000042286 apoptosis-inducing factor, mitochondrion-associated, 2 [Source:HGNC Symbol;Acc:21411]
ENSG00000140807 naked cuticle homolog 1 (Drosophila) [Source:HGNC Symbol;Acc:17045]
ENSG00000104081 Bcl2 modifying factor [Source:HGNC Symbol;Acc:24132]
ENSG00000134508 Cdk5 and Abl enzyme substrate 1 [Source:HGNC Symbol;Acc:25097]
ENSG00000145365 TRAF-interacting protein with forkhead-associated domain [Source:HGNC Symbol;Acc:19075]
ENSG00000164938 tumor protein p53 inducible nuclear protein 1 [Source:HGNC Symbol;Acc:18022]
ENSG00000163098 baculoviral IAP repeat containing 8 [Source:HGNC Symbol;Acc:14878]
ENSG00000172315 TP53 regulating kinase [Source:HGNC Symbol;Acc:16197]
ENSG00000176476 coiled-coil domain containing 101 [Source:HGNC Symbol;Acc:25156]
ENSG00000132773 target of EGR1, member 1 (nuclear) [Source:HGNC Symbol;Acc:15954]
ENSG00000150455 toll-interleukin 1 receptor (TIR) domain containing adaptor protein [Source:HGNC Symbol;Acc:17192]
ENSG00000204397 caspase recruitment domain family, member 16 [Source:HGNC Symbol;Acc:33701]
ENSG00000168062 basic leucine zipper transcription factor, ATF-like 2 [Source:HGNC Symbol;Acc:25163]
ENSG00000140044 Jun dimerization protein 2 [Source:HGNC Symbol;Acc:17546]
ENSG00000137413 TAF8 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 43kDa [Source:HGNC Symbol;Acc:17300]
ENSG00000152409 junction mediating and regulatory protein, p53 cofactor [Source:HGNC Symbol;Acc:28916]
ENSG00000146243 interleukin-1 receptor-associated kinase 1 binding protein 1 [Source:HGNC Symbol;Acc:17368]
ENSG00000122728 TAF1 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 210kDa-like [Source:HGNC Symbol;Acc:18056]
ENSG00000130700 GATA binding protein 5 [Source:HGNC Symbol;Acc:15802]
ENSG00000121083 dynein, light chain, LC8-type 2 [Source:HGNC Symbol;Acc:24596]
ENSG00000197050 zinc finger protein 420 [Source:HGNC Symbol;Acc:20649]
ENSG00000127666 toll-like receptor adaptor molecule 1 [Source:HGNC Symbol;Acc:18348]
ENSG00000162594 interleukin 23 receptor [Source:HGNC Symbol;Acc:19100]
ENSG00000163141 BCL2/adenovirus E1B 19kD interacting protein like [Source:HGNC Symbol;Acc:16976]
ENSG00000142178 salt-inducible kinase 1 [Source:HGNC Symbol;Acc:11142]
ENSG00000173163 copper metabolism (Murr1) domain containing 1 [Source:HGNC Symbol;Acc:23024]
ENSG00000160570 death effector domain containing 2 [Source:HGNC Symbol;Acc:24450]
ENSG00000169621 aprataxin and PNKP like factor [Source:HGNC Symbol;Acc:28724]
ENSG00000123572 Nik related kinase [Source:HGNC Symbol;Acc:25391]

ENSG00000124602	unc-5 homolog C (C. elegans)-like [Source:HGNC Symbol;Acc:21203]
ENSG00000174516	pellino homolog 3 (Drosophila) [Source:HGNC Symbol;Acc:30010]
ENSG00000228049	polymerase (RNA) II (DNA directed) polypeptide J2 [Source:HGNC Symbol;Acc:23208]
ENSG00000137393	ring finger protein 144B [Source:HGNC Symbol;Acc:21578]
ENSG00000171502	collagen, type XXIV, alpha 1 [Source:HGNC Symbol;Acc:20821]
ENSG00000157625	TGF-beta activated kinase 1/MAP3K7 binding protein 3 [Source:HGNC Symbol;Acc:30681]
ENSG00000066279	asp (abnormal spindle) homolog, microcephaly associated (Drosophila) [Source:HGNC Symbol;Acc:19048]
ENSG00000183305	melanoma antigen family A, 2B [Source:HGNC Symbol;Acc:19340]
ENSG00000184750	melanoma antigen family A, 2 [Source:HGNC Symbol;Acc:6800]
ENSG00000179979	cysteine-rich PAK1 inhibitor [Source:HGNC Symbol;Acc:26619]
ENSG00000172985	SH3 domain containing ring finger 3 [Source:HGNC Symbol;Acc:24699]
ENSG00000243414	toll-like receptor adaptor molecule 2 [Source:HGNC Symbol;Acc:21354]
ENSG00000102069	ubiquitin-conjugating enzyme E2N-like [Source:HGNC Symbol;Acc:31710]
ENSG00000180953	suppressor of tumorigenicity 20 [Source:HGNC Symbol;Acc:33520]
ENSG00000168255	polymerase (RNA) II (DNA directed) polypeptide J3 [Source:HGNC Symbol;Acc:33853]
ENSG00000158517	neutrophil cytosolic factor 1 [Source:HGNC Symbol;Acc:7660]
ENSG00000137309	high mobility group AT-hook 1 [Source:HGNC Symbol;Acc:5010]
ENSG00000168255	polymerase (RNA) II (DNA directed) polypeptide J3 [Source:HGNC Symbol;Acc:33853]
ENSG00000243414	toll-like receptor adaptor molecule 2 [Source:HGNC Symbol;Acc:21354]
ENSG00000134970	transmembrane emp24 protein transport domain containing 7 [Source:HGNC Symbol;Acc:24253]
ENSG00000160783	polyamine-modulated factor 1 [Source:HGNC Symbol;Acc:9112]
ENSG00000134899	excision repair cross-complementing rodent repair deficiency, complementation group 5 [Source:HGNC Symbol;Acc:3437]
ENSG00000112679	dual specificity phosphatase 22 [Source:HGNC Symbol;Acc:16077]
ENSG00000249529	NA
ENSG00000250967	NA
ENSG00000221160	NA
ENSG00000147507	NA
ENSG00000160967	NA
ENSG00000121031	NA
ENSG00000233276	NA
ENSG00000251351	NA
ENSG00000188512	NA
ENSG00000118412	NA
ENSG00000250477	NA
ENSG00000221417	NA
ENSG00000056345	NA
ENSG00000221366	NA
ENSG00000073905	NA
ENSG00000160999	NA
ENSG00000173366	NA

Supplemental Table 4: Gene candidates identified by whole-exome sequencing

Gene	Localization	Variation	cDNA	Protein	rs	MAF	Pre-diction	Same genotype (healthy)
BNIP (+)	1:151011325	missense	c.256C>T	p.R86C	3830611	0.006	prob. damag.; delet.	24x (1000G); 100x (ESP6500); present in in-house db
TRAF3IP2 (-)	6: 111913262	missense	c.28G>A	p.D10N	33980500	0.082	prob. damag.; delet.	21x (1000G); 72x (ESP6500); present in in-house db
NCOR2 (-)	12:124887058	inframe insertion	c. 1531->GCT	p.P511PQ	35831183	wo	wo	frequent in in-house db
RBBP6 (+)	16:24564879-24564881	splice donor, conservative	Na	na	72133882	wo	wo	frequent in in-house db
MAP2K3 (+)	17: 21216964	missense	c.301T>C	p.C101R	1657686	wo	unknown; tolerated	frequent in in-house db
IL12RB1 (-)	19:18186625	stop gained	c.698G>A	p.R212X	none	na	wo	not observed

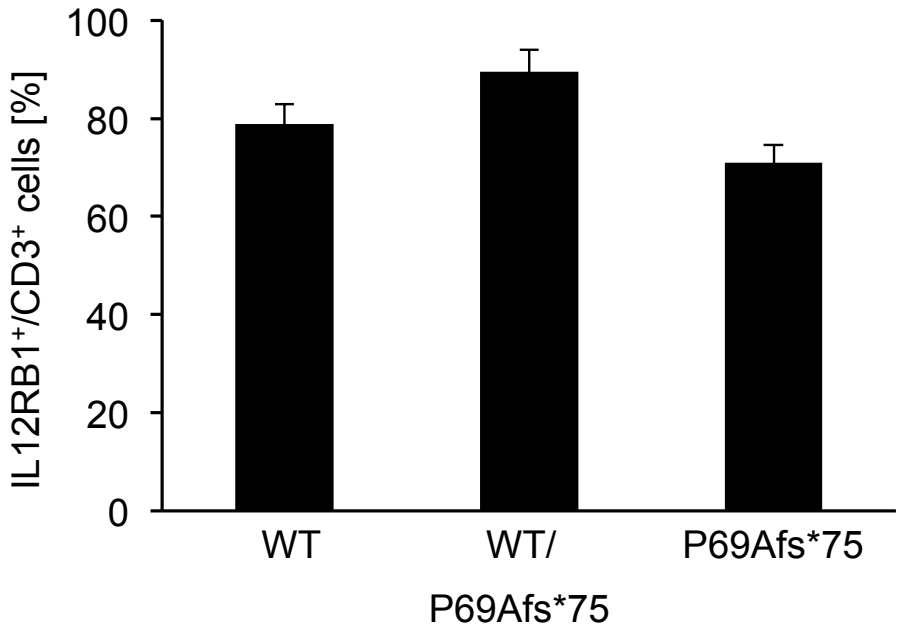
(Abbreviations: (+), located on plus strand of DNA; (-) located on minus strand of DNA; na, not applies;.wo, without; prob. damaging, probably damaging, delet., deleterious; 1000G, 1000 genomes project database (www.1000genomes.org); ESP6500, exome variant server database (http://evs.gs.washington.edu/EVS/); in-house db, in-house database)

Supplemental Table 5: Nonsynonymous nucleotide variations and frameshift indels identified by whole-exome sequencing that are present in a homozygous state in the patient and not in the parents

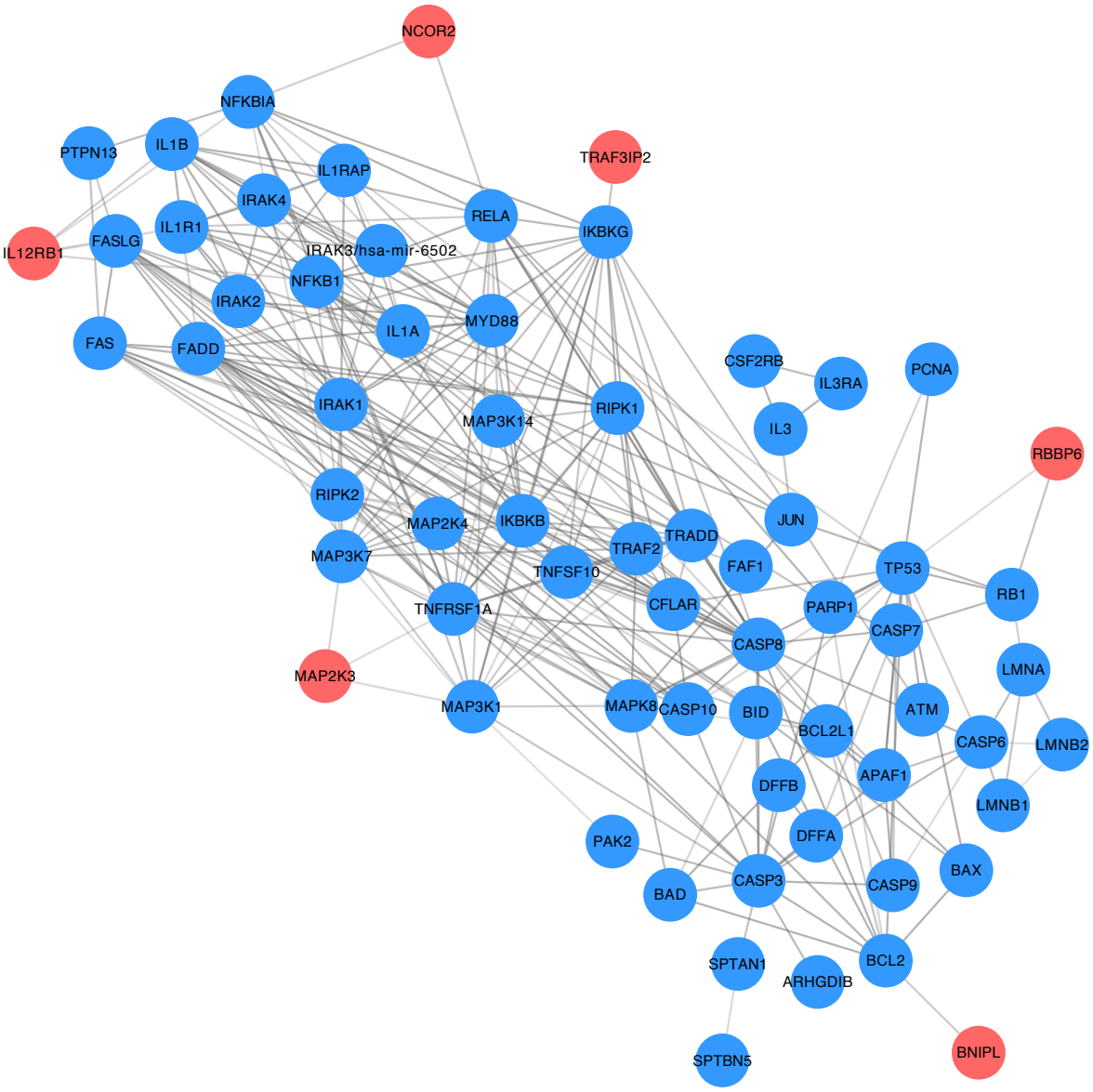
Localization	Ref	Alt	Gene	Symbol	Variation	GMAF	Annotation	AA variation	Polyphen	Sift	Protein position
'1:27687466-27687466'	'G'	'T'	'ENSG00000142733'	'MAP3K6'	missense'	'0.1484'	'rs35659744'	'N/K'	'benign'	'tolerated'	'614, 622, 346'
'1:33235651-33235651'	'A'	'G'	'ENSG00000162522'	'KIAA1522'	missense'	'0.1456'	'rs12730560'	'M/V'	'unknown'	'tolerated'	'232, 243, 291'
'1:93704952-93704952'	'A'	'G'	'ENSG00000122483'	'CCDC18'	missense'	'0.0082'	'rs41292127'	'N/D'	'benign, probably_damaging'	'tolerated'	'192, 1015, 572, 897, 896, 652, 950'
'1:151011325-151011325'	'C'	'T'	'ENSG00000163141'	'BNIPL'	missense'	'0.0618'	'rs61751619'	'R/C'	'probably_damaging'	'deleterious'	'4, 86, 84'
'1:151315287-151315287'	'G'	'C'	'ENSG00000143390'	'RFX5'	missense'	'0.0792'	'rs2233854'	'P/R'	'benign'	'deleterious'	'409, 369'
'1:171080080-171080080'	'G'	'A'	'ENSG00000007933'	'FMO3'	missense'	'0.0939'	rs1736557, CM033906'	'V/M'	'benign'	'tolerated'	'257, 194, 237'
'1:237841390-237841390'	'A'	'G'	'ENSG00000198626'	'RYR2'	missense'	'0.1433'	'rs34967813'	'Q/R'	possibly_damaging' probably_damaging'	'tolerated'	'2942, 2958, 2956'
'2:20189015-20189015'	'T'	'C'	'ENSG00000118965'	'WDR35'	missense'	'0.1044'	rs1060742, COSM148806'	'Q/R'	'benign'	'tolerated'	'18'
'2:21233972-21233972'	'T'	'C'	'ENSG00000084674'	'APOB'	missense'	'0.0197'	rs533617, CM980092'	'H/R'	'benign'	'deleterious'	'1923'
'2:24042689-24042689'	'T'	'C'	'ENSG00000119778'	'ATAD2B'	missense'	'0.0201'	'rs62125899'	'N/S'	'benign'	'tolerated'	'732, 13'
'2:27261042-27261042'	'C'	'T'	'ENSG00000119777'	'TMEM214'	missense'	'0'	'rs200292649'	'T/M'	'benign'	'tolerated'	'179, 54, 394, 349'
'2:27292989-27292989'	'G'	'A'	'ENSG00000084693'	'AGBL5'	missense'	'0.0060'	'rs140335340'	'R/H'	'benign'	'tolerated'	'840'
'2:27479282-27479282'	'G'	'A'	'ENSG00000115194'	'SLC30A3'	missense'	'0'	'rs199876300'	'T/I'	'unknown'	''	'268'
'2:32958916-32958916'	'G'	'A'	'ENSG00000018699'	'TTC27'	missense'	'0'	'rs200173708'	'D/N'	'benign'	'tolerated'	'419'
'2:44040347-44040347'	'T'	'C'	'ENSG00000138075'	'ABCG5'	missense'	'0.0032'	'rs140374206'	'M/V'	'benign'	'tolerated'	'451, 227, 622'
'2:45801853-45801853'	'G'	'A'	'ENSG00000068784'	'SRBD1'	missense'	'0.0027'	'rs6544834'	'T/M'	'possibly_damaging'	'deleterious'	'361'
'2:47380145-47380145'	'T'	'C'	'ENSG00000239605'	'C2orf61'	missense'	'0.1190'	'rs17036300'	'Q/R'	'benign'	'tolerated'	'31'
'2:54587378-54587378'	'C'	'G'	'ENSG00000177994'	'C2orf73'	missense'	'0.1177'	'rs2280717'	'Q/E'	'unknown'	''	'82'
'2:55771169-55771169'	'A'	'T'	'ENSG00000163001'	'CCDC104'	missense'	'0.1213'	'rs1045920'	'I/F'	'benign'	'tolerated'	'271, 246, 217'
'2:55872538-55872538'	'T'	'C'	'ENSG00000138035'	'PNPT1'	missense'	'0.1204'	'rs7594497'	'N/D'	'benign'	'tolerated'	'590'
'2:112832535-112832538'	'CAAT'	'C'	'ENSG00000153214'	'TMEM87B'	missense'	'0'	'rs71385858'	'SM/S'	''	''	'166'
'2:131100734-131100734'	'G'	'A'	'ENSG00000136718'	'IMP4'	missense'	'0.0975'	'rs11542411'	'E/K'	'benign, possibly_damaging'	'tolerated, deleterious'	'27'
'2:131414176-131414176'	'C'	'T'	'ENSG00000222038'	'POTEJ'	missense'	'0'	'rs62165276'	'R/W'	'benign'	'deleterious'	'615'
'3:17255827-17255827'	'C'	'T'	'ENSG00000131374'	'TBC1D5'	missense'	'0.0005'	'rs139603342, COSM212687'	'V/I'	'benign'	'tolerated'	'516, 564, 542'
'3:98307630-98307630'	'C'	'T'	'ENSG00000080819'	'CPOX'	missense'	'0.0842'	'rs2228056'	'V/I'	'benign'	'tolerated'	'294'
'3:100053684-100053685'	'C'	'CG'	'ENSG00000114021'	'NIT2'	frameshift'	'0'	''	''	''	''	'11, 17'
'3:112253058-112253059'	'C'	'CA'	'ENSG00000144848'	'ATG3'	frameshift'	'0'	'rs139705694'	''	''	''	'307'
'3:129370346-129370346'	'C'	'T'	'ENSG00000172765'	'TMCC1'	missense'	'0.0014'	'rs3821917'	'R/Q'	'benign'	'tolerated, deleterious'	'468, 533, 323, 647'
'3:132071602-132071602'	'T'	'G'	'ENSG00000014257'	'ACPP'	missense'	'0.0041'	'rs116804987'	'D/E'	'benign'	'deleterious, tolerated'	'301, 268'
'3:134267991-134267991'	'C'	'A'	'ENSG00000182923'	'CEP63'	missense'	'0.0050'	'rs34189216'	'N/K'	possibly_damaging, benign' probably_damaging'	'tolerated'	'74, 385, 58, 339'
'3:136062724-136062724'	'C'	'G'	'ENSG00000118007'	'STAG1'	missense'	'0.0719'	'rs34149860'	'Q/H'	'benign'	'tolerated'	'716, 872, 1132'
'3:142402915-142402915'	'C'	'T'	'ENSG00000120756'	'PLS1'	missense'	'0.0325'	'rs35435507'	'S/L'	'benign'	'tolerated'	'216, 137'
'3:149374873-149374873'	'G'	'T'	'ENSG00000018408'	'WWTR1'	missense'	'0.0728'	'rs1055153'	'P/Q'	'probably_damaging'	'tolerated'	'74'
'3:171404478-171404478'	'C'	'A'	'ENSG00000075651'	'PLD1'	missense'	'0.1493'	'rs2290480'	'A/S'	'benign'	'tolerated'	'622'
'3:195346665-195346665'	'G'	'A'	'ENSG00000176945'	'MUC20'	missense'	'0.1291'	'rs73212302'	'V/M'	'possibly_damaging'	'tolerated'	'323'
'3:195511331-195511331'	'A'	'G'	'ENSG00000145113'	'MUC4'	missense'	'0'	'rs56359992'	'S/P'	'possibly_damaging, benign'	''	'2374'
'3:196865242-196865242'	'C'	'T'	'ENSG00000075711'	'DLG1'	missense'	'0.0920'	'rs1134986'	'R/Q'	benign, possibly_damaging' probably_damaging'	'tolerated'	'162, 278, 245, 227, 87'
'4:15835844-15835844'	'A'	'C'	'ENSG00000004468'	'CD38'	'stop_lost'	'0.0888'	'rs1800051'	'*/S'	''	''	'123'
'4:76489582-76489582'	'G'	'A'	'ENSG00000174792'	'C4orf26'	missense'	'0.1319'	'rs2306174'	'V/I, R/H'	'benign, possibly_damaging'	', tolerated'	'124, 109'
'5:442586-442586'	'G'	'C'	'ENSG00000221990'	'C5orf55'	missense'	'0.0861'	'rs10035612'	'R/G'	'unknown'	''	'118'
'5:639231-639231'	'C'	'A'	'ENSG00000112877'	'CEP72'	missense'	'0.0962'	'rs12522955'	'P/T'	'benign'	'tolerated'	'412'
'5:65350481-65350481'	'C'	'T'	'ENSG00000112851'	'ERBB2IP'	missense'	'0.0952'	'rs3805466'	'S/L'	benign, probably_damaging' possibly_damaging'	'deleterious'	'1112, 1108, 8'
'5:80409526-80409526'	'T'	'C'	'ENSG00000113319'	'RASGRF2'	missense'	'0.0385'	'rs34193571'	'S/P'	'benign'	'tolerated'	'753'
'5:141307833-141307833'	'T'	'C'	'ENSG00000081791'	'KIAA0141'	missense'	'0.1328'	'rs10036567'	'F/L'	'benign'	'tolerated'	'128'
'5:175811094-175811096'	'C'	'CGT'	'ENSG00000048162'	'NOP16'	frameshift'	'0'	rs4815, rs78549596'	''	''	''	'195'
'6:46661479-46661479'	'G'	'T'	'ENSG00000180113'	'TDRD6'	missense'	'0.0037'	'rs142413497'	'V/L'	'benign'	'tolerated'	'1872'
'6:49580247-49580247'	'C'	'T'	'ENSG00000112077'	'RHAG'	missense'	'0.0513'	rs16879498, CM991100'	'V/I'	'possibly_damaging'	'deleterious'	'270'
'6:52357071-52357071'	'A'	'C'	'ENSG00000096093'	'EFHC1'	missense'	'0.0366'	'rs17851770'	'I/L'	'benign'	'tolerated'	'600, 619'
'6:66005857-66005857'	'T'	'A'	'ENSG00000188107'	'EYS'	missense'	'0.1342'	'rs17411795'	'E/V'	'possibly_damaging'	'deleterious'	'641'
'6:108068003-108068003'	'C'	'T'	'ENSG00000146285'	'SCML4'	missense'	'0.1122'	'rs6934505'	'R/Q'	'benign'	'tolerated, deleterious'	'97, 68, 126'
'6:109850199-109850201'	'AAC'	'A'	'ENSG00000155085'	'AKD1'	frameshift'	'0'	rs72331392, rs140788861'	''	''	''	'295'
'6:109850199-109850201'	'AC'	'A'	'ENSG00000155085'	'AKD1'	frameshift'	'0'	rs3060758, rs3060758' rs72613250'	''	''	''	'295'
'6:111913262-111913262'	'C'	'T'	'ENSG00000056972'	'TRAF3IP2'	missense'	'0.0820'	'rs33980500'	'D/N'	'probably_damaging'	'deleterious'	'10, 19'
'7:29160604-29160604'	'C'	'T'	'ENSG00000106066'	'CPVL'	missense'	'0.0934'	'rs34219043'	'R/H'	'benign'	'tolerated, '	'25'
'8:20005554-20005554'	'G'	'C'	'ENSG00000036565'	'SLC18A1'	missense'	'0.0536'	'rs17092104'	'L/V'	'probably_damaging'	'deleterious'	'392, 360'
'10:116006283-116006285'	'AAC'	'A'	'ENSG00000230165'	''	splice acceptor'	'0'	''	''	''	''	''
'10:123903133-123903133'	'G'	'A'	'ENSG00000138162'	'TACC2'	missense'	'0.1227'	'rs12765679'	'E/K'	'benign'	'deleterious'	'1916'
'10:129906427-129906427'	'C'	'A'	'ENSG00000148773'	'MKI67'	missense'	'0.0440'	'rs41306015'	'G/V'	'probably_damaging'	'deleterious'	'1226, 866'
'10:129906674-129906674'	'T'	'C'	'ENSG00000148773'	'MKI67'	missense'	'0.0440'	'rs41300566'	'K/E'	'benign, possibly_damaging'	'tolerated, deleterious'	'1144, 784'
'10:129907489-129907489'	'G'	'A'	'ENSG00000148773'	'MKI67'	missense'	'0.0426'	'rs2853344'	'A/V'	'benign'	'tolerated'	'872, 512'
'11:1262525-1262525'	'C'	'T'	'ENSG00000117983'	'MUC5B'	missense'	'0.0353'	'rs55669609'	'P/L'	'unknown'	''	'1472, 1475'
'11:1628948-1628948'	'G'	'A'	'ENSG00000196224'	'KRTAP5-3'	missense'	'0.0673'	'rs117085626'	'S/F'	'unknown'	'tolerated'	'223'
'11:1972143-1972143'	'G'	'A'	'ENSG00000214026'	'MRPL23'	missense'	'0.0678'	'rs34134444'	'R/Q'	'benign'	'tolerated'	'11, 6'
'11:1972205-1972205'	'G'	'A'	'ENSG00000214026'	'MRPL23'	missense'	'0.0614'	'rs2240197'	'G/S'	'probably_damaging'	'tolerated'	'32, 27'
'11:60610056-60610056'	'G'	'C'	'ENSG00000110104'	'CCDC86'	missense'	'0.0907'	'rs2074421'	'Q/H'	'benign'	'tolerated'	'153'
'11:82564294-82564294'	'T'	'G'	'ENSG00000137509'	'PRCP'	missense'	'0.1383'	rs2229437\n- rs2298668\n'	'E/D'	'benign'	'tolerated, '	'7, 71, 133, 112, 58'
'11:116691675-116691675'	'T'	'A'	'ENSG00000110244'	'APOA4'	missense'	'0.1053'	rs675, CM031126'	'T/S'	'benign'	'tolerated'	'367'
'11:130784396-130784396'	'G'	'A'	'ENSG00000120451'	'SNX19'	missense'	'0.1438'	'rs62621284'	'P/L'	'possibly_damaging'	'deleterious'	'480'
'11:130784616-130784616'	'T'	'C'	'ENSG00000120451'	'SNX19'	missense'	'0.1438'	'rs3190345'	'S/G'	'benign'	'tolerated'	'407'
'11:130784647-130784647'	'G'	'C'	'ENSG00000120451'	'SNX19'	missense'	'0.1442'	'rs1050081'	'D/E'	'benign'	'tolerated'	'396'
'11:130784694-130784694'	'C'	'T'	'ENSG00000120451'	'SNX19'	missense'	'0.1442'	'rs61736758'	'G/S'	'benign'	'tolerated'	'381'
'12:333193-333193'	'C'	'T'	'ENSG00000010379'	'SLC6A13'	missense'	'0.0206'	'rs577294'	'V/I'	'benign'	'tolerated'	'334, 426'
'12:6858126-6858126'	'G'	'A'	'ENSG00000089693'	'MLF2'	missense'	'0.1021'	'rs2302371'	'T/M'	'unknown'	''	'205'
'12:11420454-11420454'	'T'	'C'	'ENSG00000197870'	'PRB3'	splice acceptor'	'0'	'rs11054202'	''	''	''	''
'12:48920073-48920073'	'G'	'A'	'ENSG00000197376'	'OR8S1'	missense'	'0.0943'	'rs61941963'	'R/H'	'benign'	'tolerated'	'220'
'12:55820958-55820959'	'CA'	'C'	'ENSG00000185821'	'OR6C76'	frameshift'	'0'	'rs57387180'	''	''	''	'308'
'12:132562126-132562126'	'G'	'A'	'ENSG00000183495'	'EP400'	missense'	'0.0920'	'rs73164912'	'A/T'	'benign'	''	'3093, 3094, 3057, 3130, 3013'
'14:20502506-20502506'	'G'	'C'	'ENSG00000176253'	'OR4K13'	missense'	'0.0055'	'rs140037435'	'P/A'	'benign'	'tolerated'	'138'
'14:20691888-20691888'	'C'	'A'	'ENSG00000176219'	'OR11H6'	missense'	'0.0934'	'rs10140652'	'S/Y'	'benign'	'tolerated'	'7'
'14:20691962-20691962'	'C'	'G'	'ENSG00000176219'	'OR11H6'	missense'	'0.0934'	'rs9323693'	'L/V'	'benign'	'deleterious'	'32'
'14:22251504-22251504'	'T'	'C'	'ENSG00000211781'	'TRAV7'	missense'	'0.0096'	'rs34538191'	'S/P'	'possibly_damaging'	'tolerated'	'41'
'14:22251517-22251517'	'C'	'T'	'ENSG00000211781'	'TRAV7'	missense'	'0.0096'	'rs138473186'	'T/M'	'probably_damaging'	'deleterious'	'45'
'14:22279869-22279869'	'G'	'A'	'ENSG00000211783'	'TRAV9-1'	missense'	'0.0160'	'rs75564916'	'G/R'	'probably_damaging'	'deleterious'	'20'
'14:22280068-22280068'	'G'	'A'	'ENSG00000211783'	'TRAV9-1'	missense'	'0.0151'	'rs114385047'	'R/H'	'benign'	'tolerated'	'86'
'14:31583512-31583512'	'C'	'T'	'ENSG00000092148'	'HECTD1'	missense'	'0.0659'	'rs61976859'	'E/K'	'possibly_damaging, benign'	'deleterious'	'1312, 1885, 251'
'14:33293399-33293399'	'A'	'G'	'ENSG00000151320'	'AKAP6'	missense'	'0.0005'	'rs145616968'	'N/S'	'benign'	'tolerated'	'2127'
'14:35230980-35230980'	'C'	'T'	'ENSG00000198604'	'BAZ1A'	missense'	'0.0375'	'rs45620534'	'R/K'	'possibly_damaging, unknown'	'tolerated, '	'1377, 1409, 2'
'14:35231108-35231108'	'A'	'T'	'ENSG00000198604'	'BAZ1A'	missense'	'0.0375'	'rs1044140'	'N/K'	'probably_damaging'	'tolerated'	'1334, 1366'
'14:39716808-39716808'	'T'	'C'	ENSG00000258941' ENSG00000150526'	'MIA2'	missense'	'0.0710'	'rs3825549'	'S/P'	'possibly_damaging, benign'	'tolerated'	'344, 343'
'14:45667953-45667953'	'C'	'T'	'ENSG00000187790'	'FANCM'	missense'	'0'	''	'P/L'	'benign'	'tolerated'	'132'
'14:50238321-50238321'	'G'	'C'	'ENSG00000165516'	'KLHDC2'	missense'	'0'	''	'V/L'	'benign, possibly_damaging'	'tolerated'	'55'
'14:51370807-51370807'	'C'	'T'	'ENSG00000131969'	'ABHD12B'	missense'	'0.0023'	'rs149870138'	'R/C'	'benign'	'tolerated'	'213, 243, 320'
'14:57075920-57075920'	'G'	'T'	'ENSG00000070269'	'C14orf101'	missense'	'0.1012'	'rs17776256'	'A/S'	'probably_damaging'	'deleterious, tolerated'	'245, 89, 22'

'14:105173802-105173802'	'G'	'A'	'ENSG00000203485'	'INF2'	missense'	'0'	''	'A/T'	'benign'	'tolerated'	'400'
'14:105420590-105420590'	'C'	'T'	'ENSG00000185567'	'AHNAK2'	missense'	'0.0005'	'rs140752229'	'G/S'	'possibly_damaging'	'tolerated'	'400'
'15:23685541-23685542'	'CT'	'C'	'ENSG00000174450'	'GOLGA6L2'	frameshift'	'0'	''	''	''	''	'694'
'15:99646107-99646108'	'A'	'AG'	'ENSG00000182253'	'SYNM'	frameshift'	'NA'	'rs60530833'	''	''	''	'234'
'16:863498-863498'	'G'	'C'	'ENSG00000167945'	'PRR25'	missense'	'0.1397'	'rs13333991'	'L/F'	'possibly_damaging'	''	'282'
'16:3109032-3109032'	'G'	'A'	'ENSG00000008516'	'MMP25'	missense'	'0.0888'	'rs7188234'	'G/E'	'possibly_damaging'	'deleterious'	'541'
'16:24564879-24564881'	'GTA'	'G'	'ENSG00000122257'	'RBBP6'	splice donor'	'0'	rs72133882, COSM132840'	''	''	''	''
'16:56602798-56602798'	'G'	'A'	'ENSG00000102891'	'MT4'	missense'	'0.0563'	'rs11643815'	'G/D'	'probably_damaging'	''	'48'
'16:72993708-72993708'	'C'	'T'	'ENSG00000140836'	'ZFHX3'	missense'	'0.0298'	'rs62640010'	'A/T'	'benign'	''	'113'
'16:81181821-81181821'	'T'	'C'	'ENSG00000166473'	''	missense'	'0.0870'	'rs9921812'	'D/G'	'benign'	'tolerated'	'1632, 947'
'17:6555546-6555547'	'C'	'CG'	'ENSG00000212734'	'C17orf100'	frameshift'	'0'	''	''	''	''	'105'
'17:21216964-21216964'	'T'	'C'	'ENSG00000034152'	'MAP2K3'	missense'	'0'	'rs1657686'	'C/R'	'unknown'	'tolerated'	'101'
'17:26699367-26699368'	'G'	'GC'	'ENSG00000004139'	'SARM1'	frameshift'	'NA'	'rs34421136'	''	''	''	'72'
'17:72877212-72877212'	'C'	'T'	'ENSG00000172782'	'FADS6'	missense'	'0.0833'	'rs7219093'	'V/I'	'probably_damaging'	'deleterious'	'238, 117'
'18:61387277-61387277'	'C'	'T'	'ENSG00000206072'	'SERPINB11'	missense'	'0.0215'	'rs61740078'	'T/I'	possibly_damaging'	'deleterious'	'169'
									probably_damaging'		
'19:10676487-10676488'	'G'	'GC'	'ENSG00000129347'	'KRI1'	frameshift'	'0'	'rs34864064'	''	''	''	'27'
'19:17361116-17361116'	'G'	'A'	'ENSG00000130307'	'USHBP1'	missense'	'0.0389'	'rs1043963'	'A/V'	'benign, possibly_damaging'	'tolerated'	'677, 613'
'19:18119811-18119811'	'G'	'A'	'ENSG00000105643'	'ARRDC2'	missense'	'0'	''	'G/S'	'probably_damaging'	'deleterious'	'120, 125'
'19:18186625-18186625'	'G'	'A'	'ENSG00000096996'	'IL12RB1'	stop gained'	'0'	''	'R/*'	''	''	'212'
'19:19337625-19337625'	'C'	'T'	'ENSG00000130287'	'NCAN'	missense'	'0'	''	'T/M'	'benign'	'deleterious'	'468'
'19:19381885-19381885'	'C'	'A'	ENSG00000267629'	'TM6SF2'	missense'	'0.0014'	'rs200492531'	'V/L'	'benign'	'tolerated'	'49'
			ENSG00000213996'								
'19:20002439-20002439'	'G'	'T'	'ENSG00000256771'	'ZNF253'	missense'	'0.0714'	'rs75543118'	'G/V'	'possibly_damaging'	'tolerated'	'64, 52, 128'
'19:20117685-20117685'	'G'	'A'	'ENSG00000197124'	'ZNF682'	missense'	'0.1154'	'rs2075090'	'T/I'	'benign, possibly_damaging'	'deleterious'	'177, 209, 215, 133'
'19:20229669-20229669'	'C'	'T'	'ENSG00000213988'	'ZNF90'	missense'	'0'	''	'R/C'	'benign'	'tolerated'	'436'
'19:21477403-21477403'	'T'	'G'	'ENSG00000182141'	'ZNF708'	missense'	'0.1039'	'rs1781872'	'K/T'	'benign'	'tolerated, deleterious'	'122, 46, 58'
'19:21948570-21948570'	'T'	'C'	'ENSG00000197020'	'ZNF100'	missense'	'0.0408'	'rs12974842'	'M/V'	'benign'	'tolerated'	'8'
'19:23158847-23158847'	'T'	'A'	'ENSG00000269067'	'ZNF728'	missense'	'0.1113'	'rs1433111'	'K/I'	'probably_damaging'	'deleterious'	'431'
'19:46518651-46518651'	'A'	'G'	'ENSG00000104983'	'CCDC61'	missense'	'0.1026'	'rs7895'	'T/A'	'benign, possibly_damaging'	'tolerated'	'328, 271'
'19:46518682-46518682'	'G'	'A'	'ENSG00000104983'	'CCDC61'	missense'	'0.1012'	'rs7271'	'R/K'	'benign'	'tolerated'	'338, 281'
'19:46543566-46543566'	'C'	'T'	'ENSG00000204869'	'IGFL4'	missense'	'0.0971'	'rs17271272'	'R/Q'	'benign'	'tolerated'	'60'
'19:49303070-49303070'	'G'	'C'	'ENSG00000105552'	'BCAT2'	missense'	'0.0952'	'rs11548193'	'T/R'	'benign, possibly_damaging'	'tolerated'	'146, 94, 186, 178'
'19:55324674-55324675'	'C'	'CA'	'ENSG00000189013'	'KIR2DL4'	frameshift'	'0'	rs11371265, rs200833604'	''	''	''	'265, 267'
'20:51870336-51870336'	'G'	'C'	'ENSG00000182463'	'TSHZ2'	missense'	'0.0618'	'rs739869'	'R/S'	'benign'	'tolerated'	'113, 110'
'20:52198759-52198759'	'C'	'T'	'ENSG00000171940'	'ZNF217'	missense'	'0'	''	'V/I'	'benign'	'tolerated'	'203'
'20:52561469-52561469'	'A'	'G'	'ENSG00000064787'	'BCAS1'	missense'	'0.1126'	'rs1055246'	'S/P'	'probably_damaging, benign'	'deleterious'	'583, 505, 249, 246, 592, 454'
'20:56185303-56185303'	'G'	'A'	'ENSG00000124256'	'ZBP1'	missense'	'0.0907'	'rs41275648'	'A/V'	'benign, possibly_damaging'	'tolerated'	'309, 332, 257, 7'
'20:56227589-56227589'	'C'	'G'	'ENSG00000124225'	'PMEPA1'	missense'	'0.0783'	'rs41314918'	'E/D'	'benign'	'tolerated'	'78, 128, 93, 185, 100'
'20:57768607-57768607'	'G'	'C'	'ENSG00000124203'	'ZNF831'	missense'	'0.1213'	'rs181984'	'G/R'	'probably_damaging'	'deleterious'	'845'
'22:23154582-23154582'	'G'	'C'	'ENSG00000211669'	'IGLV3-10'	missense'	'0.0490'	'rs1065464'	'A/P'	'benign'	'tolerated'	'51'
'22:23165340-23165340'	'C'	'G'	'ENSG00000211671'	'IGLV2-8'	missense'	'0.1479'	'rs5996397'	'T/S'	'benign'	'tolerated'	'9'
'22:23247082-23247082'	'C'	'T'	'ENSG00000211678'	'IGLJ3'	missense'	'0'	'rs2009433'	'P/S'	'possibly_damaging'	''	'10'
'22:50319079-50319079'	'T'	'G'	'ENSG00000184164'	'CRELD2'	missense'	'0.0783'	rs11545762, COSM149318'	'S/A'	'benign'	'tolerated'	'263, 295, 267, 344'
'X:32583854-32583854'	'T'	'C'	'ENSG00000198947'	'DMD'	missense'	'0'	''	'N/D'	'benign'	'tolerated'	'653, 649, 645'
'X:38145911-38145911'	'C'	'T'	'ENSG00000156313'	'RPGR'	missense'	'0.0976'	rs5917557, CD033250'	'A/T'	'unknown'	''	'781'
'X:57515249-57515249'	'G'	'A'	'ENSG00000165591'	'FAAH2'	missense'	'0'	'rs139175109'	'G/R'	'probably_damaging'	'deleterious'	'495'
'X:100490933-100490933'	'G'	'C'	'ENSG00000102385'	'DRP2'	missense'	'0.1206'	'rs7066252'	'V/L'	'benign'	'tolerated'	'68'
'X:105449661-105449661'	'C'	'T'	'ENSG00000157502'	'MUM1L1'	missense'	'0.0181'	'rs143322709'	'P/L'	'benign'	'tolerated'	'79'
'X:107224898-107224898'	'C'	'T'	'ENSG00000170925'	'TEX13B'	splice donor'	'0.0048'	'rs149281284'	''	''	''	''
'X:114424597-114424597'	'G'	'A'	'ENSG00000175718'	'RBMXL3'	missense'	'0.1073'	'rs12009026'	'R/H'	'possibly_damaging'	'deleterious'	'198'
'X:128888494-128888494'	'A'	'G'	'ENSG00000122121'	'XPNPEP2'	missense'	'0.0048'	'rs145287846'	'K/R'	'probably_damaging'	'tolerated'	'385'
'X:129206293-129206293'	'G'	'A'	'ENSG00000102034'	'ELF4'	missense'	'0.0006'	'rs150084985'	'A/V'	'benign'	'tolerated'	'147'
'X:144904814-144904814'	'C'	'T'	'ENSG00000185985'	'SLITRK2'	missense'	'0'	''	'P/S'	'benign'	'tolerated'	'291'
'X:152830460-152830460'	'G'	'C'	'ENSG00000067842'	'ATP2B3'	missense'	'0'	''	'E/Q'	'probably_damaging, benign'	'tolerated'	'1067, 1081'
									possibly_damaging'		
'X:153175295-153175295'	'C'	'A'	'ENSG00000089820'	'ARHGAP4'	missense'	'0.0163'	'rs2070099'	'V/L'	'benign'	'tolerated'	'261, 194, 749, 772, 594, 812, 751'

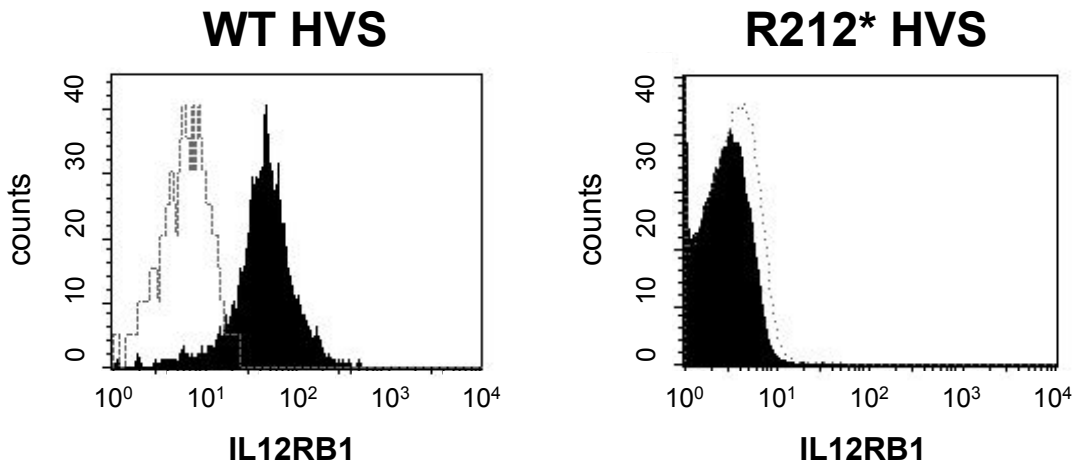
Supplemental Figures



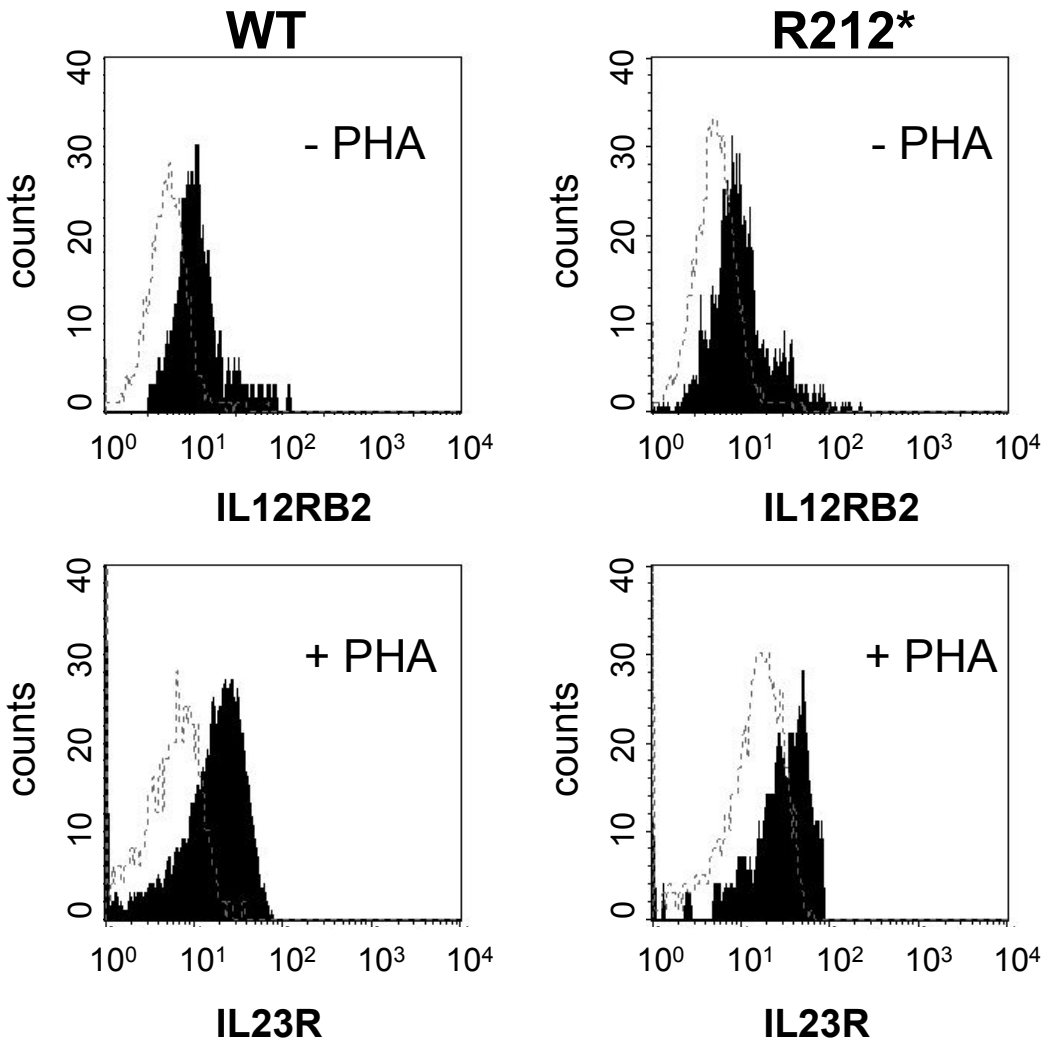
Supplemental Figure 1: IL12RB1 expression in FasL deficient patient, heterozygous carrier and homozygous wildtype control. IL12RB1 is expressed at normal level in a patient harboring the homozygous *FASLG* mutation g.172628545insT (resulting in p.P69Afs*75), a heterozygous carrier (mother) and a wildtype control. Another patient (not shown here) with the identical mutation also presented with normal expression of IL12RB1. (Mean values and standard deviations of a representative experiment performed in duplicates and repeated at least three times is shown.)



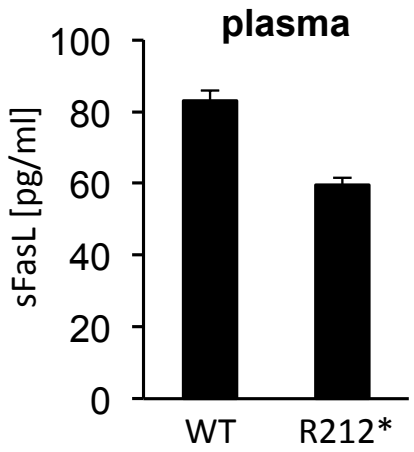
Supplemental Figure 2: The network of interactions between members of the Fas pathway and the six mutated candidate proteins. STRING 9.1 was used as a resource for protein-protein interactions. Only links between proteins with very high confidence (≥0.900) based on experimentally shown, predicted or transferred interactions were taken into account. Interaction links solely based on computational text-mining methods were discarded. Members of the Fas signaling pathway or interacting proteins are shown in blue. Gene products bearing homozygous mutations in the patient but not in unaffected family members are shown red. Only IL12RB1 shows direct high confidence interaction with FasL.



Supplemental Figure 3: IL12RB1 expression is absent in activated T cells derived from the IL12RB1 mutated patient that were immortalized using Herpes Virus Saimirii (HVS). Flow cytometric measurement of IL12RB1 surface expression on immortalized T lymphocytes of the patient (*right panel*) compared to a healthy control (*left panel*). Isotype controls are depicted as histograms with dotted lines. Results from stainings with the IL12RB1 specific antibody is presented as filled histograms.



Supplemental Figure 4: The *IL12RB1* mutation has no effect on expression of its heterodimerization partners, the IL12 receptor component IL12RB2 or the IL23 receptor component IL23R. Flow cytometric measurements of IL12RB2 and IL23R surface expression on primary T lymphocytes of the patient (*right panels*) compared to a healthy control (*left panels*) are shown after four days of activation with PHA/IL2 (*lower panels*) or without activation by PHA (*upper panels*). Isotype controls are depicted as histograms with dotted lines, results from stainings with specific antibodies as filled histograms.



Supplemental Figure 5: Soluble FasL levels are lower in the patient's plasma compared to healthy controls. sFasL concentrations were measured employing ELISA. A representative experiment repeated three times is shown. Mean values and standard deviations of duplicates are presented.