

Exome sequencing reveals heterogeneous clonal dynamics in donor cell myeloid neoplasms after stem cell transplantation

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Supplementary Material

This appendix has been provided by the authors to give readers additional information about their work.

Supplement to Julia Suárez-González^{1,2}, Juan Carlos Triviño³, Guiomar Bautista⁴, Jose Antonio García Marco⁴, Ángela Figuera⁵, Antonio Balas⁶, José Luis Vicario⁶, Francisco José Ortuño⁷, Raúl Teruel⁷, José María Álamo⁸, Diego Carbonell^{2,9}, Cristina Andrés-Zayas^{1,2}, Nieves Dorado^{2,9}, Gabriela Rodríguez-Macías⁹, Mi Kwon^{2,9}, José Luis Díez-Martín^{2,9,10}, Carolina Martínez-Laperche^{2,9#*}, Ismael Buño^{1,2,9#*}. **Whole exome sequencing reveals clonal dynamics in seven donor cell myeloid neoplasms after hematopoietic transplantation.**

Supplementary Methods

WES and variant analysis.

DNA was extracted directly from PB and BM samples and donor origin of the DCMN was confirmed in a centralized laboratory by short tandem repeat chimerism analysis in samples along post-transplant period (AmpFISTR SGM plus; Applied Biosystems, foster City, CA, USA; Supplemental Figure S2). Genomic DNA samples were prepared according to Agilent SureSelect-XT Human exon 50Mb enrichment kit (Agilent Technologies, Santa Clara, CA, USA) preparation guide. Libraries were sequenced on an Illumina HiSeq platform (Illumina, San Diego, CA, USA).

WES was generated from 40 samples to an average sequencing depth of 57 fold (range 30-110), a median of 155,949 singleton SNPs (range 150,477-194,363) was identified for each sample.

Variant calling and annotations strategies

Exome sequencing data were aligned against the last version of the Human Reference Genome (GRCh38/hg38) using the Burrows Wheeler Alignment tool (BWA) v0.7.15-r1140.¹ From the BAM formatted file obtained after read mapping, low quality reads (≤ 20 Phred Scale) and sequences flagged as PCR duplicates were removed using Samtools v1.2² and Picard Tools v2.12.1 methods (Table S2). Variant calling was performed using a combination of two different algorithms: VarScan³ and GATK.⁴ The copy number variant (CNV) analysis was performance using CNVkit algorithms, v0.7.7.dev0.⁵

All predicted variants were filtered to remove false positives related to potential homopolymer artifacts (variants found in homopolymers having a sequence length ≥ 10 were removed), with a mapping quality of 20 and with a minimum of 5 variants reads. Variant transcript annotation was based on all human transcripts obtained from Ensembl Release v81.⁶ All variants that occurred in coding exons and splice sites of canonical transcripts were annotated in multiple databases such as Database of single nucleotide polymorphisms (dbSNP),⁷ the 1000 genomes project⁸ and the Catalogue of somatic mutations in cancer⁹ (COSMIC). Splice site mutations were restricted to substitutions, deletions or insertions overlapping the 2bp intronic sequence defined as the canonical splice donor or splice acceptor. Variants affecting, 3'UTR, 5'UTR, intronic sequences, non-canonical transcripts, RNA genes and all those that did not change the amino acid sequence, were discarded for the purpose of downstream analysis. In addition, all variants from genes suspected to have pseudogenes were discarded. Variants selected were visually examined with the IGV and any data that appeared to be supported by potential sequencing, amplification, or alignment artifacts were discarded.

Identification of mutations in post-transplant samples

In the case of DCHN, samples obtained along the post-transplant period as a result of routine follow-up analysis, prior to the diagnosis of leukemia are available for study.

To identify the acquisition of mutations along the post-allo-HSCT period, DNA sequencing data from recipient post-transplant BM samples, were matched against their donor PB sample and previous BM samples (Supplemental Figure S2). Those variants detected with minor allelic frequency >0.01 in the general population were excluded. Remaining variants were further filtered to retain variants reported in the literature as associated with cancer development,

variants reported in COSMIC or variants identified as deleterious by three *in silico* analysis platforms (SIFT,¹⁰ Polyphen-2¹¹ and condel).

Donor analysis

To perform the donor analysis a cancer-associated gene list was compiled. The list comprised of a total of 2197 genes (Table S2) that included genes grouped by functional cancer related pathways such as phosphatidylinositol 3-kinase pathway-Akt (PI3K-Akt) signaling, mammalian target of rapamycin (mTOR) signaling, Janus tyrosine Kinase-Signal Transducer and Activator of Transcription (JAK-STAT) signaling, cytokine-cytokine receptor interaction, mitogen-activated protein kinase (MAPK) cascade, Peroxisome proliferator-activated receptors (PPARs) signaling, cell cycle, p53 signaling, vascular endothelial growth factor (VEGF) signaling, apoptosis, adherents junctions, Wnt signaling, cyclic AMP (cAMP) signaling, focal adhesion, extracellular matrix receptor (ECM-receptor) interaction and transforming growth factor beta (TGFB) signaling, spliceosome components; genes involved in the development of hematopoietic cell lineage, transcriptional miss-regulation in cancer, signaling pathways regulating pluripotency of stem cells, development of myeloid neoplasm, cancer predisposition, immunodeficiency and evasion of the immune response. Variants detected in these genes were further filtered to retain only those reported to the database Human Gene Mutation Database¹² (HGMD) or reported in the literature as responsible or predisposing to cancer, with a minor allelic frequency <0.01 in the general population.

Gene panel resequencing

Potential mutations identified by WES were validated by targeted (IDT, Coralville, Iowa, USA) next generation sequencing (>1000x depth, sensitivity 1%; Illumina MiSeq) of a custom panel which included all such genes plus 17 genes frequently

mutated in MN (*NRAS*, *WT1*, *KRAS*, *FLT3*, *IDH2*, *SRSF2*, *TP53*, *CEBPA*, *SF3B1*, *IDH1*, *DNMT3A*, *ASXL1*, *RUNX1*, *U2AF1*, *TET2*, *NPM1*, *JAK2*). All patient post-HSCT samples as well as donor samples were reanalyzed using this gene panel.

CNV analysis

CNVs alterations detected by WES had been previously detected by cytogenetics analysis, FISH or CGH/SNP arrays.

Clonal architecture

To reconstruct and visualize clonal architecture in order to understand inter- and intra-tumor heterogeneity and evolution, R v.3.2.2 (The R Foundation) Fishplot package was applied, for adjusting the spatial and temporal patterns, and for visualizing clonal evolution.¹³

Patient #1

A 56-year-old man presented in 2005 a mantle cell lymphoma stage IV-A with supra and infradiaphragmatic affection and BM involvement. The patient achieved complete remission (CR) after treatment with cyclophosphamide, vincristine, doxorubicin, dexamethasone and rituximab (hyper CVAD-R). Three years later a disease relapse was diagnosed and chemotherapy with etoposide, methylprednisone, high-dose of cytarabine, cisplatin and rituximab (ESHAP-R) induced a second remission.

When the patient was 60 years old, allogeneic peripheral blood SCT from an identical HLA, 72-year-old brother was performed for mantle cell lymphoma during the second remission. The conditioning regimen consisted of ibritumomab tiuxetan, fludarabine and melphalan. His post-transplant course was complicated by neurotoxicity and severe mucositis grade IV, that needed a tracheotomy.

4 years and 9 months after transplantation, follow-up PB examination showed bicytopenia and the BM showed dysplastic changes without blasts. Cytogenetic studies showed a karyotype //45,XY,-7,del(12)(p12) karyotype in 95% of metaphases. Short tandem repeat (STR) analysis of the BM cells showed complete donor chimera. Within this scenario, diagnosis of myelodysplastic syndrome (MDS) type refractory cytopenia with multilineage dysplasia (RCMD) with origin in donor-derived cells was made. The hypomethylating agent azacitidine (AZA) was administered, the patient received a total of 8 cycles of AZA with initial partial response but with posterior progression to refractory anemia with excess blast-1 (RAEB-1). Fourteen months after the diagnosis of MDS in donor cells, the patient underwent allogeneic transplantation from his haploidentical 33-year-old son after a conditioning regimen with busulfan and flurabine, cyclophosphamide in days +3, +4 and cyclosporine in day +5. He developed febrile neutropenia, renal complications, severe exudative skin reaction, pneumonia and polyneuropathy that eventually led to his death.

The donor remained healthy after transplantation, but a BM aspirated showed 5% of blastic cells and dysplastic features.

Genomic DNA was isolated and subjected to whole-exome sequencing from BM specimens of the recipient at day +25, +428, +866, +1081, +1477, +1704, +1727, +1755, +2098 after first allo-HSCT, as well as PB specimen from donor at the time of transplant.

Patient #2

A 26-year old woman was diagnosed as having pre-B acute lymphoblastic leukemia (ALL) on the basis of a BM with 50% blasts. After treatment with prednisone, daunorubicin, L-asparaginase, intratecal metotrexate followed by radioterapy (24 Gy) and consolidation therapy with citarabine and tenoposide to complete treatment, she achieved a new complete remission. 6 years after diagnosis, the patient relapsed, and the patient achieved complete remission after treatment with conventional chemotherapy (PETHEMA ALL-AR-03).¹⁴ One year after relapse, an allo-HSCT from her father, 1-

antigen HLA-antigen mismatched, was planned in second complete remission. Conditioning regimen consisted in cytarabine, total body irradiation (TBI) and timoglobulin. The patient developed cytomegalovirus viremia (VEB) resolved with Rituximab and skin rash resolved with cyclosporine. She also developed bronchiolitis accordant with chronic pulmonary graft *versus* host disease (GVHD).

Two years after the allo-HSCT the patient showed a history of anemia, without response to erythropoietin, and 34 months after allo-HSCT, a BM aspirated showed dysplastic changes without blasts, FISH studies showed del(5q) and monosomy of chromosome 7. Chimerism studies by STR of the BM cells showed 100% donor origin. The patient was diagnosed of MDS with origin in donor-derived cells. The donor remained healthy after transplantation.

Genomic DNA was isolated from BM specimens of the recipient at day +364, +609, +858 and +1012 after allo-HSCT and subjected to whole-exome sequencing, as well as PB specimen from donor at the time of transplant.

Patient #3

A 39-years-old male patient was diagnosed with chronic myeloid leukemia in chronic phase (CML-CP) with leukocytosis, cytogenetic studies performed in BM specimen showed a karyotype 46,XY,t(9,22) in all metaphases analyzed. Six months after treatment with hydroxyurea and interferon, the patient did not achieve hematologic response, neither cytogenetic response. Fourteen months after diagnosis, an allo-HSCT from his HLA-identical brother was performed following conditioning regimen with busulfan and cytarabine. His post-transplant period was complicated by neutropenic fever, oral mucositis grade II-IV, bilateral conjunctival hemorrhage, candidemia and cholestasis.

Twenty years after allo-HSCT the patient was noted to be neutropenic and thrombocytopenic. A BM aspirate was performed, which revealed dysplastic changes with 3% blasts and plasmacytosis (20% plasmatic cells). Cytogenetic studies showed a

karyotype //46,XY karyotype. FISH was negative for t(9;22) and STR analysis of the BM cells revealed full donor chimera. The patient was diagnosed of MDS with origin in donor-derived cells and plasmacytosis.

Due to progression of cytopenias a new BM aspirated was performed 6 months after the diagnosis of donor-cell derived MDS, that confirmed the diagnosis and associated FISH studies demonstrated the presence of a monosomy of chromosome 7 in 30% of the cells analyzed. Fifteen months after the diagnosis of MDS in donor cells and after 6 cycles of subcutaneous AZA, the pancytopenia was progressed and at this time the BM revealed hypercellular marrow with trilineal dysplasia, 23% blasts and significant plasmacytosis. Cytogenetic studies showed a karyotype //45,XY,-7 karyotype, confirmed by FISH in 40% of the cells. The patient was diagnosed of secondary AML in donor cells and myeloma quiescent IgA kappa (IgAk), and underwent a haploidentical-HSCT from his son.

The donor remained healthy at the moment of the diagnosis of MDS in donor derived-cells. He was evaluated and his tests were significant for an elevated serum protein electrophoresis demonstrated an abnormal band in the beta region revealing the existence of the same paraprotein (IgAk).

Genomic DNA was isolated and subjected to whole-exome sequencing from BM specimens of the recipient at days +1589, +6087, +7469 and +7675 after allo-HSCT, as well as PB specimen from donor at the time of transplant.

Patient #4

A 60-year-old male with a history of asthenia was diagnosed with AML. Cytogenetic studies in BM showed a karyotype 46,XY,t(3;17)(q21;q21),del(5q) karyotype. After treatment with fludarabine and cytarabine he achieved CR and 4 months after diagnosis an allo-HSCT from his HLA-id sister was performed. SCs mobilized from PB were infused following non-myeloablative conditioning regimen with fludarabine, busulfan and thymoglobulin. GVHD prophylaxis consisted of tacrolimus and methotrexate (MTX).

Post-transplant period was complicated by sickness, metabolic acidosis, fever, hypotension, acute cutaneous GVHD grade II and digestive GVHD grade III-IV treated with budesonide, metilprednisolone and etanercept. He also presented recurring cytomegalovirus viremias and positive EBV, resolved with ganciclovir and valganciclovir. Nineteen months after allo-HSCT, the patient presented with fever and interstitial pneumonia secondary to an upper respiratory infection. BM analysis revealed 21% myeloid blasts. Immunophenotype was CD38+, CD34+, CD64+d, CD13+, CD33+, CD117+, CD1a+d, CD123+d, CD4+d (24% of leucocytes). Moreover, cytogenetic analysis showed a complex karyotype: //45,XX,t(3;16)(q21;q22),-7[16]//90-130,XXXX,t(3;16)(q21;q22),t(3;16)(q21;q22),-7,-7,+2-5 mar[2]//46,XX[2]. Molecular STR analysis showed complete donor chimerism. Within this scenario, diagnosis of AML with origin in donor-derived cells was made. The patient received a total of 6 cycles of AZA, resulting in severe thrombopenia and disease progression. The donor remained healthy at the moment of the diagnosis of DCMN.

Genomic DNA was isolated and subjected to whole-exome sequencing from BM specimens of the recipient at day +95, +388 and +570 after allo-HSCT, as well as PB specimen from donor at the time of transplant.

Patient #5

A 55-years-old male presented a mantle cell lymphoma stage IV-A. The patient achieved complete remission (CR) after treatment with cyclophosphamide, vincristine, doxorubicin, dexamethasone, rituximab (hyper CVAD-R) and MTX-AraC, he underwent an allo-HSCT from his HLA-id brother 10 months after diagnosis. His post-transplant course was complicated by a moderate chronic cutaneous GVHD.

Routine blood analysis performed 5,5 years after transplantation showed severe pancytopenia (leucocytes 1540 u/L, Hb 10,8 g/dL and platelets 31000 u/l). A BM aspirate revealed a hypocellular BM with 27% of myeloid blast cells. Cytogenetics studies showed an abnormal karyotype: //46,XY,del(7)(q31q36) [4]// 47,XY,+1,der(1;7)(q10;p10) [18].

Immunophenotype was DR+, CD34+, CD38+, CD13+, CD33+, CD64+, CD15+, CD117+, CD123+, CD4+, CD14+d (24% of leucocytes). Molecular STR determinations showed complete donor chimerism and diagnosis of AML with origin in donor-derived cells was made. Thereafter, the patient received a new transplant and AZA were administered as maintenance therapy after transplant. Relapse occurred and a third allo-HSCT was planned from his HLA-id brother, 7 cycles of AZA were administered after transplant, however, the patient relapsed again and finally he death.

Genomic DNA was isolated and subjected to whole-exome sequencing from BM specimens of the recipient at day +128, +368 and +2011 after allo-HSCT, as well as PB specimen from donor at the time of transplant.

Patient #6

A 46-year-old woman presented a pro-B ALL, cytogenetic studies in the diagnostic BM showed a karyotype 46,XY,t(4;11) karyotype confirmed by FISH. The patient achieved complete remission after treatment with chemotherapy (PETHEMA LAL-AR 2011). She underwent Haplo-cord allo-HSCT from a matched unrelated umbilical cord blood (with her brother as third party donor) 4 months after diagnosis. Conditioning regimen consisted in fludarabine, ciclofosfamide, timoglobuline and TBI (10Gy). GVHD prophylaxis consisted of tacrolimus and metilprednisone. Her post-transplant course was complicated by diarrhea associated with *Clostridium difficile* and urinary tract infection by *Escherichia coli* and *Enterococo faecium*, she also developed bronchiolitis obliterans and fever. A complete blood test obtained the following results 24 months after allo-HSCT: leucocytes 3790 u/L, Hb 6.1 g/dL and platelets 57000 u/l, the patient reported a history of asthenia and cutaneous lesions. A BM smear demonstrated a hypercellular BM, multilineage dysplasia and myeloblasts accounted for 66%. Immunophenotype was DR+, CD38+, CD64+, CD56+, CD15+, CD14+, CD13+d, CD33+ and CD4+. STR analysis of the BM cells revealed full donor chimera and the patient was diagnosed of monocitic AML with origin in donor-derived cells. Fludarabine, cytarabine and idarubicine

were administered to the patient for induction chemotherapy and AZA as maintenance chemotherapy. she underwent a second haplo-cord allo-SCT from an unrelated matched donor in CR, but finally the patient died.

Genomic DNA was isolated and subjected to whole-exome sequencing from BM specimens of the recipient at day +99, +229, +358 and +722 after allo-HSCT, as well as PB specimen from donor at the time of transplant and from CB unit.

Patient #7

A 46-year-old male presented with a 1-week history of epistaxis, hemoptysis and fever and was diagnosed as having ALL on the basis of a blood test including 95% blasts, together with a BM aspirate with massive infiltration by mid-sized, high n/c ratio, PAS+ blast cells, with a immunophenotype CD19+, CD22+, CD10+, TdT+ and CD34+ immunophenotype. Cytogenetic studies showed a 46,XY,t(9;22)(q34;q11) karyotype. The patient achieved CR after treatment with chemotherapy (PETHEMA AL-Ph-2008)¹⁵ and 5 months after diagnosis he underwent an allo-HSCT from his 1-antigen HLA-mismatched sister. Conditioning regimen consisted in cytarabine and TBI (12Gy).

At day +150 after allo-HSCT, bicytopenia with progressive dysgranulopoiesis were observed in PB, while the BM aspirate showed dyserythropoiesis, dysgranulopoiesis, dysmegakaryopoiesis and 4% blast cells. Cytogenetic studies showed a //46,XX,t(10;11)(q24;p15) karyotype, finding that was confirmed by M-FISH. At day +500 after allo-SCT, the percentage of blast cells raised up to 14% and a complex karyotype was observed: //46,XX,t(10;11)(q24;p15)[13]//45,sl,-13,-16,+mar[2]//46,sl,del(7)(q22)[5]. CGH/SNP array analysis showed: a 54.55 Mb deletion in 7q22.2-q36.3 (25%) and a 17.32 Mb duplication in 11q23.3-q25 (60%). Molecular studies for *BCR-ABL* detection were negative. STR analysis of the BM cells revealed full donor chimera and the patient was diagnosed of MDS with origin in donor-derived cells. The donor remained healthy at the moment of the diagnosis of MDS in donor derived-cells.

Genomic DNA was isolated and subjected to whole-exome sequencing from BM specimens of the recipient at day +71, +113, +162, +419 and +728 after allo-HSCT, as well as PB specimen from donor at the time of diagnosis of MDS in donor derived-cells.

Gene	Ch	Gene description	HGVS_c_name	HGVS_p_name	Effect	Months post allo-TPH (VAF)													
						2	15	30	37	50	58	58.5	59	60					
Patient 1																			
45,XY-7	7	-	-	-	CNV	0.1	0.1	0.1	0.2	0.1	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
LUC7L2	7	LUC7 like 2, pre-mRNA splicing factor	c.568TG>CT	p.Cys190Leu	missense	-	-	-	-	-	0.28	0.4	0.22	0.38					
del(12p)	12	-	-	-	CNV	-	-	-	-	-	-	0.4	0.2	0.4					
SETBP1	18	SET binding protein	c.2612T>C	p.Ile871Thr	missense	-	-	-	-	-	-	0.4	-	-					
Patient 2						12	20	29	34										
DNMT3A	2	DNA methyltransferase 3 alpha 5	c.893G>A	p.Gly298Glu	missense	-	0.32	0.51	0.44										
TP53*	17	Tumor protein p53	-	p.Gly302AlafsTer42	frameshift	-	0.49	0.53	0.64										
LAMA5	20	Laminin subunit alpha 5	c.3407delA	p.Gln1136ArgfsTer38	frameshift	-	0.32	0.40	0.54										
del(5q)	5	-	-	-	CNV	-	0.2	0.4	0.4										
del(7q)	7	-	-	-	CNV	-	0.2	0.4	0.4										
Patient 3						53	203	248	256										
CSF3R*	1	Colony stimulating factor 3 receptor	c.2296C>T	p.Gln766Ter	stop gained	-	-	0.15	0.08										
TET2	4	Tet methylcytosine dioxygenase	c.4594C>T	p.Gln1532Ter	stop gained	-	-	0.27	0.13										
TET2	4	Tet methylcytosine dioxygenase	c.5230_5246del	p.Leu1744GlyfsTer3	frameshift	-	-	0.21	0.14										
SNX13	7	Sorting nexin 13	c.2366G>C	p.Arg789Thr	missense	-	-	0.28	0.15										
MEFV	16	MEFV, pyrin innate immunity regulator	c.1937C>T	p.Pro646Leu	missense	-	-	0.11	0.18										
SKOR2	18	SKI family transcriptional corepressor 2	c.194C>T	p.Ala65Val	missense	-	-	0.18	0.20										
ASXL1*	20	Additional Sex Combs-like 1	c.1888_1910del	p.Glu635ArgfsTer15	frameshift	-	-	0.08	0.10										
RUNX1	21	Runt related transcriptional factor 1	c.876dupC	p.Ser293LeufsTer307	frameshift	-	-	0.18	0.05										
45,XY-7	7	-	-	-	CNV	-	-	0.15	0.1										
Patient 4						3	13	19											
GSE1	16	Gse1 coiled-coil protein	c.366dupC	p.Val123ArgfsTer17	frameshift	-	-	-	0.16										
CK	-	-	-	-	CNV	-	-	-	0.15										
Patient 5						4	12	67											
CSF3R	1	Colony stimulating factor 3 receptor	c.2433dupC	p.Lys812GlnfsTer4	frameshift	-	-	-	0.2										
EML1	14	echinoderm microtubule associated protein like 1	c.632G>A	p.Arg211His	missense	-	-	-	0.12										
del(7q)	7	-	-	-	CNV	-	-	-	0.1										
Patient 6						3	8	12	24										
IRS1	2	Insulin receptor substrate 1	c.32C>A	p.Ser11Ter	stop gained	-	-	-	0.20										
SEN7	3	SUMO1sentrin specific peptidase 7	c.478G>T	p.Glu160Ter	stop gained	-	-	-	0.19										
NPM1*	5	Nucleophosmin	c.860_863dupTCTG	-	frameshift	-	-	-	0.10										
NOTCH4	6	notch 4	c.1040G>T	p.Trp347Leu	missense	-	-	-	0.24										
TAF1L	9	TATA-box binding protein associated factor 1 like	c.3313G>T	p.Asp1105Tyr	missense	-	-	-	0.17										
DTX1	12	deltex E3 ubiquitin ligase 1	c.1245G>T	p.Met415Ile	missense	-	-	-	0.16										
TP53*	17	Tumor protein p53	C.824G>T	P.Cys275Phe	missense	-	-	-	0.13										
GRB7	17	growth factor receptor bound protein 7	c.748G>T	p.Gly250Cys	missense	-	-	-	0.15										
EP300	22	E1A binding protein p300	c.3728+1G>T	-	splicing	-	-	-	0.19										
Patient 7						2	3	5	14	24									
CK	-	-	-	-	CNV	-	-	0.1	0.2	0.3									

<i>ZKSCAN2</i>	16	Zinc finger with KRAB and SCAN domains 2	c.2461C>A	p.His821Asn	missense	-	-	-	0.09	0.3
<i>PNKP</i>	19	Polynucleotide kinase 3-phosphatase	c.298C>A	p.His100Asn	missense	-	-	-	0.13	0.38
<i>del(7q)</i>	7	-	-	-	CNV	-	-	-	0.1	0.3
<i>NOP14</i>	4	NOP14 nucleolar protein	c.2382C>A	p.His794Gln	missense	-	-	-	-	0.2
<i>MEGF10</i>	5	Multiple EGF like domains 10	c.1418G>T	p.Cys473Phe	missense	-	-	-	-	0.26
<i>TENM2</i>	5	Teneurin transmembrane protein 2	c.1381G>T	p.Gly461Cys	missense	-	-	-	-	0.35
<i>IDH2</i>	15	Isocitrate dehydrogenase (NADP(+)) 2	c.418C>T	p.Arg140Trp	missense	-	-	-	-	0.14
<i>ZNF461</i>	19	Zinc finger protein 461	c.1021G>T	p.Gly341Cys	missense	-	-	-	-	0.3

Supplemental Table S1. Deleterious somatic variants acquired in post allo-HSCT period. VAF detected in the moment of DCMN diagnosis are marked in light grey. The frequency population of the detected variants is 0, except for the variant detected in *SKOR2* which is equal to 0.0002. (*) Variants detected by target resequencing custom gene panel. (Abbreviations: VAF: Variant allele frequency, CK: Complex Karyotype, Ch: chromosome, allo-HSCT: allogeneic hematopoietic stem cell transplantation).

Pathway	Gene	Gene description
Adherens junctions	<i>NECTIN1</i>	nectin cell adhesion molecule 1
	<i>NECTIN2</i>	nectin cell adhesion molecule 2
	<i>NECTIN3</i>	nectin cell adhesion molecule 3
	<i>NECTIN4</i>	nectin cell adhesion molecule 4
	<i>PARD3</i>	par-3 family cell polarity regulator
	<i>SRC</i>	SRC proto-oncogene, non-receptor tyrosine kinase
	<i>FARP2</i>	FERM, ARH/RhoGEF and pleckstrin domain protein 2
	<i>CDC42</i>	cell division cycle 42
	<i>RAC1</i>	Rac family small GTPase 1
	<i>RAC2</i>	Rac family small GTPase 2
	<i>RAC3</i>	Rac family small GTPase 3
	<i>WAS</i>	Wiskott-Aldrich syndrome
	<i>WASL</i>	Wiskott-Aldrich syndrome like
	<i>IQGAP1</i>	IQ motif containing GTPase activating protein 1
	<i>BAIAP2</i>	BAI1 associated protein 2
	<i>WASF1</i>	WAS protein family member 1
	<i>WASF2</i>	WAS protein family member 2
	<i>WASF3</i>	WAS protein family member 3
	<i>AFDN</i>	afadin, adherens junction formation factor
	<i>LMO7</i>	LIM domain 7
	<i>SSX2IP</i>	SSX family member 2 interacting protein
	<i>SORBS1</i>	sorbin and SH3 domain containing 1
	<i>ACTN1</i>	actinin alpha 1
	<i>ACTN4</i>	actinin alpha 4
	<i>VCL</i>	vinculin
	<i>TJP1</i>	tight junction protein 1
	<i>CDH1</i>	cadherin 1
	<i>CTNND1</i>	catenin delta 1
	<i>CTNNB1</i>	catenin beta 1
	<i>CTNNA3</i>	catenin alpha 3
	<i>CTNNA1</i>	catenin alpha 1
	<i>CTNNA2</i>	catenin alpha 2
	<i>ACTB</i>	Actin beta
	<i>ACTG1</i>	actin gamma 1
	<i>RHOA</i>	ras homolog family member A
	<i>PTPRM</i>	protein tyrosine phosphatase, receptor type M
	<i>PTPRB</i>	protein tyrosine phosphatase, receptor type B
	<i>PTPRF</i>	protein tyrosine phosphatase, receptor type F
	<i>PTPN1</i>	protein tyrosine phosphatase, non-receptor type 1
	<i>PTPN6</i>	protein tyrosine phosphatase, non-receptor type 6
	<i>PTPRJ</i>	protein tyrosine phosphatase, receptor type J
	<i>CSNK2A1</i>	casein kinase 2 alpha 1
	<i>CSNK2A2</i>	casein kinase 2 alpha 2
	<i>CSNK2A3</i>	casein kinase 2 alpha 3
	<i>CSNK2B</i>	casein kinase 2 beta
	<i>TCF7</i>	transcription factor 7
	<i>TCF7L1</i>	transcription factor 7 like 1
	<i>TCF7L2</i>	transcription factor 7 like 2
	<i>LEF1</i>	lymphoid enhancer binding factor 1
	<i>IGF1R</i>	insulin like growth factor 1 receptor
	<i>INSR</i>	insulin receptor
	<i>MET</i>	MET proto-oncogene, receptor tyrosine kinase
	<i>EGFR</i>	epidermal growth factor receptor
	<i>ERBB2</i>	erb-b2 receptor tyrosine kinase 2
	<i>FGFR1</i>	fibroblast growth factor receptor 1
	<i>FYN</i>	FYN proto-oncogene, Src family tyrosine kinase
	<i>YES1</i>	YES proto-oncogene 1, Src family tyrosine kinase
	<i>MAPK1</i>	mitogen-activated protein kinase 1
	<i>MAPK3</i>	mitogen-activated protein kinase 3
	<i>SNAI2</i>	snail family transcriptional repressor 2
	<i>SNAI1</i>	snail family transcriptional repressor 1
	<i>TGFBR1</i>	transforming growth factor beta receptor 1
	<i>TGFBR2</i>	transforming growth factor beta receptor 2
	<i>SMAD2</i>	SMAD family member 2
	<i>SMAD3</i>	SMAD family member 3
	<i>SMAD4</i>	SMAD family member 4
	<i>CREBBP</i>	CREB binding protein
<i>EP300</i>	E1A binding protein p300	
<i>MAP3K7</i>	mitogen-activated protein kinase kinase kinase 7	
<i>NLK</i>	nemo like kinase	
<i>FER</i>	FER tyrosine kinase	
<i>ACP1</i>	acid phosphatase 1, soluble	
<i>PORCN</i>	porcupine O-acyltransferase	
Wnt signaling pathway	<i>WNT1</i>	Wnt family member 1
	<i>WNT2</i>	Wnt family member 2
	<i>WNT2B</i>	Wnt family member 2B
	<i>WNT3</i>	Wnt family member 3
	<i>WNT3A</i>	Wnt family member 3A
	<i>WNT4</i>	Wnt family member 4
	<i>WNT5A</i>	Wnt family member 5A
	<i>WNT5B</i>	Wnt family member 5B
	<i>WNT6</i>	Wnt family member 6
	<i>WNT7A</i>	Wnt family member 7A
	<i>WNT7B</i>	Wnt family member 7B
	<i>WNT8A</i>	Wnt family member 8A
	<i>WNT8B</i>	Wnt family member 8B
	<i>WNT9A</i>	Wnt family member 9A
<i>WNT9B</i>	Wnt family member 9B	

WNT10B	Wnt family member 10B
WNT10A	Wnt family member 10A
WNT11	Wnt family member 11
WNT16	Wnt family member 16
CER1	cerberus 1, DAN family BMP antagonist
NOTUM	NOTUM, palmitoleoyl-protein carboxylesterase
WIF1	WNT inhibitory factor 1
SERPINF1	serpin family F member 1
SOST	sclerostin
DKK1	dickkopf WNT signaling pathway inhibitor 1
DKK2	dickkopf WNT signaling pathway inhibitor 2
DKK4	dickkopf WNT signaling pathway inhibitor 4
SFRP1	secreted frizzled related protein 1
SFRP2	secreted frizzled related protein 2
SFRP4	secreted frizzled related protein 4
SFRP5	secreted frizzled related protein 5
FZD1	frizzled class receptor 1
FZD7	frizzled class receptor 7
FZD2	frizzled class receptor 2
FZD3	frizzled class receptor 3
FZD4	frizzled class receptor 4
FZD5	frizzled class receptor 5
FZD8	frizzled class receptor 8
FZD6	frizzled class receptor 6
FZD10	frizzled class receptor 10
FZD9	frizzled class receptor 9
LRP5	LDL receptor related protein 5
LRP6	LDL receptor related protein 6
BAMBI	BMP and activin membrane bound inhibitor
CSNK1E	casein kinase 1 epsilon
DVL3	dishevelled segment polarity protein 3
DVL2	dishevelled segment polarity protein 2
DVL1	dishevelled segment polarity protein 1
FRAT1	FRAT1, WNT signaling pathway regulator
FRAT2	FRAT2, WNT signaling pathway regulator
CSNK2A1	casein kinase 2 alpha 1
CSNK2A2	casein kinase 2 alpha 2
CSNK2A3	casein kinase 2 alpha 3
CSNK2B	casein kinase 2 beta
NKD1	naked cuticle homolog 1
NKD2	naked cuticle homolog 2
CXXC4	CXXC finger protein 4
SENP2	SUMO1/sentrin/SMT3 specific peptidase 2
GSK3B	glycogen synthase kinase 3 beta
CTNNB1	catenin beta 1
AXIN1	axin 1
AXIN2	axin 2
APC	APC, WNT signaling pathway regulator
APC2	APC2, WNT signaling pathway regulator
CSNK1A1L	casein kinase 1 alpha 1 like
CSNK1A1	casein kinase 1 alpha 1
TCF7	transcription factor 7
TCF7L1	transcription factor 7 like 1
TCF7L2	transcription factor 7 like 2
LEF1	lymphoid enhancer binding factor 1
CTNNBIP1	catenin beta interacting protein 1
CHD8	chromodomain helicase DNA binding protein 8
SOX17	SRY-box 17
CTBP1	C-terminal binding protein 1
CTBP2	C-terminal binding protein 2
CREBBP	CREB binding protein
EP300	E1A binding protein p300
RUVBL1	RuvB like AAA ATPase 1
SMAD4	SMAD family member 4
MAP3K7	mitogen-activated protein kinase kinase kinase 7
NLK	nemo like kinase
MYC	MYC proto-oncogene, bHLH transcription factor
JUN	Jun proto-oncogene, AP-1 transcription factor subunit
FOSL1	FOS like 1, AP-1 transcription factor subunit
CCND1	cyclin D1
CCND2	cyclin D2
CCND3	cyclin D3
PPARD	peroxisome proliferator activated receptor delta
MMP7	matrix metalloproteinase 7
PSEN1	presenilin 1
PRKACA	protein kinase cAMP-activated catalytic subunit alpha
PRKACB	protein kinase cAMP-activated catalytic subunit beta
PRKACG	protein kinase cAMP-activated catalytic subunit gamma
TP53	tumor protein p53
SIAH1	siah E3 ubiquitin protein ligase 1
CACYBP	calcyclin binding protein
SKP1	S-phase kinase associated protein 1
TBL1X	transducin beta like 1X-linked
TBL1Y	transducin beta like 1, Y-linked
TBL1XR1	transducin beta like 1 X-linked receptor 1
BTRC	beta-transducin repeat containing E3 ubiquitin protein ligase
FBXW11	F-box and WD repeat domain containing 11
CUL1	cullin 1
RBX1	ring-box 1

	<i>GPC4</i>	glypican 4
	<i>VANGL2</i>	VANGL planar cell polarity protein 2
	<i>VANGL1</i>	VANGL planar cell polarity protein 1
	<i>PRICKLE1</i>	prickle planar cell polarity protein 1
	<i>PRICKLE2</i>	prickle planar cell polarity protein 2
	<i>INVS</i>	inversin
	<i>DAAM1</i>	dishevelled associated activator of morphogenesis 1
	<i>DAAM2</i>	dishevelled associated activator of morphogenesis 2
	<i>RHOA</i>	ras homolog family member A
	<i>ROCK2</i>	Rho associated coiled-coil containing protein kinase 2
	<i>RAC1</i>	Rac family small GTPase 1
	<i>RAC2</i>	Rac family small GTPase 2
	<i>RAC3</i>	Rac family small GTPase 3
	<i>MAPK8</i>	mitogen-activated protein kinase 8
	<i>MAPK10</i>	mitogen-activated protein kinase 10
	<i>MAPK9</i>	mitogen-activated protein kinase 9
	<i>PLCB1</i>	phospholipase C beta 1
	<i>PLCB2</i>	phospholipase C beta 2
	<i>PLCB3</i>	phospholipase C beta 3
	<i>PLCB4</i>	phospholipase C beta 4
	<i>CAMK2A</i>	calcium/calmodulin dependent protein kinase II alpha
	<i>CAMK2D</i>	calcium/calmodulin dependent protein kinase II delta
	<i>CAMK2B</i>	calcium/calmodulin dependent protein kinase II beta
	<i>CAMK2G</i>	calcium/calmodulin dependent protein kinase II gamma
	<i>PPP3CA</i>	protein phosphatase 3 catalytic subunit alpha
	<i>PPP3CB</i>	protein phosphatase 3 catalytic subunit beta
	<i>PPP3CC</i>	protein phosphatase 3 catalytic subunit gamma
	<i>PPP3R1</i>	protein phosphatase 3 regulatory subunit B, alpha
	<i>PPP3R2</i>	protein phosphatase 3 regulatory subunit B, beta
	<i>PRKCA</i>	protein kinase C alpha
	<i>PRKCB</i>	protein kinase C beta
	<i>PRKCG</i>	protein kinase C gamma
	<i>NFATC1</i>	nuclear factor of activated T-cells 1
	<i>NFATC2</i>	nuclear factor of activated T-cells 2
	<i>NFATC3</i>	nuclear factor of activated T-cells 3
	<i>NFATC4</i>	nuclear factor of activated T-cells 4
	<i>SMAD3</i>	SMAD family member 3
	<i>FSHB</i>	follicle stimulating hormone beta subunit
	<i>ADRB1</i>	adrenoceptor beta 1
	<i>DRD1</i>	dopamine receptor D1
	<i>DRD5</i>	dopamine receptor D5
	<i>ADORA2A</i>	adenosine A2a receptor
	<i>HTR4</i>	5-hydroxytryptamine receptor 4
	<i>HTR6</i>	5-hydroxytryptamine receptor 6
	<i>PTGER2</i>	prostaglandin E receptor 2
	<i>ADCYAP1R1</i>	ADCYAP receptor type 1
	<i>VIPR2</i>	vasoactive intestinal peptide receptor 2
	<i>TSHR</i>	thyroid stimulating hormone receptor
	<i>MC2R</i>	melanocortin 2 receptor
	<i>GLP1R</i>	glucagon like peptide 1 receptor
	<i>GIPR</i>	gastric inhibitory polypeptide receptor
	<i>GPR119</i>	G protein-coupled receptor 119
	<i>FSHR</i>	follicle stimulating hormone receptor
	<i>NPR1</i>	natriuretic peptide receptor 1
	<i>GNAS</i>	GNAS complex locus
	<i>NPY</i>	neuropeptide Y
	<i>GHRL</i>	ghrelin and obestatin prepropeptide
	<i>ADRB2</i>	adrenoceptor beta 2
	<i>HTR1A</i>	5-hydroxytryptamine receptor 1A
	<i>HTR1B</i>	5-hydroxytryptamine receptor 1B
	<i>HTR1D</i>	5-hydroxytryptamine receptor 1D
	<i>HTR1E</i>	5-hydroxytryptamine receptor 1E
	<i>HTR1F</i>	5-hydroxytryptamine receptor 1F
	<i>CHRM1</i>	cholinergic receptor muscarinic 1
	<i>CHRM2</i>	cholinergic receptor muscarinic 2
	<i>DRD2</i>	dopamine receptor D2
	<i>GABBR1</i>	gamma-aminobutyric acid type B receptor subunit 1
	<i>GABBR2</i>	gamma-aminobutyric acid type B receptor subunit 2
	<i>ADORA1</i>	adenosine A1 receptor
	<i>EDNRA</i>	endothelin receptor type A
	<i>NPY1R</i>	neuropeptide Y receptor Y1
	<i>SSTR1</i>	somatostatin receptor 1
	<i>SSTR2</i>	somatostatin receptor 2
	<i>SSTR5</i>	somatostatin receptor 5
	<i>HCAR1</i>	hydroxycarboxylic acid receptor 1
	<i>HCAR2</i>	hydroxycarboxylic acid receptor 2
	<i>HCAR3</i>	hydroxycarboxylic acid receptor 3
	<i>FFAR2</i>	free fatty acid receptor 2
	<i>SUCNR1</i>	succinate receptor 1
	<i>PTGER3</i>	prostaglandin E receptor 3
	<i>OXTR</i>	oxytocin receptor
	<i>GHSR</i>	growth hormone secretagogue receptor
	<i>GNAI1</i>	G protein subunit alpha i1
	<i>GNAI3</i>	G protein subunit alpha i3
	<i>GNAI2</i>	G protein subunit alpha i2
	<i>ADCY1</i>	adenylate cyclase 1
	<i>ADCY2</i>	adenylate cyclase 2
	<i>ADCY3</i>	adenylate cyclase 3
	<i>ADCY4</i>	adenylate cyclase 4

cAMP signaling pathway

ADCY5	adenylate cyclase 5
ADCY6	adenylate cyclase 6
ADCY7	adenylate cyclase 7
ADCY8	adenylate cyclase 8
ADCY9	adenylate cyclase 9
ADCY10	adenylate cyclase 10, soluble
HCN2	hyperpolarization activated cyclic nucleotide gated potassium and sodium channel 2
HCN4	hyperpolarization activated cyclic nucleotide gated potassium channel 4
CNGA1	cyclic nucleotide gated channel alpha 1
CNGA2	cyclic nucleotide gated channel alpha 2
CNGA3	cyclic nucleotide gated channel alpha 3
CNGA4	cyclic nucleotide gated channel alpha 4
CNGB1	cyclic nucleotide gated channel beta 1
CNGB3	cyclic nucleotide gated channel beta 3
CALML3	calmodulin like 3
CALM2	calmodulin 2
CALM3	calmodulin 3
CALM1	calmodulin 1
CALML6	calmodulin like 6
CALML5	calmodulin like 5
CALML4	calmodulin like 4
CAMK2A	calcium/calmodulin dependent protein kinase II alpha
CAMK2D	calcium/calmodulin dependent protein kinase II delta
CAMK2B	calcium/calmodulin dependent protein kinase II beta
CAMK2G	calcium/calmodulin dependent protein kinase II gamma
CAMK4	calcium/calmodulin dependent protein kinase IV
ABCC4	ATP binding cassette subfamily C member 4
RAPGEF3	Rap guanine nucleotide exchange factor 3
RAPGEF4	Rap guanine nucleotide exchange factor 4
RRAS	RAS related
RRAS2	RAS related 2
PLD1	phospholipase D1
PLD2	phospholipase D2
PLCE1	phospholipase C epsilon 1
MAPK8	mitogen-activated protein kinase 8
MAPK10	mitogen-activated protein kinase 10
MAPK9	mitogen-activated protein kinase 9
RAP1A	RAP1A, member of RAS oncogene family
RAP1B	RAP1B, member of RAS oncogene family
TIAM1	T-cell lymphoma invasion and metastasis 1
VAV3	vav guanine nucleotide exchange factor 3
VAV1	vav guanine nucleotide exchange factor 1
VAV2	vav guanine nucleotide exchange factor 2
RAC1	Rac family small GTPase 1
RAC2	Rac family small GTPase 2
RAC3	Rac family small GTPase 3
PAK1	p21 (RAC1) activated kinase 1
ARAP3	ArfGAP with RhoGAP domain, ankyrin repeat and PH domain 3
RHOA	ras homolog family member A
AFDN	afadin, adherens junction formation factor
PIK3CA	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha
PIK3CD	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit delta
PIK3CB	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit beta
PIK3R1	phosphoinositide-3-kinase regulatory subunit 1
PIK3R2	phosphoinositide-3-kinase regulatory subunit 2
PIK3R3	phosphoinositide-3-kinase regulatory subunit 3
AKT1	AKT serine/threonine kinase 1
AKT2	AKT serine/threonine kinase 2
AKT3	AKT serine/threonine kinase 3
BRAF	B-Raf proto-oncogene, serine/threonine kinase
RAF1	Raf-1 proto-oncogene, serine/threonine kinase
MAP2K1	mitogen-activated protein kinase kinase 1
MAP2K2	mitogen-activated protein kinase kinase 2
MAPK1	mitogen-activated protein kinase 1
MAPK3	mitogen-activated protein kinase 3
PRKACA	protein kinase cAMP-activated catalytic subunit alpha
PRKACB	protein kinase cAMP-activated catalytic subunit beta
PRKACG	protein kinase cAMP-activated catalytic subunit gamma
PPP1R1B	protein phosphatase 1 regulatory inhibitor subunit 1B
PPP1CA	protein phosphatase 1 catalytic subunit alpha
PPP1CB	protein phosphatase 1 catalytic subunit beta
PPP1CC	protein phosphatase 1 catalytic subunit gamma
CREB1	cAMP responsive element binding protein 1
CREB3	cAMP responsive element binding protein 3
CREB3L1	cAMP responsive element binding protein 3 like 1
CREB3L2	cAMP responsive element binding protein 3 like 2
CREB3L3	cAMP responsive element binding protein 3 like 3
CREB3L4	cAMP responsive element binding protein 3 like 4
CREB5	cAMP responsive element binding protein 5
CREBBP	CREB binding protein
EP300	E1A binding protein p300
BDNF	brain derived neurotrophic factor
FOS	Fos proto-oncogene, AP-1 transcription factor subunit
JUN	Jun proto-oncogene, AP-1 transcription factor subunit
GLI3	GLI family zinc finger 3
GLI1	GLI family zinc finger 1
PTCH1	patched 1
HHIP	hedgehog interacting protein
NFKBIA	NFKB inhibitor alpha

	<i>NFKB1</i>	nuclear factor kappa B subunit 1
	<i>RELA</i>	RELA proto-oncogene, NF-kB subunit
	<i>SOX9</i>	SRY-box 9
	<i>AMH</i>	anti-Mullerian hormone
	<i>PPARA</i>	peroxisome proliferator activated receptor alpha
	<i>ACOX3</i>	acyl-CoA oxidase 3, pristanoyl
	<i>ACOX1</i>	acyl-CoA oxidase 1
	<i>NFATC1</i>	nuclear factor of activated T-cells 1
	<i>F2R</i>	coagulation factor II thrombin receptor
	<i>BAD</i>	BCL2 associated agonist of cell death
	<i>LIPE</i>	lipase E, hormone sensitive type
	<i>ROCK1</i>	Rho associated coiled-coil containing protein kinase 1
	<i>ROCK2</i>	Rho associated coiled-coil containing protein kinase 2
	<i>PPP1R12A</i>	protein phosphatase 1 regulatory subunit 12A
	<i>MYL9</i>	myosin light chain 9
	<i>TNNI3</i>	troponin I3, cardiac type
	<i>PLN</i>	phospholamban
	<i>RYR2</i>	ryanodine receptor 2
	<i>GRIN1</i>	glutamate ionotropic receptor NMDA type subunit 1
	<i>GRIN2A</i>	glutamate ionotropic receptor NMDA type subunit 2A
	<i>GRIN2B</i>	glutamate ionotropic receptor NMDA type subunit 2B
	<i>GRIN2C</i>	glutamate ionotropic receptor NMDA type subunit 2C
	<i>GRIN2D</i>	glutamate ionotropic receptor NMDA type subunit 2D
	<i>GRIN3A</i>	glutamate ionotropic receptor NMDA type subunit 3A
	<i>GRIN3B</i>	glutamate ionotropic receptor NMDA type subunit 3B
	<i>GRIA1</i>	glutamate ionotropic receptor AMPA type subunit 1
	<i>GRIA2</i>	glutamate ionotropic receptor AMPA type subunit 2
	<i>GRIA3</i>	glutamate ionotropic receptor AMPA type subunit 3
	<i>GRIA4</i>	glutamate ionotropic receptor AMPA type subunit 4
	<i>CFTR</i>	cystic fibrosis transmembrane conductance regulator
	<i>ATP1A1</i>	ATPase Na+/K+ transporting subunit alpha 1
	<i>ATP1A2</i>	ATPase Na+/K+ transporting subunit alpha 2
	<i>ATP1A3</i>	ATPase Na+/K+ transporting subunit alpha 3
	<i>ATP1A4</i>	ATPase Na+/K+ transporting subunit alpha 4
	<i>ATP1B4</i>	ATPase Na+/K+ transporting family member beta 4
	<i>ATP1B1</i>	ATPase Na+/K+ transporting subunit beta 1
	<i>ATP1B2</i>	ATPase Na+/K+ transporting subunit beta 2
	<i>ATP1B3</i>	ATPase Na+/K+ transporting subunit beta 3
	<i>FXD2</i>	FXD domain containing ion transport regulator 2
	<i>FXD1</i>	FXD domain containing ion transport regulator 1
	<i>SLC9A1</i>	solute carrier family 9 member A1
	<i>ORAI1</i>	ORAI calcium release-activated calcium modulator 1
	<i>ATP2B1</i>	ATPase plasma membrane Ca2+ transporting 1
	<i>ATP2B3</i>	ATPase plasma membrane Ca2+ transporting 3
	<i>ATP2B4</i>	ATPase plasma membrane Ca2+ transporting 4
	<i>ATP2B2</i>	ATPase plasma membrane Ca2+ transporting 2
	<i>CACNA1C</i>	calcium voltage-gated channel subunit alpha1 C
	<i>CACNA1D</i>	calcium voltage-gated channel subunit alpha1 D
	<i>CACNA1F</i>	calcium voltage-gated channel subunit alpha1 F
	<i>CACNA1S</i>	calcium voltage-gated channel subunit alpha1 S
	<i>PDE3A</i>	phosphodiesterase 3A
	<i>PDE3B</i>	phosphodiesterase 3B
	<i>PDE4A</i>	phosphodiesterase 4A
	<i>PDE4B</i>	phosphodiesterase 4B
	<i>PDE4C</i>	phosphodiesterase 4C
	<i>PDE4D</i>	phosphodiesterase 4D
	<i>ATP2A2</i>	ATPase sarcoplasmic/endoplasmic reticulum Ca2+ transporting 2
Focal adhesion	<i>COL1A1</i>	collagen type I alpha 1 chain
	<i>COL1A2</i>	collagen type I alpha 2 chain
	<i>COL2A1</i>	collagen type II alpha 1 chain
	<i>COL4A2</i>	collagen type IV alpha 2 chain
	<i>COL4A4</i>	collagen type IV alpha 4 chain
	<i>COL4A6</i>	collagen type IV alpha 6 chain
	<i>COL4A1</i>	collagen type IV alpha 1 chain
	<i>COL4A5</i>	collagen type IV alpha 5 chain
	<i>COL4A3</i>	collagen type IV alpha 3 chain
	<i>COL6A1</i>	collagen type VI alpha 1 chain
	<i>COL6A2</i>	collagen type VI alpha 2 chain
	<i>COL6A3</i>	collagen type VI alpha 3 chain
	<i>COL6A6</i>	collagen type VI alpha 6 chain
	<i>COL6A5</i>	collagen type VI alpha 5 chain
	<i>COL9A1</i>	collagen type IX alpha 1 chain
	<i>COL9A2</i>	collagen type IX alpha 2 chain
	<i>COL9A3</i>	collagen type IX alpha 3 chain
	<i>LAMA1</i>	laminin subunit alpha 1
	<i>LAMA2</i>	laminin subunit alpha 2
	<i>LAMA3</i>	laminin subunit alpha 3
	<i>LAMA5</i>	laminin subunit alpha 5
	<i>LAMA4</i>	laminin subunit alpha 4
	<i>LAMB1</i>	laminin subunit beta 1
	<i>LAMB2</i>	laminin subunit beta 2
	<i>LAMB3</i>	laminin subunit beta 3
	<i>LAMB4</i>	laminin subunit beta 4
	<i>LAMC1</i>	laminin subunit gamma 1
	<i>LAMC2</i>	laminin subunit gamma 2
	<i>LAMC3</i>	laminin subunit gamma 3
	<i>CHAD</i>	chondroadherin
	<i>RELN</i>	reelin
	<i>THBS1</i>	thrombospondin 1

COMP	cartilage oligomeric matrix protein
THBS2	thrombospondin 2
THBS3	thrombospondin 3
THBS4	thrombospondin 4
FN1	fibronectin 1
SPP1	secreted phosphoprotein 1
VTN	vitronectin
TNC	tenascin C
TNN	tenascin N
TNR	tenascin R
TNXB	tenascin XB
VWF	von Willebrand factor
IBSP	integrin binding sialoprotein
ITGA1	integrin subunit alpha 1
ITGA2	integrin subunit alpha 2
ITGA2B	integrin subunit alpha 2b
ITGA3	integrin subunit alpha 3
ITGA4	integrin subunit alpha 4
ITGA5	integrin subunit alpha 5
ITGA6	integrin subunit alpha 6
ITGA7	integrin subunit alpha 7
ITGA8	integrin subunit alpha 8
ITGA9	integrin subunit alpha 9
ITGA10	integrin subunit alpha 10
ITGA11	integrin subunit alpha 11
ITGAV	integrin subunit alpha V
ITGB1	integrin subunit beta 1
ITGB3	integrin subunit beta 3
ITGB4	integrin subunit beta 4
ITGB5	integrin subunit beta 5
ITGB6	integrin subunit beta 6
ITGB7	integrin subunit beta 7
ITGB8	integrin subunit beta 8
PDGFA	platelet derived growth factor subunit A
PDGFB	platelet derived growth factor subunit B
PDGFC	platelet derived growth factor C
PDGFD	platelet derived growth factor D
EGF	epidermal growth factor
IGF1	insulin like growth factor 1
VEGFA	vascular endothelial growth factor A
VEGFB	vascular endothelial growth factor B
PGF	placental growth factor
VEGFC	vascular endothelial growth factor C
VEGFD	vascular endothelial growth factor D
HGF	hepatocyte growth factor
PDGFRA	platelet derived growth factor receptor alpha
PDGFRB	platelet derived growth factor receptor beta
IGF1R	insulin like growth factor 1 receptor
KDR	kinase insert domain receptor
EGFR	epidermal growth factor receptor
FLT1	fms related tyrosine kinase 1
FLT4	fms related tyrosine kinase 4
MET	MET proto-oncogene, receptor tyrosine kinase
ERBB2	erb-b2 receptor tyrosine kinase 2
SRC	SRC proto-oncogene, non-receptor tyrosine kinase
ARHGAP35	Rho GTPase activating protein 35
ARHGAP5	Rho GTPase activating protein 5
RHOA	ras homolog family member A
DIAPH1	diaphanous related formin 1
ROCK1	Rho associated coiled-coil containing protein kinase 1
ROCK2	Rho associated coiled-coil containing protein kinase 2
MYL2	myosin light chain 2
MYL5	myosin light chain 5
MYL7	myosin light chain 7
MYL9	myosin light chain 9
MYL10	myosin light chain 10
MYL12B	myosin light chain 12B
MYL12A	myosin light chain 12A
MYLPF	myosin light chain, phosphorylatable, fast skeletal muscle
PPP1CA	protein phosphatase 1 catalytic subunit alpha
PPP1CB	protein phosphatase 1 catalytic subunit beta
PPP1CC	protein phosphatase 1 catalytic subunit gamma
PPP1R12A	protein phosphatase 1 regulatory subunit 12A
PPP1R12B	protein phosphatase 1 regulatory subunit 12B
PPP1R12C	protein phosphatase 1 regulatory subunit 12C
MYLK	myosin light chain kinase
MYLK2	myosin light chain kinase 2
MYLK3	myosin light chain kinase 3
MYLK4	myosin light chain kinase family member 4
ACTB	actin beta
ACTG1	actin gamma 1
RASGRF1	Ras protein specific guanine nucleotide releasing factor 1
CAPN2	calpain 2
ACTN1	actinin alpha 1
ACTN4	actinin alpha 4
TLN1	talin 1
TLN2	talin 2
FLNA	filamin A
FLNC	filamin C

	FLNB	filamin B
	PXN	paxillin
	ILK	integrin linked kinase
	ZYX	zyxin
	VASP	vasodilator stimulated phosphoprotein
	VCL	vinculin
	PARVB	parvin beta
	PARVA	parvin alpha
	PARVG	parvin gamma
	PDPK1	3-phosphoinositide dependent protein kinase 1
	AKT1	AKT serine/threonine kinase 1
	AKT2	AKT serine/threonine kinase 2
	AKT3	AKT serine/threonine kinase 3
	GSK3B	glycogen synthase kinase 3 beta
	CTNNB1	catenin beta 1
	PRKCA	protein kinase C alpha
	PRKCB	protein kinase C beta
	PRKCG	protein kinase C gamma
	PTK2	protein tyrosine kinase 2
	PIK3CA	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha
	PIK3CD	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit delta
	PIK3CB	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit beta
	PIK3R1	phosphoinositide-3-kinase regulatory subunit 1
	PIK3R2	phosphoinositide-3-kinase regulatory subunit 2
	PIK3R3	phosphoinositide-3-kinase regulatory subunit 3
	PTEN	phosphatase and tensin homolog
	VAV3	vav guanine nucleotide exchange factor 3
	VAV1	vav guanine nucleotide exchange factor 1
	VAV2	vav guanine nucleotide exchange factor 2
	RAC1	Rac family small GTPase 1
	RAC2	Rac family small GTPase 2
	RAC3	Rac family small GTPase 3
	PAK1	p21 (RAC1) activated kinase 1
	PAK2	p21 (RAC1) activated kinase 2
	PAK3	p21 (RAC1) activated kinase 3
	PAK4	p21 (RAC1) activated kinase 4
	PAK6	p21 (RAC1) activated kinase 6
	BUB1B-PAK6	BUB1B-PAK6 readthrough
	PAK5	p21 (RAC1) activated kinase 5
	CDC42	cell division cycle 42
	BCAR1	BCAR1, Cas family scaffolding protein
	CRK	CRK proto-oncogene, adaptor protein
	CRKL	CRK like proto-oncogene, adaptor protein
	DOCK1	dedicator of cytokinesis 1
	RAPGEF1	Rap guanine nucleotide exchange factor 1
	RAP1A	RAP1A, member of RAS oncogene family
	RAP1B	RAP1B, member of RAS oncogene family
	MAPK8	mitogen-activated protein kinase 8
	MAPK10	mitogen-activated protein kinase 10
	MAPK9	mitogen-activated protein kinase 9
	JUN	Jun proto-oncogene, AP-1 transcription factor subunit
	BRAF	B-Raf proto-oncogene, serine/threonine kinase
	CAV1	caveolin 1
	CAV2	caveolin 2
	CAV3	caveolin 3
	FYN	FYN proto-oncogene, Src family tyrosine kinase
	SHC1	SHC adaptor protein 1
	SHC2	SHC adaptor protein 2
	SHC3	SHC adaptor protein 3
	SHC4	SHC adaptor protein 4
	GRB2	growth factor receptor bound protein 2
	SOS1	SOS Ras/Rac guanine nucleotide exchange factor 1
	SOS2	SOS Ras/Rho guanine nucleotide exchange factor 2
	HRAS	HRas proto-oncogene, GTPase
	RAF1	Raf-1 proto-oncogene, serine/threonine kinase
	MAP2K1	mitogen-activated protein kinase kinase 1
	MAPK1	mitogen-activated protein kinase 1
	MAPK3	mitogen-activated protein kinase 3
	ELK1	ELK1, ETS transcription factor
	CCND1	cyclin D1
	CCND2	cyclin D2
	CCND3	cyclin D3
	BIRC2	baculoviral IAP repeat containing 2
	BIRC3	baculoviral IAP repeat containing 3
	XIAP	X-linked inhibitor of apoptosis
	BAD	BCL2 associated agonist of cell death
	BCL2	BCL2, apoptosis regulator
	PIP5K1C	phosphatidylinositol-4-phosphate 5-kinase type 1 gamma
ECM-receptor interaction	COL1A1	collagen type I alpha 1 chain
	COL1A2	collagen type I alpha 2 chain
	COL2A1	collagen type II alpha 1 chain
	COL4A2	collagen type IV alpha 2 chain
	COL4A4	collagen type IV alpha 4 chain
	COL4A6	collagen type IV alpha 6 chain
	COL4A1	collagen type IV alpha 1 chain
	COL4A5	collagen type IV alpha 5 chain
	COL4A3	collagen type IV alpha 3 chain
	COL6A1	collagen type VI alpha 1 chain
COL6A2	collagen type VI alpha 2 chain	

	COL6A3	collagen type VI alpha 3 chain
	COL6A6	collagen type VI alpha 6 chain
	COL6A5	collagen type VI alpha 5 chain
	COL9A1	collagen type IX alpha 1 chain
	COL9A2	collagen type IX alpha 2 chain
	COL9A3	collagen type IX alpha 3 chain
	LAMA1	laminin subunit alpha 1
	LAMA2	laminin subunit alpha 2
	LAMA3	laminin subunit alpha 3
	LAMA5	laminin subunit alpha 5
	LAMA4	laminin subunit alpha 4
	LAMB1	laminin subunit beta 1
	LAMB2	laminin subunit beta 2
	LAMB3	laminin subunit beta 3
	LAMB4	laminin subunit beta 4
	LAMC1	laminin subunit gamma 1
	LAMC2	laminin subunit gamma 2
	LAMC3	laminin subunit gamma 3
	CHAD	chondroadherin
	RELN	reelin
	THBS1	thrombospondin 1
	COMP	cartilage oligomeric matrix protein
	THBS2	thrombospondin 2
	THBS3	thrombospondin 3
	THBS4	thrombospondin 4
	FN1	fibronectin 1
	SPP1	secreted phosphoprotein 1
	VTN	vitronectin
	TNC	tenascin C
	TNN	tenascin N
	TNR	tenascin R
	TNXB	tenascin XB
	VWF	von Willebrand factor
	IBSP	integrin binding sialoprotein
	AGRN	agrin
	HSPG2	heparan sulfate proteoglycan 2
	ITGA1	integrin subunit alpha 1
	ITGA2	integrin subunit alpha 2
	ITGA2B	integrin subunit alpha 2b
	ITGA3	integrin subunit alpha 3
	ITGA4	integrin subunit alpha 4
	ITGA5	integrin subunit alpha 5
	ITGA6	integrin subunit alpha 6
	ITGA7	integrin subunit alpha 7
	ITGA8	integrin subunit alpha 8
	ITGA9	integrin subunit alpha 9
	ITGA10	integrin subunit alpha 10
	ITGA11	integrin subunit alpha 11
	ITGAV	integrin subunit alpha V
	ITGB1	integrin subunit beta 1
	ITGB3	integrin subunit beta 3
	ITGB4	integrin subunit beta 4
	ITGB5	integrin subunit beta 5
	ITGB6	integrin subunit beta 6
	ITGB7	integrin subunit beta 7
	ITGB8	integrin subunit beta 8
	CD44	CD44 molecule (Indian blood group)
	SDC1	syndecan 1
	SDC4	syndecan 4
	SV2C	synaptic vesicle glycoprotein 2C
	SV2B	synaptic vesicle glycoprotein 2B
	SV2A	synaptic vesicle glycoprotein 2A
	CD36	CD36 molecule
	GP5	glycoprotein V platelet
	GP1BA	glycoprotein Ib platelet alpha subunit
	GP1BB	glycoprotein Ib platelet beta subunit
	GP9	glycoprotein IX platelet
	GP6	glycoprotein VI platelet
	DAG1	dystroglycan 1
	CD47	CD47 molecule
	HMMR	hyaluronan mediated motility receptor
PI3K-Akt signaling pathway	EGF	epidermal growth factor
	FGF1	fibroblast growth factor 1
	FGF2	fibroblast growth factor 2
	FGF3	fibroblast growth factor 3
	FGF4	fibroblast growth factor 4
	FGF17	fibroblast growth factor 17
	FGF6	fibroblast growth factor 6
	FGF7	fibroblast growth factor 7
	FGF8	fibroblast growth factor 8
	FGF9	fibroblast growth factor 9
	FGF10	fibroblast growth factor 10
	FGF11	fibroblast growth factor 11
	FGF12	fibroblast growth factor 12
	FGF13	fibroblast growth factor 13
	FGF14	fibroblast growth factor 14
	FGF16	fibroblast growth factor 16
	FGF5	fibroblast growth factor 5
FGF18	fibroblast growth factor 18	

FGF19	fibroblast growth factor 19
FGF20	fibroblast growth factor 20
FGF21	fibroblast growth factor 21
FGF22	fibroblast growth factor 22
FGF23	fibroblast growth factor 23
NGF	nerve growth factor
INS	insulin
IGF1	insulin like growth factor 1
PDGFA	platelet derived growth factor subunit A
PDGFB	platelet derived growth factor subunit B
PDGFC	platelet derived growth factor C
PDGFD	platelet derived growth factor D
CSF1	colony stimulating factor 1
KITLG	KIT ligand
VEGFA	vascular endothelial growth factor A
VEGFB	vascular endothelial growth factor B
PGF	placental growth factor
VEGFC	vascular endothelial growth factor C
VEGFD	vascular endothelial growth factor D
HGF	hepatocyte growth factor
ANGPT1	angiopoietin 1
ANGPT2	angiopoietin 2
ANGPT4	angiopoietin 4
EFNA1	ephrin A1
EFNA2	ephrin A2
EFNA3	ephrin A3
EFNA4	ephrin A4
EFNA5	ephrin A5
EGFR	epidermal growth factor receptor
FGFR1	fibroblast growth factor receptor 1
FGFR2	fibroblast growth factor receptor 2
FGFR3	fibroblast growth factor receptor 3
FGFR4	fibroblast growth factor receptor 4
NGFR	nerve growth factor receptor
INSR	insulin receptor
IGF1R	insulin like growth factor 1 receptor
PDGFRA	platelet derived growth factor receptor alpha
PDGFRB	platelet derived growth factor receptor beta
CSF1R	colony stimulating factor 1 receptor
KIT	KIT proto-oncogene receptor tyrosine kinase
FLT1	fms related tyrosine kinase 1
FLT4	fms related tyrosine kinase 4
KDR	kinase insert domain receptor
MET	MET proto-oncogene, receptor tyrosine kinase
TEK	TEK receptor tyrosine kinase
EPHA2	EPH receptor A2
GRB2	growth factor receptor bound protein 2
SOS1	SOS Ras/Rac guanine nucleotide exchange factor 1
SOS2	SOS Ras/Rho guanine nucleotide exchange factor 2
HRAS	HRas proto-oncogene, GTPase
KRAS	KRAS proto-oncogene, GTPase
NRAS	NRAS proto-oncogene, GTPase
RAF1	Raf-1 proto-oncogene, serine/threonine kinase
MAP2K1	mitogen-activated protein kinase kinase 1
MAP2K2	mitogen-activated protein kinase kinase 2
MAPK1	mitogen-activated protein kinase 1
MAPK3	mitogen-activated protein kinase 3
IRS1	insulin receptor substrate 1
TLR2	toll like receptor 2
TLR4	toll like receptor 4
RAC1	Rac family small GTPase 1
IGH	putative V-set and immunoglobulin domain-containing-like protein IGHV4OR15-8
SYK	spleen associated tyrosine kinase
CD19	CD19 molecule
PIK3AP1	phosphoinositide-3-kinase adaptor protein 1
GH1	growth hormone 1
GH2	growth hormone 2
CSH1	chorionic somatomammotropin hormone 1
CSH2	chorionic somatomammotropin hormone 2
PRL	prolactin
OSM	oncostatin M
IL2	interleukin 2
IL3	interleukin 3
IL6	interleukin 6
IL4	interleukin 4
IL7	interleukin 7
IFNA1	interferon alpha 1
IFNA2	interferon alpha 2
IFNA4	interferon alpha 4
IFNA5	interferon alpha 5
IFNA6	interferon alpha 6
IFNA7	interferon alpha 7
IFNA8	interferon alpha 8
IFNA10	interferon alpha 10
IFNA13	interferon alpha 13
IFNA14	interferon alpha 14
IFNA16	interferon alpha 16
IFNA17	interferon alpha 17
IFNA21	interferon alpha 21

<i>IFNB1</i>	interferon beta 1
<i>EPO</i>	erythropoietin
<i>CSF3</i>	colony stimulating factor 3
<i>GHR</i>	growth hormone receptor
<i>PRLR</i>	prolactin receptor
<i>OSMR</i>	oncostatin M receptor
<i>IL2RA</i>	interleukin 2 receptor subunit alpha
<i>IL2RB</i>	interleukin 2 receptor subunit beta
<i>IL2RG</i>	interleukin 2 receptor subunit gamma
<i>IL3RA</i>	interleukin 3 receptor subunit alpha
<i>IL6R</i>	interleukin 6 receptor
<i>IL4R</i>	interleukin 4 receptor
<i>IL7R</i>	interleukin 7 receptor
<i>IFNAR1</i>	interferon alpha and beta receptor subunit 1
<i>IFNAR2</i>	interferon alpha and beta receptor subunit 2
<i>EPOR</i>	erythropoietin receptor
<i>CSF3R</i>	colony stimulating factor 3 receptor
<i>JAK1</i>	Janus kinase 1
<i>JAK2</i>	Janus kinase 2
<i>JAK3</i>	Janus kinase 3
<i>COL1A1</i>	collagen type I alpha 1 chain
<i>COL1A2</i>	collagen type I alpha 2 chain
<i>COL2A1</i>	collagen type II alpha 1 chain
<i>COL4A2</i>	collagen type IV alpha 2 chain
<i>COL4A4</i>	collagen type IV alpha 4 chain
<i>COL4A6</i>	collagen type IV alpha 6 chain
<i>COL4A1</i>	collagen type IV alpha 1 chain
<i>COL4A5</i>	collagen type IV alpha 5 chain
<i>COL4A3</i>	collagen type IV alpha 3 chain
<i>COL6A1</i>	collagen type VI alpha 1 chain
<i>COL6A2</i>	collagen type VI alpha 2 chain
<i>COL6A3</i>	collagen type VI alpha 3 chain
<i>COL6A6</i>	collagen type VI alpha 6 chain
<i>COL6A5</i>	collagen type VI alpha 5 chain
<i>COL9A1</i>	collagen type IX alpha 1 chain
<i>COL9A2</i>	collagen type IX alpha 2 chain
<i>COL9A3</i>	collagen type IX alpha 3 chain
<i>LAMA1</i>	laminin subunit alpha 1
<i>LAMA2</i>	laminin subunit alpha 2
<i>LAMA3</i>	laminin subunit alpha 3
<i>LAMA5</i>	laminin subunit alpha 5
<i>LAMA4</i>	laminin subunit alpha 4
<i>LAMB1</i>	laminin subunit beta 1
<i>LAMB2</i>	laminin subunit beta 2
<i>LAMB3</i>	laminin subunit beta 3
<i>LAMB4</i>	laminin subunit beta 4
<i>LAMC1</i>	laminin subunit gamma 1
<i>LAMC2</i>	laminin subunit gamma 2
<i>LAMC3</i>	laminin subunit gamma 3
<i>CHAD</i>	chondroadherin
<i>RELN</i>	reelin
<i>THBS1</i>	thrombospondin 1
<i>COMP</i>	cartilage oligomeric matrix protein
<i>THBS2</i>	thrombospondin 2
<i>THBS3</i>	thrombospondin 3
<i>THBS4</i>	thrombospondin 4
<i>FN1</i>	fibronectin 1
<i>SPP1</i>	secreted phosphoprotein 1
<i>VTN</i>	vitronectin
<i>TNC</i>	tenascin C
<i>TNN</i>	tenascin N
<i>TNR</i>	tenascin R
<i>TNXB</i>	tenascin XB
<i>VWF</i>	von Willebrand factor
<i>IBSP</i>	integrin binding sialoprotein
<i>ITGA1</i>	integrin subunit alpha 1
<i>ITGA2</i>	integrin subunit alpha 2
<i>ITGA2B</i>	integrin subunit alpha 2b
<i>ITGA3</i>	integrin subunit alpha 3
<i>ITGA4</i>	integrin subunit alpha 4
<i>ITGA5</i>	integrin subunit alpha 5
<i>ITGA6</i>	integrin subunit alpha 6
<i>ITGA7</i>	integrin subunit alpha 7
<i>ITGA8</i>	integrin subunit alpha 8
<i>ITGA9</i>	integrin subunit alpha 9
<i>ITGA10</i>	integrin subunit alpha 10
<i>ITGA11</i>	integrin subunit alpha 11
<i>ITGAV</i>	integrin subunit alpha V
<i>ITGB1</i>	integrin subunit beta 1
<i>ITGB3</i>	integrin subunit beta 3
<i>ITGB4</i>	integrin subunit beta 4
<i>ITGB5</i>	integrin subunit beta 5
<i>ITGB6</i>	integrin subunit beta 6
<i>ITGB7</i>	integrin subunit beta 7
<i>ITGB8</i>	integrin subunit beta 8
<i>PTK2</i>	protein tyrosine kinase 2
<i>PIK3CA</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha
<i>PIK3CD</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit delta
<i>PIK3CB</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit beta

PIK3R1	phosphoinositide-3-kinase regulatory subunit 1
PIK3R2	phosphoinositide-3-kinase regulatory subunit 2
PIK3R3	phosphoinositide-3-kinase regulatory subunit 3
F2R	coagulation factor II thrombin receptor
CHRM1	cholinergic receptor muscarinic 1
CHRM2	cholinergic receptor muscarinic 2
LPAR1	lysophosphatidic acid receptor 1
LPAR2	lysophosphatidic acid receptor 2
LPAR3	lysophosphatidic acid receptor 3
LPAR4	lysophosphatidic acid receptor 4
LPAR5	lysophosphatidic acid receptor 5
LPAR6	lysophosphatidic acid receptor 6
GNB1	G protein subunit beta 1
GNB2	G protein subunit beta 2
GNB3	G protein subunit beta 3
GNB4	G protein subunit beta 4
GNB5	G protein subunit beta 5
GNG2	G protein subunit gamma 2
GNG3	G protein subunit gamma 3
GNG4	G protein subunit gamma 4
GNG5	G protein subunit gamma 5
GNG7	G protein subunit gamma 7
GNG8	G protein subunit gamma 8
GNG10	G protein subunit gamma 10
GNG11	G protein subunit gamma 11
GNG12	G protein subunit gamma 12
GNG13	G protein subunit gamma 13
GNGT1	G protein subunit gamma transducin 1
GNGT2	G protein subunit gamma transducin 2
PIK3CG	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit gamma
PIK3R5	phosphoinositide-3-kinase regulatory subunit 5
PIK3R6	phosphoinositide-3-kinase regulatory subunit 6
PDPK1	3-phosphoinositide dependent protein kinase 1
STK11	serine/threonine kinase 11
PRKAA1	protein kinase AMP-activated catalytic subunit alpha 1
PRKAA2	protein kinase AMP-activated catalytic subunit alpha 2
DDIT4	DNA damage inducible transcript 4
TSC1	TSC complex subunit 1
TSC2	TSC complex subunit 2
RHEB	Ras homolog, mTORC1 binding
MLST8	MTOR associated protein, LST8 homolog
MTOR	mechanistic target of rapamycin kinase
RPTOR	regulatory associated protein of MTOR complex 1
EIF4EBP1	eukaryotic translation initiation factor 4E binding protein 1
EIF4E	eukaryotic translation initiation factor 4E
EIF4E2	eukaryotic translation initiation factor 4E family member 2
EIF4E1B	eukaryotic translation initiation factor 4E family member 1B
RPS6KB1	ribosomal protein S6 kinase B1
RPS6KB2	ribosomal protein S6 kinase B2
EIF4B	eukaryotic translation initiation factor 4B
RPS6	ribosomal protein S6
PRKCA	protein kinase C alpha
PKN1	protein kinase N1
PKN3	protein kinase N3
PKN2	protein kinase N2
SGK1	serum/glucocorticoid regulated kinase 1
SGK2	SGK2, serine/threonine kinase 2
SGK3	serum/glucocorticoid regulated kinase family member 3
C8orf44-SGK3	C8orf44-SGK3 readthrough
AKT1	AKT serine/threonine kinase 1
AKT2	AKT serine/threonine kinase 2
AKT3	AKT serine/threonine kinase 3
PTEN	phosphatase and tensin homolog
THEM4	thioesterase superfamily member 4
PPP2CA	protein phosphatase 2 catalytic subunit alpha
PPP2CB	protein phosphatase 2 catalytic subunit beta
PPP2R1B	protein phosphatase 2 scaffold subunit Abeta
PPP2R1A	protein phosphatase 2 scaffold subunit Aalpha
PPP2R2A	protein phosphatase 2 regulatory subunit Balpha
PPP2R2B	protein phosphatase 2 regulatory subunit Bbeta
PPP2R2C	protein phosphatase 2 regulatory subunit Bgamma
PPP2R2D	protein phosphatase 2 regulatory subunit Bdelta
PPP2R3B	protein phosphatase 2 regulatory subunit B"beta
PPP2R3C	protein phosphatase 2 regulatory subunit B"gamma
PPP2R3A	protein phosphatase 2 regulatory subunit B"alpha
PPP2R5B	protein phosphatase 2 regulatory subunit B'beta
PPP2R5C	protein phosphatase 2 regulatory subunit B'gamma
PPP2R5D	protein phosphatase 2 regulatory subunit B'delta
PPP2R5E	protein phosphatase 2 regulatory subunit B'epsilon
PPP2R5A	protein phosphatase 2 regulatory subunit B'alpha
HSP90AA1	heat shock protein 90 alpha family class A member 1
HSP90AB1	heat shock protein 90 alpha family class B member 1
HSP90B1	heat shock protein 90 beta family member 1
CDC37	cell division cycle 37
CRTC2	CREB regulated transcription coactivator 2
PHLPP1	PH domain and leucine rich repeat protein phosphatase 1
PHLPP2	PH domain and leucine rich repeat protein phosphatase 2
TCL1A	T-cell leukemia/lymphoma 1A
TCL1B	T-cell leukemia/lymphoma 1B

	<i>MTCP1</i>	mature T-cell proliferation 1	
	<i>NOS3</i>	nitric oxide synthase 3	
	<i>BRCA1</i>	BRCA1, DNA repair associated	
	<i>GSK3B</i>	glycogen synthase kinase 3 beta	
	<i>GYS2</i>	glycogen synthase 2	
	<i>GYS1</i>	glycogen synthase 1	
	<i>PCK1</i>	phosphoenolpyruvate carboxykinase 1	
	<i>PCK2</i>	phosphoenolpyruvate carboxykinase 2, mitochondrial	
	<i>G6PC</i>	glucose-6-phosphatase catalytic subunit	
	<i>G6PC2</i>	glucose-6-phosphatase catalytic subunit 2	
	<i>G6PC3</i>	glucose-6-phosphatase catalytic subunit 3	
	<i>MYC</i>	MYC proto-oncogene, bHLH transcription factor	
	<i>CCND1</i>	cyclin D1	
	<i>CDKN1A</i>	cyclin dependent kinase inhibitor 1A	
	<i>CDKN1B</i>	cyclin dependent kinase inhibitor 1B	
	<i>CDK2</i>	cyclin dependent kinase 2	
	<i>CDK4</i>	cyclin dependent kinase 4	
	<i>CDK6</i>	cyclin dependent kinase 6	
	<i>CCND2</i>	cyclin D2	
	<i>CCND3</i>	cyclin D3	
	<i>CCNE1</i>	cyclin E1	
	<i>CCNE2</i>	cyclin E2	
	<i>FOXO3</i>	forkhead box O3	
	<i>RBL2</i>	RB transcriptional corepressor like 2	
	<i>FASLG</i>	Fas ligand	
	<i>BCL2L11</i>	BCL2 like 11	
	<i>YWHAZ</i>	tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein zeta	
	<i>YWHAH</i>	tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein beta	
	<i>YWHAQ</i>	tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein theta	
	<i>YWHAE</i>	tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein epsilon	
	<i>YWHAH</i>	tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein eta	
	<i>YWHAG</i>	tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein gamma	
	<i>BAD</i>	BCL2 associated agonist of cell death	
	<i>BCL2L1</i>	BCL2 like 1	
	<i>BCL2</i>	BCL2, apoptosis regulator	
	<i>CASP9</i>	caspase 9	
	<i>CREB1</i>	cAMP responsive element binding protein 1	
	<i>ATF2</i>	activating transcription factor 2	
	<i>ATF4</i>	activating transcription factor 4	
	<i>CREB3</i>	cAMP responsive element binding protein 3	
	<i>CREB3L1</i>	cAMP responsive element binding protein 3 like 1	
	<i>CREB3L2</i>	cAMP responsive element binding protein 3 like 2	
	<i>CREB3L3</i>	cAMP responsive element binding protein 3 like 3	
	<i>CREB3L4</i>	cAMP responsive element binding protein 3 like 4	
	<i>CREB5</i>	cAMP responsive element binding protein 5	
	<i>ATF6B</i>	activating transcription factor 6 beta	
	<i>MCL1</i>	MCL1, BCL2 family apoptosis regulator	
	<i>RXRA</i>	retinoid X receptor alpha	
	<i>NR4A1</i>	nuclear receptor subfamily 4 group A member 1	
	<i>IKBKG</i>	inhibitor of nuclear factor kappa B kinase subunit gamma	
	<i>CHUK</i>	conserved helix-loop-helix ubiquitous kinase	
	<i>IKBKB</i>	inhibitor of nuclear factor kappa B kinase subunit beta	
	<i>RELA</i>	RELA proto-oncogene, NF-kB subunit	
	<i>NFKB1</i>	nuclear factor kappa B subunit 1	
	<i>MYB</i>	MYB proto-oncogene, transcription factor	
	<i>MDM2</i>	MDM2 proto-oncogene	
	<i>TP53</i>	tumor protein p53	
mTOR signaling	<i>SLC7A5</i>	solute carrier family 7 member 5	
	<i>SLC3A2</i>	solute carrier family 3 member 2	
	<i>SLC38A9</i>	solute carrier family 38 member 9	
	<i>ATP6V1A</i>	ATPase H+ transporting V1 subunit A	
	<i>ATP6V1B1</i>	ATPase H+ transporting V1 subunit B1	
	<i>ATP6V1B2</i>	ATPase H+ transporting V1 subunit B2	
	<i>ATP6V1C2</i>	ATPase H+ transporting V1 subunit C2	
	<i>ATP6V1C1</i>	ATPase H+ transporting V1 subunit C1	
	<i>ATP6V1D</i>	ATPase H+ transporting V1 subunit D	
	<i>ATP6V1E2</i>	ATPase H+ transporting V1 subunit E2	
	<i>ATP6V1E1</i>	ATPase H+ transporting V1 subunit E1	
	<i>ATP6V1F</i>	ATPase H+ transporting V1 subunit F	
	<i>ATP6V1G1</i>	ATPase H+ transporting V1 subunit G1	
	<i>ATP6V1G3</i>	ATPase H+ transporting V1 subunit G3	
	<i>ATP6V1G2</i>	ATPase H+ transporting V1 subunit G2	
	<i>ATP6V1H</i>	ATPase H+ transporting V1 subunit H	
	<i>LAMTOR1</i>	late endosomal/lysosomal adaptor, MAPK and MTOR activator 1	
	<i>LAMTOR2</i>	late endosomal/lysosomal adaptor, MAPK and MTOR activator 2	
	<i>LAMTOR3</i>	late endosomal/lysosomal adaptor, MAPK and MTOR activator 3	
	<i>LAMTOR4</i>	late endosomal/lysosomal adaptor, MAPK and MTOR activator 4	
	<i>LAMTOR5</i>	late endosomal/lysosomal adaptor, MAPK and MTOR activator 5	
		<i>FLCN</i>	folliculin
		<i>FNIP1</i>	folliculin interacting protein 1
		<i>FNIP2</i>	folliculin interacting protein 2
		<i>RRAGA</i>	Ras related GTP binding A
		<i>RRAGB</i>	Ras related GTP binding B
		<i>RRAGC</i>	Ras related GTP binding C
		<i>RRAGD</i>	Ras related GTP binding D
		<i>RPTOR</i>	regulatory associated protein of MTOR complex 1
		<i>AKT1S1</i>	AKT1 substrate 1
		<i>MTOR</i>	mechanistic target of rapamycin kinase
	<i>DEPTOR</i>	DEP domain containing MTOR interacting protein	

<i>MLST8</i>	MTOR associated protein, LST8 homolog
<i>TELO2</i>	telomere maintenance 2
<i>TTI1</i>	TELO2 interacting protein 1
<i>CLIP1</i>	CAP-Gly domain containing linker protein 1
<i>GRB10</i>	growth factor receptor bound protein 10
<i>ULK1</i>	unc-51 like autophagy activating kinase 1
<i>ULK2</i>	unc-51 like autophagy activating kinase 2
<i>EIF4EBP1</i>	eukaryotic translation initiation factor 4E binding protein 1
<i>EIF4E</i>	eukaryotic translation initiation factor 4E
<i>EIF4E2</i>	eukaryotic translation initiation factor 4E family member 2
<i>EIF4E1B</i>	eukaryotic translation initiation factor 4E family member 1B
<i>RPS6KB1</i>	ribosomal protein S6 kinase B1
<i>RPS6KB2</i>	ribosomal protein S6 kinase B2
<i>EIF4B</i>	eukaryotic translation initiation factor 4B
<i>RPS6</i>	ribosomal protein S6
<i>RNF152</i>	ring finger protein 152
<i>SKP2</i>	S-phase kinase associated protein 2
<i>DEPDC5</i>	DEP domain containing 5
<i>NPRL2</i>	NPR2 like, GATOR1 complex subunit
<i>NPRL3</i>	NPR3 like, GATOR1 complex subunit
<i>MIOS</i>	meiosis regulator for oocyte development
<i>SEH1L</i>	SEH1 like nucleoporin
<i>WDR24</i>	WD repeat domain 24
<i>WDR59</i>	WD repeat domain 59
<i>SEC13</i>	SEC13 homolog, nuclear pore and COPII coat complex component
<i>SESN2</i>	sestrin 2
<i>STRADA</i>	STE20-related kinase adaptor alpha
<i>STRADB</i>	STE20-related kinase adaptor beta
<i>STK11</i>	serine/threonine kinase 11
<i>CAB39</i>	calcium binding protein 39
<i>CAB39L</i>	calcium binding protein 39 like
<i>PRKAA1</i>	protein kinase AMP-activated catalytic subunit alpha 1
<i>PRKAA2</i>	protein kinase AMP-activated catalytic subunit alpha 2
<i>TSC1</i>	TSC complex subunit 1
<i>TSC2</i>	TSC complex subunit 2
<i>TBC1D7</i>	TBC1 domain family member 7
<i>RHEB</i>	Ras homolog, mTORC1 binding
<i>DDIT4</i>	DNA damage inducible transcript 4
<i>WNT1</i>	Wnt family member 1
<i>WNT2</i>	Wnt family member 2
<i>WNT2B</i>	Wnt family member 2B
<i>WNT3</i>	Wnt family member 3
<i>WNT3A</i>	Wnt family member 3A
<i>WNT4</i>	Wnt family member 4
<i>WNT5A</i>	Wnt family member 5A
<i>WNT5B</i>	Wnt family member 5B
<i>WNT6</i>	Wnt family member 6
<i>WNT7A</i>	Wnt family member 7A
<i>WNT7B</i>	Wnt family member 7B
<i>WNT8A</i>	Wnt family member 8A
<i>WNT8B</i>	Wnt family member 8B
<i>WNT9A</i>	Wnt family member 9A
<i>WNT9B</i>	Wnt family member 9B
<i>WNT10B</i>	Wnt family member 10B
<i>WNT10A</i>	Wnt family member 10A
<i>WNT11</i>	Wnt family member 11
<i>WNT16</i>	Wnt family member 16
<i>FZD1</i>	frizzled class receptor 1
<i>FZD7</i>	frizzled class receptor 7
<i>FZD2</i>	frizzled class receptor 2
<i>FZD3</i>	frizzled class receptor 3
<i>FZD4</i>	frizzled class receptor 4
<i>FZD5</i>	frizzled class receptor 5
<i>FZD8</i>	frizzled class receptor 8
<i>FZD6</i>	frizzled class receptor 6
<i>FZD10</i>	frizzled class receptor 10
<i>FZD9</i>	frizzled class receptor 9
<i>LRP5</i>	LDL receptor related protein 5
<i>LRP6</i>	LDL receptor related protein 6
<i>DVL3</i>	dishevelled segment polarity protein 3
<i>DVL2</i>	dishevelled segment polarity protein 2
<i>DVL1</i>	dishevelled segment polarity protein 1
<i>GSK3B</i>	glycogen synthase kinase 3 beta
<i>TNF</i>	tumor necrosis factor
<i>TNFRSF1A</i>	TNF receptor superfamily member 1A
<i>IKBKB</i>	inhibitor of nuclear factor kappa B kinase subunit beta
<i>INS</i>	insulin
<i>IGF1</i>	insulin like growth factor 1
<i>INSR</i>	insulin receptor
<i>IGF1R</i>	insulin like growth factor 1 receptor
<i>GRB2</i>	growth factor receptor bound protein 2
<i>SOS1</i>	SOS Ras/Rac guanine nucleotide exchange factor 1
<i>SOS2</i>	SOS Ras/Rho guanine nucleotide exchange factor 2
<i>HRAS</i>	HRas proto-oncogene, GTPase
<i>KRAS</i>	KRAS proto-oncogene, GTPase
<i>NRAS</i>	NRAS proto-oncogene, GTPase
<i>BRAF</i>	B-Raf proto-oncogene, serine/threonine kinase
<i>RAF1</i>	Raf-1 proto-oncogene, serine/threonine kinase
<i>MAP2K1</i>	mitogen-activated protein kinase kinase 1

	<i>MAP2K2</i>	mitogen-activated protein kinase kinase 2
	<i>MAPK1</i>	mitogen-activated protein kinase 1
	<i>MAPK3</i>	mitogen-activated protein kinase 3
	<i>RPS6KA3</i>	ribosomal protein S6 kinase A3
	<i>RPS6KA1</i>	ribosomal protein S6 kinase A1
	<i>RPS6KA2</i>	ribosomal protein S6 kinase A2
	<i>RPS6KA6</i>	ribosomal protein S6 kinase A6
	<i>IRS1</i>	insulin receptor substrate 1
	<i>PIK3R1</i>	phosphoinositide-3-kinase regulatory subunit 1
	<i>PIK3R2</i>	phosphoinositide-3-kinase regulatory subunit 2
	<i>PIK3R3</i>	phosphoinositide-3-kinase regulatory subunit 3
	<i>PIK3CA</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha
	<i>PIK3CD</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit delta
	<i>PIK3CB</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit beta
	<i>PTEN</i>	phosphatase and tensin homolog
	<i>PDPK1</i>	3-phosphoinositide dependent protein kinase 1
	<i>AKT1</i>	AKT serine/threonine kinase 1
	<i>AKT2</i>	AKT serine/threonine kinase 2
	<i>AKT3</i>	AKT serine/threonine kinase 3
	<i>CHUK</i>	conserved helix-loop-helix ubiquitous kinase
	<i>MAPKAP1</i>	mitogen-activated protein kinase associated protein 1
	<i>RICTOR</i>	RPTOR independent companion of MTOR complex 2
	<i>PRRS5</i>	proline rich 5
	<i>RHOA</i>	ras homolog family member A
	<i>PRKCA</i>	protein kinase C alpha
	<i>PRKCB</i>	protein kinase C beta
	<i>PRKCG</i>	protein kinase C gamma
	<i>SGK1</i>	serum/glucocorticoid regulated kinase 1
	<i>LPIN1</i>	lipin 1
Jak-STAT signaling pathway	<i>IL2</i>	interleukin 2
	<i>IL3</i>	interleukin 3
	<i>IL4</i>	interleukin 4
	<i>IL5</i>	interleukin 5
	<i>IL6</i>	interleukin 6
	<i>IL7</i>	interleukin 7
	<i>IL9</i>	interleukin 9
	<i>IL10</i>	interleukin 10
	<i>IL11</i>	interleukin 11
	<i>IL12A</i>	interleukin 12A
	<i>IL12B</i>	interleukin 12B
	<i>IL13</i>	interleukin 13
	<i>IL15</i>	interleukin 15
	<i>IL19</i>	interleukin 19
	<i>IL20</i>	interleukin 20
	<i>IL24</i>	interleukin 24
	<i>IL21</i>	interleukin 21
	<i>IL22</i>	interleukin 22
	<i>IL23A</i>	interleukin 23 subunit alpha
	<i>IL17D</i>	interleukin 17D
	<i>IFNA1</i>	interferon alpha 1
	<i>IFNA2</i>	interferon alpha 2
	<i>IFNA4</i>	interferon alpha 4
	<i>IFNA5</i>	interferon alpha 5
	<i>IFNA6</i>	interferon alpha 6
	<i>IFNA7</i>	interferon alpha 7
	<i>IFNA8</i>	interferon alpha 8
	<i>IFNA10</i>	interferon alpha 10
	<i>IFNA13</i>	interferon alpha 13
	<i>IFNA14</i>	interferon alpha 14
	<i>IFNA16</i>	interferon alpha 16
	<i>IFNA17</i>	interferon alpha 17
	<i>IFNA21</i>	interferon alpha 21
	<i>IFNB1</i>	interferon beta 1
	<i>IFNG</i>	interferon gamma
	<i>IFNE</i>	interferon epsilon
	<i>IFNK</i>	interferon kappa
	<i>IFNL2</i>	interferon lambda 2
	<i>IFNL3</i>	interferon lambda 3
	<i>IFNL1</i>	interferon lambda 1
	<i>IFNW1</i>	interferon omega 1
	<i>OSM</i>	oncostatin M
	<i>LIF</i>	LIF, interleukin 6 family cytokine
	<i>TSLP</i>	thymic stromal lymphopoietin
	<i>CTF1</i>	cardiotrophin 1
	<i>CSF2</i>	colony stimulating factor 2
	<i>CNTF</i>	ciliary neurotrophic factor
	<i>CSF3</i>	colony stimulating factor 3
<i>EPO</i>	erythropoietin	
<i>GH1</i>	growth hormone 1	
<i>GH2</i>	growth hormone 2	
<i>CSH1</i>	chorionic somatomammotropin hormone 1	
<i>CSH2</i>	chorionic somatomammotropin hormone 2	
<i>LEP</i>	leptin	
<i>THPO</i>	thrombopoietin	
<i>PRL</i>	prolactin	
<i>IL2RA</i>	interleukin 2 receptor subunit alpha	
<i>IL2RB</i>	interleukin 2 receptor subunit beta	
<i>IL2RG</i>	interleukin 2 receptor subunit gamma	
<i>IL3RA</i>	interleukin 3 receptor subunit alpha	

IL4R	interleukin 4 receptor
IL5RA	interleukin 5 receptor subunit alpha
IL6R	interleukin 6 receptor
IL7R	interleukin 7 receptor
IL9R	interleukin 9 receptor
IL10RA	interleukin 10 receptor subunit alpha
IL10RB	interleukin 10 receptor subunit beta
IL11RA	interleukin 11 receptor subunit alpha
IL12RB1	interleukin 12 receptor subunit beta 1
IL12RB2	interleukin 12 receptor subunit beta 2
IL13RA1	interleukin 13 receptor subunit alpha 1
IL13RA2	interleukin 13 receptor subunit alpha 2
IL15RA	interleukin 15 receptor subunit alpha
IL20RA	interleukin 20 receptor subunit alpha
IL20RB	interleukin 20 receptor subunit beta
IL21R	interleukin 21 receptor
IL22RA1	interleukin 22 receptor subunit alpha 1
IL22RA2	interleukin 22 receptor subunit alpha 2
IL23R	interleukin 23 receptor
IL27RA	interleukin 27 receptor subunit alpha
IL6ST	interleukin 6 signal transducer
IFNAR1	interferon alpha and beta receptor subunit 1
IFNAR2	interferon alpha and beta receptor subunit 2
IFNGR1	interferon gamma receptor 1
IFNGR2	interferon gamma receptor 2
IFNLR1	interferon lambda receptor 1
OSMR	oncostatin M receptor
LIFR	LIF receptor alpha
CRLF2	cytokine receptor like factor 2
CNTFR	ciliary neurotrophic factor receptor
CSF2RA	colony stimulating factor 2 receptor alpha subunit
CSF2RB	colony stimulating factor 2 receptor beta common subunit
CSF3R	colony stimulating factor 3 receptor
EPOR	erythropoietin receptor
GHR	growth hormone receptor
LEPR	leptin receptor
MPL	MPL proto-oncogene, thrombopoietin receptor
PRLR	prolactin receptor
JAK1	Janus kinase 1
JAK2	Janus kinase 2
JAK3	Janus kinase 3
TYK2	tyrosine kinase 2
STAT1	signal transducer and activator of transcription 1
STAT2	signal transducer and activator of transcription 2
STAT3	signal transducer and activator of transcription 3
STAT4	signal transducer and activator of transcription 4
STAT5A	signal transducer and activator of transcription 5A
STAT5B	signal transducer and activator of transcription 5B
STAT6	signal transducer and activator of transcription 6
CISH	cytokine inducible SH2 containing protein
SOCS1	suppressor of cytokine signaling 1
SOCS2	suppressor of cytokine signaling 2
SOCS3	suppressor of cytokine signaling 3
SOCS4	suppressor of cytokine signaling 4
SOCS5	suppressor of cytokine signaling 5
SOCS7	suppressor of cytokine signaling 7
SOCS6	suppressor of cytokine signaling 6
BCL2	BCL2, apoptosis regulator
MCL1	MCL1, BCL2 family apoptosis regulator
BCL2L1	BCL2 like 1
PIM1	Pim-1 proto-oncogene, serine/threonine kinase
MYC	MYC proto-oncogene, bHLH transcription factor
CCND1	cyclin D1
CCND2	cyclin D2
CCND3	cyclin D3
CDKN1A	cyclin dependent kinase inhibitor 1A
AOX1	aldehyde oxidase 1
GFAP	glial fibrillary acidic protein
STAM2	signal transducing adaptor molecule 2
STAM	signal transducing adaptor molecule
PTPN2	protein tyrosine phosphatase, non-receptor type 2
PTPN6	protein tyrosine phosphatase, non-receptor type 6
IRF9	interferon regulatory factor 9
CREBBP	CREB binding protein
EP300	E1A binding protein p300
PIAS1	protein inhibitor of activated STAT 1
PIAS2	protein inhibitor of activated STAT 2
PIAS3	protein inhibitor of activated STAT 3
PIAS4	protein inhibitor of activated STAT 4
FHL1	four and a half LIM domains 1
PTPN11	protein tyrosine phosphatase, non-receptor type 11
GRB2	growth factor receptor bound protein 2
SOS1	SOS Ras/Rac guanine nucleotide exchange factor 1
SOS2	SOS Ras/Rho guanine nucleotide exchange factor 2
HRAS	HRas proto-oncogene, GTPase
RAF1	Raf-1 proto-oncogene, serine/threonine kinase
PIK3CA	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha
PIK3CD	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit delta
PIK3CB	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit beta

	<i>PIK3R1</i>	phosphoinositide-3-kinase regulatory subunit 1
	<i>PIK3R2</i>	phosphoinositide-3-kinase regulatory subunit 2
	<i>PIK3R3</i>	phosphoinositide-3-kinase regulatory subunit 3
	<i>AKT1</i>	AKT serine/threonine kinase 1
	<i>AKT2</i>	AKT serine/threonine kinase 2
	<i>AKT3</i>	AKT serine/threonine kinase 3
	<i>MTOR</i>	mechanistic target of rapamycin kinase
Citokine-cytokine receptor interaction	<i>CXCL1</i>	C-X-C motif chemokine ligand 1
	<i>CXCL2</i>	C-X-C motif chemokine ligand 2
	<i>CXCL3</i>	C-X-C motif chemokine ligand 3
	<i>CXCL5</i>	C-X-C motif chemokine ligand 5
	<i>CXCL6</i>	C-X-C motif chemokine ligand 6
	<i>PPBP</i>	pro-platelet basic protein
	<i>CXCL8</i>	C-X-C motif chemokine ligand 8
	<i>CXCL9</i>	C-X-C motif chemokine ligand 9
	<i>CXCL10</i>	C-X-C motif chemokine ligand 10
	<i>CXCL11</i>	C-X-C motif chemokine ligand 11
	<i>CXCL12</i>	C-X-C motif chemokine ligand 12
	<i>CXCL13</i>	C-X-C motif chemokine ligand 13
	<i>CXCL16</i>	C-X-C motif chemokine ligand 16
	<i>PF4</i>	platelet factor 4
	<i>PF4V1</i>	platelet factor 4 variant 1
	<i>CXCL14</i>	C-X-C motif chemokine ligand 14
	<i>XCL1</i>	X-C motif chemokine ligand 1
	<i>XCL2</i>	X-C motif chemokine ligand 2
	<i>CX3CL1</i>	C-X3-C motif chemokine ligand 1
	<i>CCL1</i>	C-C motif chemokine ligand 1
	<i>CCL20</i>	C-C motif chemokine ligand 20
	<i>CCL25</i>	C-C motif chemokine ligand 25
	<i>CCL17</i>	C-C motif chemokine ligand 17
	<i>CCL22</i>	C-C motif chemokine ligand 22
	<i>CCL19</i>	C-C motif chemokine ligand 19
	<i>CCL21</i>	C-C motif chemokine ligand 21
	<i>CCL2</i>	C-C motif chemokine ligand 2
	<i>CCL4</i>	C-C motif chemokine ligand 4
	<i>CCL4L2</i>	C-C motif chemokine ligand 4 like 2
	<i>CCL4L1</i>	C-C motif chemokine ligand 4 like 1
	<i>CCL3</i>	C-C motif chemokine ligand 3
	<i>CCL3L1</i>	C-C motif chemokine ligand 3 like 1
	<i>CCL3L3</i>	C-C motif chemokine ligand 3 like 3
	<i>CCL13</i>	C-C motif chemokine ligand 13
	<i>CCL7</i>	C-C motif chemokine ligand 7
	<i>CCL5</i>	C-C motif chemokine ligand 5
	<i>CCL14</i>	C-C motif chemokine ligand 14
	<i>CCL16</i>	C-C motif chemokine ligand 16
	<i>CCL15</i>	C-C motif chemokine ligand 15
	<i>CCL23</i>	C-C motif chemokine ligand 23
	<i>CCL8</i>	C-C motif chemokine ligand 8
	<i>CCL11</i>	C-C motif chemokine ligand 11
	<i>CCL24</i>	C-C motif chemokine ligand 24
	<i>CCL26</i>	C-C motif chemokine ligand 26
	<i>CCL28</i>	C-C motif chemokine ligand 28
	<i>CCL27</i>	C-C motif chemokine ligand 27
	<i>CCL18</i>	C-C motif chemokine ligand 18
	<i>IL6</i>	interleukin 6
	<i>IL11</i>	interleukin 11
	<i>OSM</i>	oncostatin M
<i>LIF</i>	LIF, interleukin 6 family cytokine	
<i>CNTF</i>	ciliary neurotrophic factor	
<i>CLCF1</i>	cardiotrophin like cytokine factor 1	
<i>CTF1</i>	cardiotrophin 1	
<i>CSF3</i>	colony stimulating factor 3	
<i>LEP</i>	leptin	
<i>IL4</i>	interleukin 4	
<i>IL13</i>	interleukin 13	
<i>IL12A</i>	interleukin 12A	
<i>IL12B</i>	interleukin 12B	
<i>IL23A</i>	interleukin 23 subunit alpha	
<i>CSF2</i>	colony stimulating factor 2	
<i>IL3</i>	interleukin 3	
<i>IL5</i>	interleukin 5	
<i>IL2</i>	interleukin 2	
<i>IL7</i>	interleukin 7	
<i>IL9</i>	interleukin 9	
<i>IL15</i>	interleukin 15	
<i>IL21</i>	interleukin 21	
<i>TSLP</i>	thymic stromal lymphopoietin	
<i>EPO</i>	erythropoietin	
<i>GH1</i>	growth hormone 1	
<i>GH2</i>	growth hormone 2	
<i>PRL</i>	prolactin	
<i>THPO</i>	thrombopoietin	
<i>PDGFC</i>	platelet derived growth factor C	
<i>PDGFA</i>	platelet derived growth factor subunit A	
<i>PDGFB</i>	platelet derived growth factor subunit B	
<i>VEGFA</i>	vascular endothelial growth factor A	
<i>VEGFB</i>	vascular endothelial growth factor B	
<i>VEGFC</i>	vascular endothelial growth factor C	
<i>VEGFD</i>	vascular endothelial growth factor D	

HGF	hepatocyte growth factor
EGF	epidermal growth factor
CSF1	colony stimulating factor 1
KITLG	KIT ligand
FLT3LG	fms related tyrosine kinase 3 ligand
IFNA1	interferon alpha 1
IFNA2	interferon alpha 2
IFNA4	interferon alpha 4
IFNA5	interferon alpha 5
IFNA6	interferon alpha 6
IFNA7	interferon alpha 7
IFNA8	interferon alpha 8
IFNA10	interferon alpha 10
IFNA13	interferon alpha 13
IFNA14	interferon alpha 14
IFNA16	interferon alpha 16
IFNA17	interferon alpha 17
IFNA21	interferon alpha 21
IFNB1	interferon beta 1
IFNW1	interferon omega 1
IFNK	interferon kappa
IFNE	interferon epsilon
IFNG	interferon gamma
IL10	interleukin 10
IL19	interleukin 19
IL20	interleukin 20
IL24	interleukin 24
IL22	interleukin 22
IFNL2	interferon lambda 2
IFNL3	interferon lambda 3
IFNL1	interferon lambda 1
IL26	interleukin 26
TNFSF15	TNF superfamily member 15
TNFSF10	TNF superfamily member 10
TNFSF11	TNF superfamily member 11
TNFSF12	TNF superfamily member 12
TNF	tumor necrosis factor
LTA	lymphotoxin alpha
LTB	lymphotoxin beta
TNFSF14	TNF superfamily member 14
FASLG	Fas ligand
CD40LG	CD40 ligand
CD70	CD70 molecule
TNFSF8	TNF superfamily member 8
TNFSF9	TNF superfamily member 9
TNFSF4	TNF superfamily member 4
TNFSF18	TNF superfamily member 18
TNFSF13	TNF superfamily member 13
TNFSF13B	TNF superfamily member 13b
EDA	ectodysplasin A
TGFB1	transforming growth factor beta 1
TGFB2	transforming growth factor beta 2
TGFB3	transforming growth factor beta 3
INHBA	inhibin beta A subunit
INHBB	inhibin beta B subunit
INHBC	inhibin beta C subunit
INHBE	inhibin beta E subunit
AMH	anti-Mullerian hormone
BMP2	bone morphogenetic protein 2
BMP7	bone morphogenetic protein 7
GDF5	growth differentiation factor 5
IL1A	interleukin 1 alpha
IL1B	interleukin 1 beta
IL18	interleukin 18
IL25	interleukin 25
IL17A	interleukin 17A
IL17F	interleukin 17F
IL17C	interleukin 17C
IL17B	interleukin 17B
IL17D	interleukin 17D
CXCR2	C-X-C motif chemokine receptor 2
CXCR1	C-X-C motif chemokine receptor 1
CXCR3	C-X-C motif chemokine receptor 3
CXCR4	C-X-C motif chemokine receptor 4
CXCR5	C-X-C motif chemokine receptor 5
CXCR6	C-X-C motif chemokine receptor 6
ACKR3	atypical chemokine receptor 3
XCR1	X-C motif chemokine receptor 1
CX3CR1	C-X3-C motif chemokine receptor 1
CCR8	C-C motif chemokine receptor 8
CCR6	C-C motif chemokine receptor 6
CCR9	C-C motif chemokine receptor 9
CCR4	C-C motif chemokine receptor 4
CCR7	C-C motif chemokine receptor 7
CCR2	C-C motif chemokine receptor 2
CCR5	C-C motif chemokine receptor 5 (gene/pseudogene)
CCR1	C-C motif chemokine receptor 1
CCR3	C-C motif chemokine receptor 3
CCR10	C-C motif chemokine receptor 10

IL6R	interleukin 6 receptor
IL6ST	interleukin 6 signal transducer
IL11RA	interleukin 11 receptor subunit alpha
LIFR	LIF receptor alpha
OSMR	oncostatin M receptor
CNTFR	ciliary neurotrophic factor receptor
CSF3R	colony stimulating factor 3 receptor
LEPR	leptin receptor
IL4R	interleukin 4 receptor
IL13RA1	interleukin 13 receptor subunit alpha 1
IL12RB1	interleukin 12 receptor subunit beta 1
IL12RB2	interleukin 12 receptor subunit beta 2
IL23R	interleukin 23 receptor
CSF2RA	colony stimulating factor 2 receptor alpha subunit
CSF2RB	colony stimulating factor 2 receptor beta common subunit
IL3RA	interleukin 3 receptor subunit alpha
IL5RA	interleukin 5 receptor subunit alpha
IL2RA	interleukin 2 receptor subunit alpha
IL2RB	interleukin 2 receptor subunit beta
IL2RG	interleukin 2 receptor subunit gamma
IL7R	interleukin 7 receptor
IL9R	interleukin 9 receptor
IL15RA	interleukin 15 receptor subunit alpha
IL21R	interleukin 21 receptor
CRLF2	cytokine receptor like factor 2
EPOR	erythropoietin receptor
GHR	growth hormone receptor
PRLR	prolactin receptor
MPL	MPL proto-oncogene, thrombopoietin receptor
PDGFRA	platelet derived growth factor receptor alpha
PDGFRB	platelet derived growth factor receptor beta
FLT1	fms related tyrosine kinase 1
KDR	kinase insert domain receptor
FLT4	fms related tyrosine kinase 4
MET	MET proto-oncogene, receptor tyrosine kinase
EGFR	epidermal growth factor receptor
CSF1R	colony stimulating factor 1 receptor
KIT	KIT proto-oncogene receptor tyrosine kinase
FLT3	fms related tyrosine kinase 3
IFNAR1	interferon alpha and beta receptor subunit 1
IFNAR2	interferon alpha and beta receptor subunit 2
IFNGR1	interferon gamma receptor 1
IFNGR2	interferon gamma receptor 2
IL10RA	interleukin 10 receptor subunit alpha
IL10RB	interleukin 10 receptor subunit beta
IL20RA	interleukin 20 receptor subunit alpha
IL20RB	interleukin 20 receptor subunit beta
IL22RA1	interleukin 22 receptor subunit alpha 1
IL22RA2	interleukin 22 receptor subunit alpha 2
IFNLR1	interferon lambda receptor 1
TNFRSF10A	TNF receptor superfamily member 10a
TNFRSF10B	TNF receptor superfamily member 10b
TNFRSF10C	TNF receptor superfamily member 10c
TNFRSF10D	TNF receptor superfamily member 10d
TNFRSF11B	TNF receptor superfamily member 11b
TNFRSF11A	TNF receptor superfamily member 11a
TNFRSF25	TNF receptor superfamily member 25
TNFRSF12A	TNF receptor superfamily member 12A
TNFRSF21	TNF receptor superfamily member 21
NGFR	nerve growth factor receptor
TNFRSF1B	TNF receptor superfamily member 1B
TNFRSF1A	TNF receptor superfamily member 1A
LTBR	lymphotoxin beta receptor
TNFRSF14	TNF receptor superfamily member 14
TNFRSF6B	TNF receptor superfamily member 6b
FAS	Fas cell surface death receptor
CD40	CD40 molecule
CD27	CD27 molecule
TNFRSF8	TNF receptor superfamily member 8
TNFRSF9	TNF receptor superfamily member 9
TNFRSF4	TNF receptor superfamily member 4
TNFRSF18	TNF receptor superfamily member 18
TNFRSF17	TNF receptor superfamily member 17
TNFRSF13B	TNF receptor superfamily member 13B
TNFRSF13C	TNF receptor superfamily member 13C
EDAR	ectodysplasin A receptor
EDA2R	ectodysplasin A2 receptor
TNFRSF19	TNF receptor superfamily member 19
RELT	RELT, TNF receptor
TGFB2	transforming growth factor beta receptor 2
TGFB1	transforming growth factor beta receptor 1
ACVR2A	activin A receptor type 2A
ACVR2B	activin A receptor type 2B
ACVR1	activin A receptor type 1
ACVR1B	activin A receptor type 1B
AMHR2	anti-Mullerian hormone receptor type 2
BMP2	bone morphogenetic protein receptor type 2
BMP1A	bone morphogenetic protein receptor type 1A
BMP1B	bone morphogenetic protein receptor type 1B

	<i>IL1R1</i>	interleukin 1 receptor type 1
	<i>IL1RAP</i>	interleukin 1 receptor accessory protein
	<i>IL1R2</i>	interleukin 1 receptor type 2
	<i>IL18R1</i>	interleukin 18 receptor 1
	<i>IL18RAP</i>	interleukin 18 receptor accessory protein
	<i>IL17RA</i>	interleukin 17 receptor A
	<i>IL17RB</i>	interleukin 17 receptor B
	<i>IL17RC</i>	interleukin 17 receptor C
	<i>IL17RE</i>	interleukin 17 receptor E
	<i>PLEKHO2</i>	pleckstrin homology domain containing O2
MapK signaling pathway	<i>CACNA1A</i>	calcium voltage-gated channel subunit alpha1 A
	<i>CACNA1B</i>	calcium voltage-gated channel subunit alpha1 B
	<i>CACNA1C</i>	calcium voltage-gated channel subunit alpha1 C
	<i>CACNA1D</i>	calcium voltage-gated channel subunit alpha1 D
	<i>CACNA1E</i>	calcium voltage-gated channel subunit alpha1 E
	<i>CACNA1F</i>	calcium voltage-gated channel subunit alpha1 F
	<i>CACNA1G</i>	calcium voltage-gated channel subunit alpha1 G
	<i>CACNA1H</i>	calcium voltage-gated channel subunit alpha1 H
	<i>CACNA1I</i>	calcium voltage-gated channel subunit alpha1 I
	<i>CACNA1S</i>	calcium voltage-gated channel subunit alpha1 S
	<i>CACNA2D1</i>	calcium voltage-gated channel auxiliary subunit alpha2delta 1
	<i>CACNA2D2</i>	calcium voltage-gated channel auxiliary subunit alpha2delta 2
	<i>CACNA2D3</i>	calcium voltage-gated channel auxiliary subunit alpha2delta 3
	<i>CACNA2D4</i>	calcium voltage-gated channel auxiliary subunit alpha2delta 4
	<i>CACNB1</i>	calcium voltage-gated channel auxiliary subunit beta 1
	<i>CACNB2</i>	calcium voltage-gated channel auxiliary subunit beta 2
	<i>CACNB3</i>	calcium voltage-gated channel auxiliary subunit beta 3
	<i>CACNB4</i>	calcium voltage-gated channel auxiliary subunit beta 4
	<i>CACNG1</i>	calcium voltage-gated channel auxiliary subunit gamma 1
	<i>CACNG2</i>	calcium voltage-gated channel auxiliary subunit gamma 2
	<i>CACNG3</i>	calcium voltage-gated channel auxiliary subunit gamma 3
	<i>CACNG4</i>	calcium voltage-gated channel auxiliary subunit gamma 4
	<i>CACNG5</i>	calcium voltage-gated channel auxiliary subunit gamma 5
	<i>CACNG6</i>	calcium voltage-gated channel auxiliary subunit gamma 6
	<i>CACNG7</i>	calcium voltage-gated channel auxiliary subunit gamma 7
	<i>CACNG8</i>	calcium voltage-gated channel auxiliary subunit gamma 8
	<i>PRKACA</i>	protein kinase cAMP-activated catalytic subunit alpha
	<i>PRKACB</i>	protein kinase cAMP-activated catalytic subunit beta
	<i>PRKACG</i>	protein kinase cAMP-activated catalytic subunit gamma
	<i>PRKCA</i>	protein kinase C alpha
	<i>PRKCB</i>	protein kinase C beta
	<i>PRKCG</i>	protein kinase C gamma
	<i>GNA12</i>	G protein subunit alpha 12
	<i>GNG12</i>	G protein subunit gamma 12
	<i>PPP3CA</i>	protein phosphatase 3 catalytic subunit alpha
	<i>PPP3CB</i>	protein phosphatase 3 catalytic subunit beta
	<i>PPP3CC</i>	protein phosphatase 3 catalytic subunit gamma
	<i>PPP3R1</i>	protein phosphatase 3 regulatory subunit B, alpha
	<i>PPP3R2</i>	protein phosphatase 3 regulatory subunit B, beta
	<i>RASGRF1</i>	Ras protein specific guanine nucleotide releasing factor 1
	<i>RASGRF2</i>	Ras protein specific guanine nucleotide releasing factor 2
	<i>RASGRP1</i>	RAS guanyl releasing protein 1
	<i>RASGRP2</i>	RAS guanyl releasing protein 2
	<i>RASGRP3</i>	RAS guanyl releasing protein 3
	<i>RASGRP4</i>	RAS guanyl releasing protein 4
	<i>RAPGEF2</i>	Rap guanine nucleotide exchange factor 2
	<i>NF1</i>	neurofibromin 1
	<i>RASA1</i>	RAS p21 protein activator 1
	<i>RASA2</i>	RAS p21 protein activator 2
	<i>RAP1A</i>	RAP1A, member of RAS oncogene family
	<i>RAP1B</i>	RAP1B, member of RAS oncogene family
	<i>NGF</i>	nerve growth factor
	<i>BDNF</i>	brain derived neurotrophic factor
	<i>NTF3</i>	neurotrophin 3
	<i>NTF4</i>	neurotrophin 4
	<i>EGF</i>	epidermal growth factor
	<i>FGF1</i>	fibroblast growth factor 1
	<i>FGF2</i>	fibroblast growth factor 2
	<i>FGF3</i>	fibroblast growth factor 3
	<i>FGF4</i>	fibroblast growth factor 4
<i>FGF17</i>	fibroblast growth factor 17	
<i>FGF6</i>	fibroblast growth factor 6	
<i>FGF7</i>	fibroblast growth factor 7	
<i>FGF8</i>	fibroblast growth factor 8	
<i>FGF9</i>	fibroblast growth factor 9	
<i>FGF10</i>	fibroblast growth factor 10	
<i>FGF11</i>	fibroblast growth factor 11	
<i>FGF12</i>	fibroblast growth factor 12	
<i>FGF13</i>	fibroblast growth factor 13	
<i>FGF14</i>	fibroblast growth factor 14	
<i>FGF16</i>	fibroblast growth factor 16	
<i>FGF5</i>	fibroblast growth factor 5	
<i>FGF18</i>	fibroblast growth factor 18	
<i>FGF19</i>	fibroblast growth factor 19	
<i>FGF20</i>	fibroblast growth factor 20	
<i>FGF21</i>	fibroblast growth factor 21	
<i>FGF22</i>	fibroblast growth factor 22	
<i>FGF23</i>	fibroblast growth factor 23	
<i>PDGFA</i>	platelet derived growth factor subunit A	

<i>PDGFB</i>	platelet derived growth factor subunit B
<i>NTRK1</i>	neurotrophic receptor tyrosine kinase 1
<i>NTRK2</i>	neurotrophic receptor tyrosine kinase 2
<i>EGFR</i>	epidermal growth factor receptor
<i>FGFR1</i>	fibroblast growth factor receptor 1
<i>FGFR2</i>	fibroblast growth factor receptor 2
<i>FGFR3</i>	fibroblast growth factor receptor 3
<i>FGFR4</i>	fibroblast growth factor receptor 4
<i>PDGFRA</i>	platelet derived growth factor receptor alpha
<i>PDGFRB</i>	platelet derived growth factor receptor beta
<i>GRB2</i>	growth factor receptor bound protein 2
<i>SOS1</i>	SOS Ras/Rac guanine nucleotide exchange factor 1
<i>SOS2</i>	SOS Ras/Rho guanine nucleotide exchange factor 2
<i>HRAS</i>	HRas proto-oncogene, GTPase
<i>KRAS</i>	KRAS proto-oncogene, GTPase
<i>NRAS</i>	NRAS proto-oncogene, GTPase
<i>RRAS</i>	RAS related
<i>RRAS2</i>	RAS related 2
<i>MRAS</i>	muscle RAS oncogene homolog
<i>BRAF</i>	B-Raf proto-oncogene, serine/threonine kinase
<i>RAF1</i>	Raf-1 proto-oncogene, serine/threonine kinase
<i>MOS</i>	MOS proto-oncogene, serine/threonine kinase
<i>MAP2K1</i>	mitogen-activated protein kinase kinase 1
<i>MAP2K2</i>	mitogen-activated protein kinase kinase 2
<i>LAMTOR3</i>	late endosomal/lysosomal adaptor, MAPK and MTOR activator 3
<i>MAPK1</i>	mitogen-activated protein kinase 1
<i>MAPK3</i>	mitogen-activated protein kinase 3
<i>MKNK1</i>	MAP kinase interacting serine/threonine kinase 1
<i>MKNK2</i>	MAP kinase interacting serine/threonine kinase 2
<i>RPS6KA3</i>	ribosomal protein S6 kinase A3
<i>RPS6KA1</i>	ribosomal protein S6 kinase A1
<i>RPS6KA2</i>	ribosomal protein S6 kinase A2
<i>RPS6KA6</i>	ribosomal protein S6 kinase A6
<i>ATF4</i>	activating transcription factor 4
<i>ELK1</i>	ELK1, ETS transcription factor
<i>ELK4</i>	ELK4, ETS transcription factor
<i>MYC</i>	MYC proto-oncogene, bHLH transcription factor
<i>SRF</i>	serum response factor
<i>FOS</i>	Fos proto-oncogene, AP-1 transcription factor subunit
<i>MAPT</i>	microtubule associated protein tau
<i>STMN1</i>	stathmin 1
<i>PLA2G4E</i>	phospholipase A2 group IVE
<i>PLA2G4A</i>	phospholipase A2 group IVA
<i>JMJD7-PLA2G4B</i>	JMJD7-PLA2G4B readthrough
<i>PLA2G4B</i>	phospholipase A2 group IVB
<i>PLA2G4C</i>	phospholipase A2 group IVC
<i>PLA2G4D</i>	phospholipase A2 group IVD
<i>PLA2G4F</i>	phospholipase A2 group IVF
<i>TNF</i>	tumor necrosis factor
<i>IL1A</i>	interleukin 1 alpha
<i>IL1B</i>	interleukin 1 beta
<i>TGFB1</i>	transforming growth factor beta 1
<i>TGFB2</i>	transforming growth factor beta 2
<i>TGFB3</i>	transforming growth factor beta 3
<i>TNFRSF1A</i>	TNF receptor superfamily member 1A
<i>IL1R1</i>	interleukin 1 receptor type 1
<i>IL1R2</i>	interleukin 1 receptor type 2
<i>TGFBRI</i>	transforming growth factor beta receptor 1
<i>TGFBRII</i>	transforming growth factor beta receptor 2
<i>FASLG</i>	Fas ligand
<i>FAS</i>	Fas cell surface death receptor
<i>CD14</i>	CD14 molecule
<i>RAC1</i>	Rac family small GTPase 1
<i>RAC2</i>	Rac family small GTPase 2
<i>RAC3</i>	Rac family small GTPase 3
<i>CDC42</i>	cell division cycle 42
<i>CASP3</i>	caspase 3
<i>TRAF2</i>	TNF receptor associated factor 2
<i>DAXX</i>	death domain associated protein
<i>TRAF6</i>	TNF receptor associated factor 6
<i>GADD45A</i>	growth arrest and DNA damage inducible alpha
<i>GADD45B</i>	growth arrest and DNA damage inducible beta
<i>GADD45G</i>	growth arrest and DNA damage inducible gamma
<i>TAB1</i>	TGF-beta activated kinase 1 (MAP3K7) binding protein 1
<i>TAB2</i>	TGF-beta activated kinase 1/MAP3K7 binding protein 2
<i>ECSIT</i>	ECSIT signalling integrator
<i>MAP4K3</i>	mitogen-activated protein kinase kinase kinase kinase 3
<i>MAP4K4</i>	mitogen-activated protein kinase kinase kinase kinase 4
<i>MAP4K1</i>	mitogen-activated protein kinase kinase kinase kinase 1
<i>PAK1</i>	p21 (RAC1) activated kinase 1
<i>PAK2</i>	p21 (RAC1) activated kinase 2
<i>STK4</i>	serine/threonine kinase 4
<i>STK3</i>	serine/threonine kinase 3
<i>MAP4K2</i>	mitogen-activated protein kinase kinase kinase kinase 2
<i>MAP3K8</i>	mitogen-activated protein kinase kinase kinase 8
<i>MAP3K1</i>	mitogen-activated protein kinase kinase kinase 1
<i>MAP3K11</i>	mitogen-activated protein kinase kinase kinase 11
<i>MAP3K2</i>	mitogen-activated protein kinase kinase kinase 2
<i>MAP3K3</i>	mitogen-activated protein kinase kinase kinase 3

	MAP3K13	mitogen-activated protein kinase kinase kinase 13
	MAP3K12	mitogen-activated protein kinase kinase kinase 12
	MAP3K20	mitogen-activated protein kinase kinase kinase 20
	MAP3K6	mitogen-activated protein kinase kinase kinase 6
	MAP3K5	mitogen-activated protein kinase kinase kinase 5
	MAP3K7	mitogen-activated protein kinase kinase kinase 7
	MAP3K4	mitogen-activated protein kinase kinase kinase 4
	TAOK2	TAO kinase 2
	TAOK3	TAO kinase 3
	TAOK1	TAO kinase 1
	MAP2K4	mitogen-activated protein kinase kinase 4
	MAP2K7	mitogen-activated protein kinase kinase 7
	MAP2K3	mitogen-activated protein kinase kinase 3
	MAP2K6	mitogen-activated protein kinase kinase 6
	MAPK8IP1	mitogen-activated protein kinase 8 interacting protein 1
	MAPK8IP2	mitogen-activated protein kinase 8 interacting protein 2
	MAPK8IP3	mitogen-activated protein kinase 8 interacting protein 3
	FLNA	filamin A
	FLNC	filamin C
	FLNB	filamin B
	CRK	CRK proto-oncogene, adaptor protein
	CRKL	CRK like proto-oncogene, adaptor protein
	ARRB1	arrestin beta 1
	ARRB2	arrestin beta 2
	MAPK8	mitogen-activated protein kinase 8
	MAPK10	mitogen-activated protein kinase 10
	MAPK9	mitogen-activated protein kinase 9
	MAPK11	mitogen-activated protein kinase 11
	MAPK12	mitogen-activated protein kinase 12
	MAPK13	mitogen-activated protein kinase 13
	MAPK14	mitogen-activated protein kinase 14
	MAPKAPK5	mitogen-activated protein kinase-activated protein kinase 5
	MAPKAPK2	mitogen-activated protein kinase-activated protein kinase 2
	MAPKAPK3	mitogen-activated protein kinase-activated protein kinase 3
	RPS6KA5	ribosomal protein S6 kinase A5
	RPS6KA4	ribosomal protein S6 kinase A4
	CDC25B	cell division cycle 25B
	NFATC1	nuclear factor of activated T-cells 1
	NFATC3	nuclear factor of activated T-cells 3
	JUN	Jun proto-oncogene, AP-1 transcription factor subunit
	JUND	JunD proto-oncogene, AP-1 transcription factor subunit
	ATF2	activating transcription factor 2
	TP53	tumor protein p53
	DDIT3	DNA damage inducible transcript 3
	MAX	MYC associated factor X
	MEF2C	myocyte enhancer factor 2C
	HSPB1	heat shock protein family B (small) member 1
	AKT1	AKT serine/threonine kinase 1
	AKT2	AKT serine/threonine kinase 2
	AKT3	AKT serine/threonine kinase 3
	PPM1A	protein phosphatase, Mg ²⁺ /Mn ²⁺ dependent 1A
	PTPRR	protein tyrosine phosphatase, receptor type R
	PTPN5	protein tyrosine phosphatase, non-receptor type 5
	PTPN7	protein tyrosine phosphatase, non-receptor type 7
	DUSP1	dual specificity phosphatase 1
	DUSP4	dual specificity phosphatase 4
	DUSP2	dual specificity phosphatase 2
	DUSP7	dual specificity phosphatase 7
	DUSP8	dual specificity phosphatase 8
	DUSP5	dual specificity phosphatase 5
	DUSP16	dual specificity phosphatase 16
	DUSP6	dual specificity phosphatase 6
	DUSP9	dual specificity phosphatase 9
	DUSP10	dual specificity phosphatase 10
	DUSP3	dual specificity phosphatase 3
	PPP5C	protein phosphatase 5 catalytic subunit
	PPP5D1	PPP5 tetratricopeptide repeat domain containing 1
	PPM1B	protein phosphatase, Mg ²⁺ /Mn ²⁺ dependent 1B
	HSPA8	heat shock protein family A (Hsp70) member 8
	HSPA1A	heat shock protein family A (Hsp70) member 1A
	HSPA2	heat shock protein family A (Hsp70) member 2
	HSPA1L	heat shock protein family A (Hsp70) member 1 like
	HSPA1B	heat shock protein family A (Hsp70) member 1B
	HSPA6	heat shock protein family A (Hsp70) member 6
	MECOM	MDS1 and EVI1 complex locus
	MAP2K5	mitogen-activated protein kinase kinase 5
	MAPK7	mitogen-activated protein kinase 7
	NR4A1	nuclear receptor subfamily 4 group A member 1
	MAP3K14	mitogen-activated protein kinase kinase kinase 14
	CHUK	conserved helix-loop-helix ubiquitous kinase
	IKBKB	inhibitor of nuclear factor kappa B kinase subunit beta
	IKBKG	inhibitor of nuclear factor kappa B kinase subunit gamma
	NLK	nemo like kinase
	NFKB1	nuclear factor kappa B subunit 1
	NFKB2	nuclear factor kappa B subunit 2
	RELA	RELA proto-oncogene, NF-kB subunit
	RELB	RELB proto-oncogene, NF-kB subunit
PPAR signaling pathway	CD36	CD36 molecule
	SLC27A1	solute carrier family 27 member 1

	<i>SLC27A4</i>	solute carrier family 27 member 4
	<i>SLC27A2</i>	solute carrier family 27 member 2
	<i>SLC27A5</i>	solute carrier family 27 member 5
	<i>SLC27A6</i>	solute carrier family 27 member 6
	<i>FABP1</i>	fatty acid binding protein 1
	<i>FABP2</i>	fatty acid binding protein 2
	<i>FABP3</i>	fatty acid binding protein 3
	<i>FABP4</i>	fatty acid binding protein 4
	<i>FABP5</i>	fatty acid binding protein 5
	<i>FABP6</i>	fatty acid binding protein 6
	<i>FABP7</i>	fatty acid binding protein 7
	<i>PPARA</i>	peroxisome proliferator activated receptor alpha
	<i>RXRA</i>	retinoid X receptor alpha
	<i>RXRB</i>	retinoid X receptor beta
	<i>RXRG</i>	retinoid X receptor gamma
	<i>PPARD</i>	peroxisome proliferator activated receptor delta
	<i>PPARG</i>	peroxisome proliferator activated receptor gamma
	<i>APOA1</i>	apolipoprotein A1
	<i>APOA2</i>	apolipoprotein A2
	<i>APOC3</i>	apolipoprotein C3
	<i>APOA5</i>	apolipoprotein A5
	<i>PLTP</i>	phospholipid transfer protein
	<i>FADS2</i>	fatty acid desaturase 2
	<i>SCD</i>	stearoyl-CoA desaturase
	<i>SCD5</i>	stearoyl-CoA desaturase 5
	<i>CYP7A1</i>	cytochrome P450 family 7 subfamily A member 1
	<i>CYP8B1</i>	cytochrome P450 family 8 subfamily B member 1
	<i>NR1H3</i>	nuclear receptor subfamily 1 group H member 3
	<i>CYP27A1</i>	cytochrome P450 family 27 subfamily A member 1
	<i>DBI</i>	diazepam binding inhibitor, acyl-CoA binding protein
	<i>LPL</i>	lipoprotein lipase
	<i>ACSL6</i>	acyl-CoA synthetase long chain family member 6
	<i>ACSL4</i>	acyl-CoA synthetase long chain family member 4
	<i>ACSL1</i>	acyl-CoA synthetase long chain family member 1
	<i>ACSL5</i>	acyl-CoA synthetase long chain family member 5
	<i>ACSL3</i>	acyl-CoA synthetase long chain family member 3
	<i>ACSBG1</i>	acyl-CoA synthetase bubblegum family member 1
	<i>ACSBG2</i>	acyl-CoA synthetase bubblegum family member 2
	<i>OLR1</i>	oxidized low density lipoprotein receptor 1
	<i>EHHADH</i>	enoyl-CoA hydratase and 3-hydroxyacyl CoA dehydrogenase
	<i>ACAA1</i>	acetyl-CoA acyltransferase 1
	<i>SCP2</i>	sterol carrier protein 2
	<i>ACOX3</i>	acyl-CoA oxidase 3, pristanoyl
	<i>ACOX1</i>	acyl-CoA oxidase 1
	<i>ACOX2</i>	acyl-CoA oxidase 2
	<i>CPT1A</i>	carnitine palmitoyltransferase 1A
	<i>CPT1B</i>	carnitine palmitoyltransferase 1B
	<i>CPT1C</i>	carnitine palmitoyltransferase 1C
	<i>CPT2</i>	carnitine palmitoyltransferase 2
	<i>ACADL</i>	acyl-CoA dehydrogenase, long chain
	<i>ACADM</i>	acyl-CoA dehydrogenase, C-4 to C-12 straight chain
	<i>ANGPTL4</i>	angiopoietin like 4
	<i>SORBS1</i>	sorbin and SH3 domain containing 1
	<i>PLIN1</i>	perilipin 1
	<i>PLIN2</i>	perilipin 2
	<i>PLIN4</i>	perilipin 4
	<i>PLIN5</i>	perilipin 5
	<i>ADIPOQ</i>	adiponectin, C1Q and collagen domain containing
	<i>MMP1</i>	matrix metalloproteinase 1
	<i>UCP1</i>	uncoupling protein 1
	<i>ILK</i>	integrin linked kinase
	<i>PDPK1</i>	3-phosphoinositide dependent protein kinase 1
	<i>UBC</i>	ubiquitin C
	<i>PCK1</i>	phosphoenolpyruvate carboxykinase 1
	<i>PCK2</i>	phosphoenolpyruvate carboxykinase 2, mitochondrial
	<i>GK2</i>	glycerol kinase 2
	<i>GK</i>	glycerol kinase
	<i>AQP7</i>	aquaporin 7
	<i>HMGCS2</i>	3-hydroxy-3-methylglutaryl-CoA synthase 2
	<i>ME1</i>	malic enzyme 1
Cell cycle	<i>CCND1</i>	cyclin D1
	<i>CCND2</i>	cyclin D2
	<i>CCND3</i>	cyclin D3
	<i>CDK4</i>	cyclin dependent kinase 4
	<i>CDK6</i>	cyclin dependent kinase 6
	<i>RB1</i>	RB transcriptional corepressor 1
	<i>RBL1</i>	RB transcriptional corepressor like 1
	<i>RBL2</i>	RB transcriptional corepressor like 2
	<i>ABL1</i>	ABL proto-oncogene 1, non-receptor tyrosine kinase
	<i>HDAC1</i>	histone deacetylase 1
	<i>HDAC2</i>	histone deacetylase 2
	<i>E2F1</i>	E2F transcription factor 1
	<i>E2F2</i>	E2F transcription factor 2
	<i>E2F3</i>	E2F transcription factor 3
	<i>E2F4</i>	E2F transcription factor 4
	<i>E2F5</i>	E2F transcription factor 5
	<i>TFDP1</i>	transcription factor Dp-1
	<i>TFDP2</i>	transcription factor Dp-2
	<i>GSK3B</i>	glycogen synthase kinase 3 beta

TGFB1	transforming growth factor beta 1
TGFB2	transforming growth factor beta 2
TGFB3	transforming growth factor beta 3
SMAD2	SMAD family member 2
SMAD3	SMAD family member 3
SMAD4	SMAD family member 4
MYC	MYC proto-oncogene, bHLH transcription factor
ZBTB17	zinc finger and BTB domain containing 17
CDKN2A	cyclin dependent kinase inhibitor 2A
CDKN2B	cyclin dependent kinase inhibitor 2B
CDKN2C	cyclin dependent kinase inhibitor 2C
CDKN2D	cyclin dependent kinase inhibitor 2D
CDKN1B	cyclin dependent kinase inhibitor 1B
CDKN1C	cyclin dependent kinase inhibitor 1C
CDKN1A	cyclin dependent kinase inhibitor 1A
CCNE1	cyclin E1
CCNE2	cyclin E2
CDK2	cyclin dependent kinase 2
SKP1	S-phase kinase associated protein 1
CUL1	cullin 1
RBX1	ring-box 1
SKP2	S-phase kinase associated protein 2
CCNA2	cyclin A2
CCNA1	cyclin A1
CDC6	cell division cycle 6
CDC45	cell division cycle 45
CDC7	cell division cycle 7
DBF4	DBF4 zinc finger
CDK1	cyclin dependent kinase 1
CCNB1	cyclin B1
CCNB2	cyclin B2
CCNB3	cyclin B3
CDC25B	cell division cycle 25B
CDC25C	cell division cycle 25C
YWHAZ	tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein zeta
YWHAB	tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein beta
YWHAQ	tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein theta
YWHAE	tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein epsilon
YWHAH	tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein eta
YWHAG	tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein gamma
PLK1	polo like kinase 1
WEE1	WEE1 G2 checkpoint kinase
WEE2	WEE1 homolog 2
PKMYT1	protein kinase, membrane associated tyrosine/threonine 1
CCNH	cyclin H
CDK7	cyclin dependent kinase 7
ANAPC1	anaphase promoting complex subunit 1
ANAPC2	anaphase promoting complex subunit 2
CDC27	cell division cycle 27
ANAPC4	anaphase promoting complex subunit 4
ANAPC5	anaphase promoting complex subunit 5
CDC16	cell division cycle 16
ANAPC7	anaphase promoting complex subunit 7
CDC23	cell division cycle 23
ANAPC10	anaphase promoting complex subunit 10
ANAPC11	anaphase promoting complex subunit 11
CDC26	cell division cycle 26
ANAPC13	anaphase promoting complex subunit 13
CDC20	cell division cycle 20
PTTG1	pituitary tumor-transforming 1
PTTG2	pituitary tumor-transforming 2
ESPL1	extra spindle pole bodies like 1, separate
SMC1A	structural maintenance of chromosomes 1A
SMC1B	structural maintenance of chromosomes 1B
SMC3	structural maintenance of chromosomes 3
STAG2	stromal antigen 2
STAG1	stromal antigen 1
RAD21	RAD21 cohesin complex component
TTK	TTK protein kinase
BUB1	BUB1 mitotic checkpoint serine/threonine kinase
BUB3	BUB3, mitotic checkpoint protein
BUB1B	BUB1 mitotic checkpoint serine/threonine kinase B
MAD1L1	MAD1 mitotic arrest deficient like 1
MAD2L1	mitotic arrest deficient 2 like 1
MAD2L2	mitotic arrest deficient 2 like 2
FZR1	fizzy and cell division cycle 20 related 1
CDC14B	cell division cycle 14B
CDC14A	cell division cycle 14A
ATR	ATR serine/threonine kinase
ATM	ATM serine/threonine kinase
TP53	tumor protein p53
CHEK1	checkpoint kinase 1
CHEK2	checkpoint kinase 2
CREBBP	CREB binding protein
EP300	E1A binding protein p300
PRKDC	protein kinase, DNA-activated, catalytic polypeptide
MDM2	MDM2 proto-oncogene
GADD45A	growth arrest and DNA damage inducible alpha
GADD45B	growth arrest and DNA damage inducible beta

	<i>GADD45G</i>	growth arrest and DNA damage inducible gamma
	<i>PCNA</i>	proliferating cell nuclear antigen
	<i>SFN</i>	stratifin
	<i>CDC25A</i>	cell division cycle 25A
	<i>ORC1</i>	origin recognition complex subunit 1
	<i>ORC2</i>	origin recognition complex subunit 2
	<i>ORC3</i>	origin recognition complex subunit 3
	<i>ORC4</i>	origin recognition complex subunit 4
	<i>ORC5</i>	origin recognition complex subunit 5
	<i>ORC6</i>	origin recognition complex subunit 6
	<i>MCM2</i>	minichromosome maintenance complex component 2
	<i>MCM3</i>	minichromosome maintenance complex component 3
	<i>MCM4</i>	minichromosome maintenance complex component 4
	<i>MCM5</i>	minichromosome maintenance complex component 5
	<i>MCM6</i>	minichromosome maintenance complex component 6
	<i>MCM7</i>	minichromosome maintenance complex component 7
p53 signaling pathway	<i>ATM</i>	ATM serine/threonine kinase
	<i>CHEK2</i>	checkpoint kinase 2
	<i>ATR</i>	ATR serine/threonine kinase
	<i>CHEK1</i>	checkpoint kinase 1
	<i>GORAB</i>	golgin, RAB6 interacting
	<i>CDKN2A</i>	cyclin dependent kinase inhibitor 2A
	<i>MDM2</i>	MDM2 proto-oncogene
	<i>MDM4</i>	MDM4, p53 regulator
	<i>TP53</i>	tumor protein p53
	<i>CDKN1A</i>	cyclin dependent kinase inhibitor 1A
	<i>CCND1</i>	cyclin D1
	<i>CCND2</i>	cyclin D2
	<i>CCND3</i>	cyclin D3
	<i>CDK4</i>	cyclin dependent kinase 4
	<i>CDK6</i>	cyclin dependent kinase 6
	<i>CCNE1</i>	cyclin E1
	<i>CCNE2</i>	cyclin E2
	<i>CDK2</i>	cyclin dependent kinase 2
	<i>SFN</i>	stratifin
	<i>RPRM</i>	reprimin, TP53 dependent G2 arrest mediator homolog
	<i>CCNB1</i>	cyclin B1
	<i>CCNB2</i>	cyclin B2
	<i>CDK1</i>	cyclin dependent kinase 1
	<i>GADD45A</i>	growth arrest and DNA damage inducible alpha
	<i>GADD45B</i>	growth arrest and DNA damage inducible beta
	<i>GADD45G</i>	growth arrest and DNA damage inducible gamma
	<i>GTSE1</i>	G2 and S-phase expressed 1
	<i>FAS</i>	Fas cell surface death receptor
	<i>PIDD1</i>	p53-induced death domain protein 1
	<i>CASP8</i>	caspase 8
	<i>BID</i>	BH3 interacting domain death agonist
	<i>BAX</i>	BCL2 associated X, apoptosis regulator
	<i>PMAIP1</i>	phorbol-12-myristate-13-acetate-induced protein 1
	<i>BBC3</i>	BCL2 binding component 3
	<i>TP53AIP1</i>	tumor protein p53 regulated apoptosis inducing protein 1
	<i>TP53I3</i>	tumor protein p53 inducible protein 3
	<i>EI24</i>	EI24, autophagy associated transmembrane protein
	<i>SHISA5</i>	shisa family member 5
	<i>PERP</i>	PERP, TP53 apoptosis effector
	<i>ZMAT3</i>	zinc finger matrix-type 3
	<i>SIAH1</i>	siah E3 ubiquitin protein ligase 1
	<i>CYCS</i>	cytochrome c, somatic
	<i>APAF1</i>	apoptotic peptidase activating factor 1
	<i>CASP9</i>	caspase 9
	<i>CASP3</i>	caspase 3
	<i>IGFBP3</i>	insulin like growth factor binding protein 3
	<i>IGF1</i>	insulin like growth factor 1
	<i>SERPINE1</i>	serpin family E member 1
	<i>ADGRB1</i>	adhesion G protein-coupled receptor B1
	<i>CD82</i>	CD82 molecule
	<i>THBS1</i>	thrombospondin 1
	<i>SERPINB5</i>	serpin family B member 5
	<i>DDB2</i>	damage specific DNA binding protein 2
	<i>RRM2B</i>	ribonucleotide reductase regulatory TP53 inducible subunit M2B
	<i>RRM2</i>	ribonucleotide reductase regulatory subunit M2
	<i>SESN1</i>	sestrin 1
<i>SESN3</i>	sestrin 3	
<i>SESN2</i>	sestrin 2	
<i>PTEN</i>	phosphatase and tensin homolog	
<i>TSC2</i>	TSC complex subunit 2	
<i>STEAP3</i>	STEAP3 metalloproteinase	
<i>RFWD2</i>	ring finger and WD repeat domain 2	
<i>RCHY1</i>	ring finger and CHY zinc finger domain containing 1	
<i>CCNG1</i>	cyclin G1	
<i>CCNG2</i>	cyclin G2	
<i>PPM1D</i>	protein phosphatase, Mg ²⁺ /Mn ²⁺ dependent 1D	
<i>TP73</i>	tumor protein p73	
<i>TNFRSF10B</i>	TNF receptor superfamily member 10b	
VEGF signaling pathway	<i>VEGFA</i>	vascular endothelial growth factor A
	<i>KDR</i>	kinase insert domain receptor
	<i>SH2D2A</i>	SH2 domain containing 2A
	<i>PLCG1</i>	phospholipase C gamma 1
	<i>PLCG2</i>	phospholipase C gamma 2

	<i>PRKCA</i>	protein kinase C alpha
	<i>PRKCB</i>	protein kinase C beta
	<i>PRKCG</i>	protein kinase C gamma
	<i>SPHK1</i>	sphingosine kinase 1
	<i>SPHK2</i>	sphingosine kinase 2
	<i>HRAS</i>	HRas proto-oncogene, GTPase
	<i>KRAS</i>	KRAS proto-oncogene, GTPase
	<i>NRAS</i>	NRAS proto-oncogene, GTPase
	<i>RAF1</i>	Raf-1 proto-oncogene, serine/threonine kinase
	<i>MAP2K1</i>	mitogen-activated protein kinase kinase 1
	<i>MAP2K2</i>	mitogen-activated protein kinase kinase 2
	<i>MAPK1</i>	mitogen-activated protein kinase 1
	<i>MAPK3</i>	mitogen-activated protein kinase 3
	<i>PLA2G4E</i>	phospholipase A2 group IVE
	<i>PLA2G4A</i>	phospholipase A2 group IVA
	<i>JMJD7-PLA2G4B</i>	JMJD7-PLA2G4B readthrough
	<i>PLA2G4B</i>	phospholipase A2 group IVB
	<i>PLA2G4C</i>	phospholipase A2 group IVC
	<i>PLA2G4D</i>	phospholipase A2 group IVD
	<i>PLA2G4F</i>	phospholipase A2 group IVF
	<i>PPP3CA</i>	protein phosphatase 3 catalytic subunit alpha
	<i>PPP3CB</i>	protein phosphatase 3 catalytic subunit beta
	<i>PPP3CC</i>	protein phosphatase 3 catalytic subunit gamma
	<i>PPP3R1</i>	protein phosphatase 3 regulatory subunit B, alpha
	<i>PPP3R2</i>	protein phosphatase 3 regulatory subunit B, beta
	<i>NFATC2</i>	nuclear factor of activated T-cells 2
	<i>PTGS2</i>	prostaglandin-endoperoxide synthase 2
	<i>PTK2</i>	protein tyrosine kinase 2
	<i>SHC2</i>	SHC adaptor protein 2
	<i>PXN</i>	paxillin
	<i>CDC42</i>	cell division cycle 42
	<i>MAPK11</i>	mitogen-activated protein kinase 11
	<i>MAPK12</i>	mitogen-activated protein kinase 12
	<i>MAPK13</i>	mitogen-activated protein kinase 13
	<i>MAPK14</i>	mitogen-activated protein kinase 14
	<i>MAPKAPK2</i>	mitogen-activated protein kinase-activated protein kinase 2
	<i>MAPKAPK3</i>	mitogen-activated protein kinase-activated protein kinase 3
	<i>HSPB1</i>	heat shock protein family B (small) member 1
	<i>SRC</i>	SRC proto-oncogene, non-receptor tyrosine kinase
	<i>PIK3CA</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha
	<i>PIK3CD</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit delta
	<i>PIK3CB</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit beta
	<i>PIK3R1</i>	phosphoinositide-3-kinase regulatory subunit 1
	<i>PIK3R2</i>	phosphoinositide-3-kinase regulatory subunit 2
	<i>PIK3R3</i>	phosphoinositide-3-kinase regulatory subunit 3
	<i>RAC1</i>	Rac family small GTPase 1
	<i>RAC2</i>	Rac family small GTPase 2
	<i>RAC3</i>	Rac family small GTPase 3
	<i>AKT1</i>	AKT serine/threonine kinase 1
	<i>AKT2</i>	AKT serine/threonine kinase 2
	<i>AKT3</i>	AKT serine/threonine kinase 3
	<i>NOS3</i>	nitric oxide synthase 3
	<i>CASP9</i>	caspase 9
	<i>BAD</i>	BCL2 associated agonist of cell death
Apoptosis	<i>TNFRSF10</i>	TNF superfamily member 10
	<i>TNFRSF10A</i>	TNF receptor superfamily member 10a
	<i>TNFRSF10B</i>	TNF receptor superfamily member 10b
	<i>TNFRSF10C</i>	TNF receptor superfamily member 10c
	<i>TNFRSF10D</i>	TNF receptor superfamily member 10d
	<i>FASLG</i>	Fas ligand
	<i>FAS</i>	Fas cell surface death receptor
	<i>FADD</i>	Fas associated via death domain
	<i>TNF</i>	tumor necrosis factor
	<i>TNFRSF1A</i>	TNF receptor superfamily member 1A
	<i>TRADD</i>	TNFRSF1A associated via death domain
	<i>CFLAR</i>	CASP8 and FADD like apoptosis regulator
	<i>CASP8</i>	caspase 8
	<i>CASP10</i>	caspase 10
	<i>CASP6</i>	caspase 6
	<i>CASP3</i>	caspase 3
	<i>CASP7</i>	caspase 7
	<i>BID</i>	BH3 interacting domain death agonist
	<i>BAX</i>	BCL2 associated X, apoptosis regulator
	<i>BAK1</i>	BCL2 antagonist/killer 1
	<i>DIABLO</i>	diablo IAP-binding mitochondrial protein
	<i>38231</i>	septin 4
	<i>HTRA2</i>	HtrA serine peptidase 2
	<i>CYCS</i>	cytochrome c, somatic
	<i>APAF1</i>	apoptotic peptidase activating factor 1
	<i>CASP9</i>	caspase 9
	<i>PRF1</i>	perforin 1
	<i>GZMB</i>	granzyme B
	<i>TUBA1B</i>	tubulin alpha 1b
	<i>TUBA4A</i>	tubulin alpha 4a
	<i>TUBA3C</i>	tubulin alpha 3c
	<i>TUBA1A</i>	tubulin alpha 1a
	<i>TUBA1C</i>	tubulin alpha 1c
<i>TUBA8</i>	tubulin alpha 8	
<i>TUBA3E</i>	tubulin alpha 3e	

TUBA3D	tubulin alpha 3d
TUBAL3	tubulin alpha like 3
MCL1	MCL1, BCL2 family apoptosis regulator
ACTB	actin beta
ACTG1	actin gamma 1
SPTA1	spectrin alpha, erythrocytic 1
SPTAN1	spectrin alpha, non-erythrocytic 1
LMNA	lamin A/C
LMNB1	lamin B1
LMNB2	lamin B2
PARP2	poly(ADP-ribose) polymerase 2
PARP1	poly(ADP-ribose) polymerase 1
PARP3	poly(ADP-ribose) polymerase family member 3
PARP4	poly(ADP-ribose) polymerase family member 4
DFFA	DNA fragmentation factor subunit alpha
DFFB	DNA fragmentation factor subunit beta
ENDOG	endonuclease G
AIFM1	apoptosis inducing factor mitochondria associated 1
ERN1	endoplasmic reticulum to nucleus signaling 1
TRAF2	TNF receptor associated factor 2
ITPR1	inositol 1,4,5-trisphosphate receptor type 1
ITPR2	inositol 1,4,5-trisphosphate receptor type 2
ITPR3	inositol 1,4,5-trisphosphate receptor type 3
CAPN1	calpain 1
CAPN2	calpain 2
CASP12	caspase 12 (gene/pseudogene)
EIF2AK3	eukaryotic translation initiation factor 2 alpha kinase 3
EIF2S1	eukaryotic translation initiation factor 2 subunit alpha
ATF4	activating transcription factor 4
DDIT3	DNA damage inducible transcript 3
CTSB	cathepsin B
CTSC	cathepsin C
CTSD	cathepsin D
CTSF	cathepsin F
CTSH	cathepsin H
CTSK	cathepsin K
CTSL	cathepsin L
CTSO	cathepsin O
CTSS	cathepsin S
CTSV	cathepsin V
CTSW	cathepsin W
CTSZ	cathepsin Z
BIRC2	baculoviral IAP repeat containing 2
BIRC3	baculoviral IAP repeat containing 3
XIAP	X-linked inhibitor of apoptosis
BIRC5	baculoviral IAP repeat containing 5
BCL2L11	BCL2 like 11
BCL2L1	BCL2 like 1
BCL2	BCL2, apoptosis regulator
DAXX	death domain associated protein
RIPK1	receptor interacting serine/threonine kinase 1
DAB2IP	DAB2 interacting protein
MAP3K5	mitogen-activated protein kinase kinase kinase 5
MAPK8	mitogen-activated protein kinase 8
MAPK10	mitogen-activated protein kinase 10
MAPK9	mitogen-activated protein kinase 9
BAD	BCL2 associated agonist of cell death
JUN	Jun proto-oncogene, AP-1 transcription factor subunit
FOS	Fos proto-oncogene, AP-1 transcription factor subunit
TP53	tumor protein p53
HRK	harakiri, BCL2 interacting protein
MAP3K14	mitogen-activated protein kinase kinase kinase 14
CHUK	conserved helix-loop-helix ubiquitous kinase
IKBK1	inhibitor of nuclear factor kappa B kinase subunit beta
IKBK2	inhibitor of nuclear factor kappa B kinase subunit gamma
NFKBIA	NFKB inhibitor alpha
NFKB1	nuclear factor kappa B subunit 1
RELA	RELA proto-oncogene, NF-kB subunit
PTPN13	protein tyrosine phosphatase, non-receptor type 13
GADD45A	growth arrest and DNA damage inducible alpha
GADD45B	growth arrest and DNA damage inducible beta
GADD45G	growth arrest and DNA damage inducible gamma
TRAF1	TNF receptor associated factor 1
BCL2A1	BCL2 related protein A1
ATM	ATM serine/threonine kinase
PIDD1	p53-induced death domain protein 1
TP53AIP1	tumor protein p53 regulated apoptosis inducing protein 1
BBC3	BCL2 binding component 3
PMAIP1	phorbol-12-myristate-13-acetate-induced protein 1
CASP2	caspase 2
NGF	nerve growth factor
NTRK1	neurotrophic receptor tyrosine kinase 1
IL3	interleukin 3
IL3RA	interleukin 3 receptor subunit alpha
CSF2RB	colony stimulating factor 2 receptor beta common subunit
PIK3CA	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha
PIK3CD	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit delta
PIK3CB	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit beta
PIK3R1	phosphoinositide-3-kinase regulatory subunit 1

	<i>PIK3R2</i>	phosphoinositide-3-kinase regulatory subunit 2
	<i>PIK3R3</i>	phosphoinositide-3-kinase regulatory subunit 3
	<i>PDPK1</i>	3-phosphoinositide dependent protein kinase 1
	<i>AKT1</i>	AKT serine/threonine kinase 1
	<i>AKT2</i>	AKT serine/threonine kinase 2
	<i>AKT3</i>	AKT serine/threonine kinase 3
	<i>HRAS</i>	HRas proto-oncogene, GTPase
	<i>KRAS</i>	KRAS proto-oncogene, GTPase
	<i>NRAS</i>	NRAS proto-oncogene, GTPase
	<i>RAF1</i>	Raf-1 proto-oncogene, serine/threonine kinase
	<i>MAP2K1</i>	mitogen-activated protein kinase kinase 1
	<i>MAP2K2</i>	mitogen-activated protein kinase kinase 2
	<i>MAPK1</i>	mitogen-activated protein kinase 1
	<i>MAPK3</i>	mitogen-activated protein kinase 3
TGF-beta signaling	<i>CHRD</i>	chordin
	<i>NOG</i>	noggin
	<i>NBL1</i>	neuroblastoma 1, DAN family BMP antagonist
	<i>MINOS1-NBL1</i>	MINOS1-NBL1 readthrough
	<i>THBS1</i>	thrombospondin 1
	<i>DCN</i>	decorin
	<i>LEFTY1</i>	left-right determination factor 1
	<i>LEFTY2</i>	left-right determination factor 2
	<i>FST</i>	folliculin
	<i>BMP2</i>	bone morphogenetic protein 2
	<i>BMP4</i>	bone morphogenetic protein 4
	<i>BMP5</i>	bone morphogenetic protein 5
	<i>BMP6</i>	bone morphogenetic protein 6
	<i>BMP7</i>	bone morphogenetic protein 7
	<i>BMP8B</i>	bone morphogenetic protein 8b
	<i>BMP8A</i>	bone morphogenetic protein 8a
	<i>GDF5</i>	growth differentiation factor 5
	<i>GDF6</i>	growth differentiation factor 6
	<i>GDF7</i>	growth differentiation factor 7
	<i>AMH</i>	anti-Mullerian hormone
	<i>LTBP1</i>	latent transforming growth factor beta binding protein 1
	<i>TGFB1</i>	transforming growth factor beta 1
	<i>TGFB2</i>	transforming growth factor beta 2
	<i>TGFB3</i>	transforming growth factor beta 3
	<i>INHBA</i>	inhibin beta A subunit
	<i>INHBB</i>	inhibin beta B subunit
	<i>INHBC</i>	inhibin beta C subunit
	<i>INHBE</i>	inhibin beta E subunit
	<i>NODAL</i>	nodal growth differentiation factor
	<i>BMPR2</i>	bone morphogenetic protein receptor type 2
	<i>AMHR2</i>	anti-Mullerian hormone receptor type 2
	<i>TGFB2R2</i>	transforming growth factor beta receptor 2
	<i>ACVR2A</i>	activin A receptor type 2A
	<i>ACVR2B</i>	activin A receptor type 2B
	<i>BMPRI1A</i>	bone morphogenetic protein receptor type 1A
	<i>BMPRI1B</i>	bone morphogenetic protein receptor type 1B
	<i>ACVR1</i>	activin A receptor type 1
	<i>TGFB2R1</i>	transforming growth factor beta receptor 1
	<i>ACVR1B</i>	activin A receptor type 1B
	<i>ACVR1C</i>	activin A receptor type 1C
	<i>BAMBI</i>	BMP and activin membrane bound inhibitor
	<i>SMAD1</i>	SMAD family member 1
	<i>SMAD5</i>	SMAD family member 5
	<i>SMAD9</i>	SMAD family member 9
	<i>SMAD2</i>	SMAD family member 2
	<i>SMAD3</i>	SMAD family member 3
	<i>SMAD4</i>	SMAD family member 4
	<i>SMAD6</i>	SMAD family member 6
	<i>SMAD7</i>	SMAD family member 7
	<i>SMURF1</i>	SMAD specific E3 ubiquitin protein ligase 1
	<i>SMURF2</i>	SMAD specific E3 ubiquitin protein ligase 2
	<i>ZFYVE9</i>	zinc finger FYVE-type containing 9
	<i>ZFYVE16</i>	zinc finger FYVE-type containing 16
	<i>ID1</i>	inhibitor of DNA binding 1, HLH protein
	<i>ID2</i>	inhibitor of DNA binding 2, HLH protein
	<i>ID3</i>	inhibitor of DNA binding 3, HLH protein
	<i>ID4</i>	inhibitor of DNA binding 4, HLH protein
<i>RBL1</i>	RB transcriptional corepressor like 1	
<i>E2F4</i>	E2F transcription factor 4	
<i>E2F5</i>	E2F transcription factor 5	
<i>TFDP1</i>	transcription factor Dp-1	
<i>CREBBP</i>	CREB binding protein	
<i>EP300</i>	E1A binding protein p300	
<i>SP1</i>	Sp1 transcription factor	
<i>TGIF1</i>	TGFB induced factor homeobox 1	
<i>TGIF2</i>	TGFB induced factor homeobox 2	
<i>MYC</i>	MYC proto-oncogene, bHLH transcription factor	
<i>CDKN2B</i>	cyclin dependent kinase inhibitor 2B	
<i>PITX2</i>	paired like homeodomain 2	
<i>RBX1</i>	ring-box 1	
<i>CUL1</i>	cullin 1	
<i>SKP1</i>	S-phase kinase associated protein 1	
<i>MAPK1</i>	mitogen-activated protein kinase 1	
<i>MAPK3</i>	mitogen-activated protein kinase 3	
<i>IFNG</i>	interferon gamma	

	<i>TNF</i>	tumor necrosis factor
	<i>RHOA</i>	ras homolog family member A
	<i>ROCK1</i>	Rho associated coiled-coil containing protein kinase 1
	<i>PPP2R1B</i>	protein phosphatase 2 scaffold subunit Abeta
	<i>PPP2R1A</i>	protein phosphatase 2 scaffold subunit Aalpha
	<i>PPP2CA</i>	protein phosphatase 2 catalytic subunit alpha
	<i>PPP2CB</i>	protein phosphatase 2 catalytic subunit beta
	<i>RPS6KB1</i>	ribosomal protein S6 kinase B1
	<i>RPS6KB2</i>	ribosomal protein S6 kinase B2
	<i>RNU6-1</i>	RNA, U6 small nuclear 1
	<i>DDX46</i>	DEAD-box helicase 46
	<i>DDX39B</i>	DEAD-box helicase 39B
	<i>DHX16</i>	DEAH-box helicase 16
	<i>DHX38</i>	DEAH-box helicase 38
	<i>CDC40</i>	cell division cycle 40
	<i>PRPF18</i>	pre-mRNA processing factor 18
	<i>DHX8</i>	DEAH-box helicase 8
	<i>SLU7</i>	SLU7 homolog, splicing factor
	<i>DHX15</i>	DEAH-box helicase 15
	<i>SNRPB</i>	small nuclear ribonucleoprotein polypeptides B and B1
	<i>SNRPD1</i>	small nuclear ribonucleoprotein D1 polypeptide
	<i>SNRPD2</i>	small nuclear ribonucleoprotein D2 polypeptide
	<i>SNRPD3</i>	small nuclear ribonucleoprotein D3 polypeptide
	<i>SNRPE</i>	small nuclear ribonucleoprotein polypeptide E
	<i>SNRPF</i>	small nuclear ribonucleoprotein polypeptide F
	<i>SNRPG</i>	small nuclear ribonucleoprotein polypeptide G
	<i>SNRNP70</i>	small nuclear ribonucleoprotein U1 subunit 70
	<i>SNRPA</i>	small nuclear ribonucleoprotein polypeptide A
	<i>SNRPC</i>	small nuclear ribonucleoprotein polypeptide C
	<i>PRPF40B</i>	pre-mRNA processing factor 40 homolog B
	<i>PRPF40A</i>	pre-mRNA processing factor 40 homolog A
	<i>RBM25</i>	RNA binding motif protein 25
	<i>DDX5</i>	DEAD-box helicase 5
	<i>TCERG1</i>	transcription elongation regulator 1
	<i>SNRPA1</i>	small nuclear ribonucleoprotein polypeptide A'
	<i>SNRPB2</i>	small nuclear ribonucleoprotein polypeptide B2
	<i>SF3A1</i>	splicing factor 3a subunit 1
	<i>SF3A2</i>	splicing factor 3a subunit 2
	<i>SF3A3</i>	splicing factor 3a subunit 3
	<i>SF3B1</i>	splicing factor 3b subunit 1
	<i>SF3B2</i>	splicing factor 3b subunit 2
	<i>SF3B3</i>	splicing factor 3b subunit 3
	<i>SF3B4</i>	splicing factor 3b subunit 4
	<i>SF3B5</i>	splicing factor 3b subunit 5
	<i>SF3B6</i>	splicing factor 3b subunit 6
	<i>PHF5A</i>	PHD finger protein 5A
	<i>DDX42</i>	DEAD-box helicase 42
	<i>U2AF1</i>	U2 small nuclear RNA auxiliary factor 1
	<i>U2AF1L5</i>	U2 small nuclear RNA auxiliary factor 1 like 5
	<i>U2AF1L4</i>	U2 small nuclear RNA auxiliary factor 1 like 4
	<i>U2AF2</i>	U2 small nuclear RNA auxiliary factor 2
	<i>PUF60</i>	poly(U) binding splicing factor 60
	<i>SMNDC1</i>	survival motor neuron domain containing 1
	<i>RBM17</i>	RNA binding motif protein 17
	<i>CHERP</i>	calcium homeostasis endoplasmic reticulum protein
	<i>U2SURP</i>	U2 snRNP associated SURP domain containing
	<i>RP9</i>	RP9, pre-mRNA splicing factor
	<i>LSM2</i>	LSM2 homolog, U6 small nuclear RNA and mRNA degradation associated
	<i>LSM3</i>	LSM3 homolog, U6 small nuclear RNA and mRNA degradation associated
	<i>LSM4</i>	LSM4 homolog, U6 small nuclear RNA and mRNA degradation associated
	<i>LSM5</i>	LSM5 homolog, U6 small nuclear RNA and mRNA degradation associated
	<i>LSM6</i>	LSM6 homolog, U6 small nuclear RNA and mRNA degradation associated
	<i>LSM7</i>	LSM7 homolog, U6 small nuclear RNA and mRNA degradation associated
	<i>LSM8</i>	LSM8 homolog, U6 small nuclear RNA associated
	<i>PRPF3</i>	pre-mRNA processing factor 3
	<i>PRPF4</i>	pre-mRNA processing factor 4
	<i>PPIH</i>	peptidylprolyl isomerase H
	<i>PRPF31</i>	pre-mRNA processing factor 31
	<i>SNU13</i>	small nuclear ribonucleoprotein 13
	<i>SNRNP27</i>	small nuclear ribonucleoprotein U4/U6.U5 subunit 27
	<i>USP39</i>	ubiquitin specific peptidase 39
	<i>SART1</i>	SART1, U4/U6.U5 tri-snRNP-associated protein 1
	<i>ZMAT2</i>	zinc finger matrin-type 2
	<i>PRPF38A</i>	pre-mRNA processing factor 38A
	<i>PRPF38B</i>	pre-mRNA processing factor 38B
	<i>EFTUD2</i>	elongation factor Tu GTP binding domain containing 2
	<i>SNRNP200</i>	small nuclear ribonucleoprotein U5 subunit 200
	<i>PRPF6</i>	pre-mRNA processing factor 6
	<i>PRPF8</i>	pre-mRNA processing factor 8
	<i>SNRNP40</i>	small nuclear ribonucleoprotein U5 subunit 40
	<i>DDX23</i>	DEAD-box helicase 23
	<i>TXNL4A</i>	thioredoxin like 4A
	<i>PRPF19</i>	pre-mRNA processing factor 19
	<i>CDC5L</i>	cell division cycle 5 like
	<i>BCAS2</i>	BCAS2, pre-mRNA processing factor
	<i>PLRG1</i>	pleiotropic regulator 1
	<i>CWC15</i>	CWC15 spliceosome associated protein homolog
	<i>CTNBL1</i>	catenin beta like 1
	<i>HSPA8</i>	heat shock protein family A (Hsp70) member 8

Spliceosoma

	<i>HSPA1A</i>	heat shock protein family A (Hsp70) member 1A	
	<i>HSPA2</i>	heat shock protein family A (Hsp70) member 2	
	<i>HSPA1L</i>	heat shock protein family A (Hsp70) member 1 like	
	<i>HSPA1B</i>	heat shock protein family A (Hsp70) member 1B	
	<i>HSPA6</i>	heat shock protein family A (Hsp70) member 6	
	<i>PQBP1</i>	polyglutamine binding protein 1	
	<i>WBP11</i>	VW domain binding protein 11	
	<i>SNW1</i>	SNW domain containing 1	
	<i>XAB2</i>	XPA binding protein 2	
	<i>SYF2</i>	SYF2 pre-mRNA splicing factor	
	<i>CRNKL1</i>	crooked neck pre-mRNA splicing factor 1	
	<i>ISY1</i>	ISY1 splicing factor homolog	
	<i>ISY1-RAB43</i>	ISY1-RAB43 readthrough	
	<i>PPIL1</i>	peptidylprolyl isomerase like 1	
	<i>PIIE</i>	peptidylprolyl isomerase E	
	<i>CCDC12</i>	coiled-coil domain containing 12	
	<i>RBM22</i>	RNA binding motif protein 22	
	<i>BUD31</i>	BUD31 homolog	
	<i>AQR</i>	aquarius intron-binding spliceosomal factor	
	<i>ACIN1</i>	apoptotic chromatin condensation inducer 1	
	<i>EIF4A3</i>	eukaryotic translation initiation factor 4A3	
	<i>RBM8A</i>	RNA binding motif protein 8A	
	<i>MAGOH</i>	mago homolog, exon junction complex core component	
	<i>MAGOHB</i>	mago homolog B, exon junction complex core component	
	<i>THOC1</i>	THO complex 1	
	<i>THOC2</i>	THO complex 2	
	<i>THOC3</i>	THO complex 3	
	<i>ALYREF</i>	Aly/REF export factor	
	<i>NCBP1</i>	nuclear cap binding protein subunit 1	
	<i>NCBP2</i>	nuclear cap binding protein subunit 2	
	<i>HNRNPA3</i>	heterogeneous nuclear ribonucleoprotein A3	
	<i>HNRNPA1</i>	heterogeneous nuclear ribonucleoprotein A1	
	<i>HNRNPA1L2</i>	heterogeneous nuclear ribonucleoprotein A1-like 2	
	<i>HNRNPC</i>	heterogeneous nuclear ribonucleoprotein C (C1/C2)	
	<i>RBMX</i>	RNA binding motif protein, X-linked	
	<i>RBMXL1</i>	RNA binding motif protein, X-linked like 1	
	<i>RBMXL2</i>	RNA binding motif protein, X-linked like 2	
	<i>RBMXL3</i>	RNA binding motif protein, X-linked like 3	
	<i>HNRNPK</i>	heterogeneous nuclear ribonucleoprotein K	
	<i>HNRNPM</i>	heterogeneous nuclear ribonucleoprotein M	
	<i>HNRNPU</i>	heterogeneous nuclear ribonucleoprotein U	
	<i>PCBP1</i>	poly(rC) binding protein 1	
	<i>SRSF1</i>	serine and arginine rich splicing factor 1	
	<i>SRSF2</i>	serine and arginine rich splicing factor 2	
	<i>SRSF8</i>	serine and arginine rich splicing factor 8	
	<i>SRSF3</i>	serine and arginine rich splicing factor 3	
	<i>SRSF4</i>	serine and arginine rich splicing factor 4	
	<i>SRSF5</i>	serine and arginine rich splicing factor 5	
	<i>SRSF6</i>	serine and arginine rich splicing factor 6	
	<i>SRSF7</i>	serine and arginine rich splicing factor 7	
	<i>SRSF9</i>	serine and arginine rich splicing factor 9	
	<i>TRA2A</i>	transformer 2 alpha homolog	
	<i>TRA2B</i>	transformer 2 beta homolog	
	<i>SRSF10</i>	serine and arginine rich splicing factor 10	
Hematopoietic cell lineage	<i>KITLG</i>	KIT ligand	
	<i>IL7</i>	interleukin 7	
	<i>IL4</i>	interleukin 4	
	<i>CSF2</i>	colony stimulating factor 2	
	<i>FLT3LG</i>	fms related tyrosine kinase 3 ligand	
	<i>IL5</i>	interleukin 5	
	<i>CSF3</i>	colony stimulating factor 3	
	<i>IL3</i>	interleukin 3	
	<i>IL6</i>	interleukin 6	
	<i>IL11</i>	interleukin 11	
	<i>IL1A</i>	interleukin 1 alpha	
	<i>IL1B</i>	interleukin 1 beta	
	<i>TNF</i>	tumor necrosis factor	
	<i>CSF1</i>	colony stimulating factor 1	
	<i>EPO</i>	erythropoietin	
	<i>THPO</i>	thrombopoietin	
	<i>CD34</i>	CD34 molecule	
		<i>FLT3</i>	fms related tyrosine kinase 3
		<i>DNTT</i>	DNA nucleotidylexotransferase
		<i>HLA-DMA</i>	major histocompatibility complex, class II, DM alpha
		<i>HLA-DMB</i>	major histocompatibility complex, class II, DM beta
		<i>HLA-DOA</i>	major histocompatibility complex, class II, DO alpha
		<i>HLA-DOB</i>	major histocompatibility complex, class II, DO beta
		<i>HLA-DPA1</i>	major histocompatibility complex, class II, DP alpha 1
		<i>HLA-DPB1</i>	major histocompatibility complex, class II, DP beta 1
		<i>HLA-DQA1</i>	major histocompatibility complex, class II, DQ alpha 1
		<i>HLA-DQA2</i>	major histocompatibility complex, class II, DQ alpha 2
		<i>HLA-DQB1</i>	major histocompatibility complex, class II, DQ beta 1
		<i>HLA-DRA</i>	major histocompatibility complex, class II, DR alpha
		<i>HLA-DRB1</i>	major histocompatibility complex, class II, DR beta 1
		<i>HLA-DRB3</i>	major histocompatibility complex, class II, DR beta 3
		<i>HLA-DRB4</i>	major histocompatibility complex, class II, DR beta 4
		<i>HLA-DRB5</i>	major histocompatibility complex, class II, DR beta 5
	<i>CD44</i>	CD44 molecule (Indian blood group)	
	<i>KIT</i>	KIT proto-oncogene receptor tyrosine kinase	

	<i>IL2RA</i>	interleukin 2 receptor subunit alpha
	<i>IL7R</i>	interleukin 7 receptor
	<i>TFRC</i>	transferrin receptor
	<i>CD38</i>	CD38 molecule
	<i>CD7</i>	CD7 molecule
	<i>CD2</i>	CD2 molecule
	<i>CD5</i>	CD5 molecule
	<i>CD1A</i>	CD1a molecule
	<i>CD1B</i>	CD1b molecule
	<i>CD1C</i>	CD1c molecule
	<i>CD1D</i>	CD1d molecule
	<i>CD1E</i>	CD1e molecule
	<i>CD4</i>	CD4 molecule
	<i>CD8A</i>	CD8a molecule
	<i>CD8B</i>	CD8b molecule
	<i>CD3D</i>	CD3d molecule
	<i>CD3E</i>	CD3e molecule
	<i>CD3G</i>	CD3g molecule
	<i>MME</i>	membrane metalloendopeptidase
	<i>CD9</i>	CD9 molecule
	<i>CD19</i>	CD19 molecule
	<i>CD22</i>	CD22 molecule
	<i>CD24</i>	CD24 molecule
	<i>MS4A1</i>	membrane spanning 4-domains A1
	<i>CR2</i>	complement C3d receptor 2
	<i>CD37</i>	CD37 molecule
	<i>IGH</i>	putative V-set and immunoglobulin domain-containing-like protein IGHV4OR15-8
	<i>FCER2</i>	Fc fragment of IgE receptor II
	<i>CR1</i>	complement C3b/C4b receptor 1 (Knops blood group)
	<i>CSF2RA</i>	colony stimulating factor 2 receptor alpha subunit
	<i>IL3RA</i>	interleukin 3 receptor subunit alpha
	<i>CD33</i>	CD33 molecule
	<i>IL4R</i>	interleukin 4 receptor
	<i>IL6R</i>	interleukin 6 receptor
	<i>FCGR1A</i>	Fc fragment of IgG receptor Ia
	<i>CSF1R</i>	colony stimulating factor 1 receptor
	<i>ANPEP</i>	alanyl aminopeptidase, membrane
	<i>ITGAM</i>	integrin subunit alpha M
	<i>CD14</i>	CD14 molecule
	<i>IL9R</i>	interleukin 9 receptor
	<i>IL1R1</i>	interleukin 1 receptor type 1
	<i>IL1R2</i>	interleukin 1 receptor type 2
	<i>CSF3R</i>	colony stimulating factor 3 receptor
	<i>IL5RA</i>	interleukin 5 receptor subunit alpha
	<i>EPOR</i>	erythropoietin receptor
	<i>CD36</i>	CD36 molecule
	<i>GYPA</i>	glycophorin A (MNS blood group)
	<i>CD55</i>	CD55 molecule (Cromer blood group)
	<i>CD59</i>	CD59 molecule (CD59 blood group)
	<i>IL11RA</i>	interleukin 11 receptor subunit alpha
	<i>ITGB3</i>	integrin subunit beta 3
	<i>ITGA2B</i>	integrin subunit alpha 2b
	<i>GP9</i>	glycoprotein IX platelet
	<i>GP1BA</i>	glycoprotein Ib platelet alpha subunit
	<i>GP1BB</i>	glycoprotein Ib platelet beta subunit
	<i>GP5</i>	glycoprotein V platelet
	<i>ITGA1</i>	integrin subunit alpha 1
	<i>ITGA2</i>	integrin subunit alpha 2
	<i>ITGA3</i>	integrin subunit alpha 3
	<i>ITGA4</i>	integrin subunit alpha 4
	<i>ITGA5</i>	integrin subunit alpha 5
	<i>ITGA6</i>	integrin subunit alpha 6
	<i>KIT</i>	KIT proto-oncogene receptor tyrosine kinase
	<i>FLT3</i>	fms related tyrosine kinase 3
	<i>PIK3CA</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha
	<i>PIK3CD</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit delta
	<i>PIK3CB</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit beta
	<i>PIK3R1</i>	phosphoinositide-3-kinase regulatory subunit 1
	<i>PIK3R2</i>	phosphoinositide-3-kinase regulatory subunit 2
	<i>PIK3R3</i>	phosphoinositide-3-kinase regulatory subunit 3
	<i>AKT1</i>	AKT serine/threonine kinase 1
	<i>AKT2</i>	AKT serine/threonine kinase 2
	<i>AKT3</i>	AKT serine/threonine kinase 3
	<i>CHUK</i>	conserved helix-loop-helix ubiquitous kinase
	<i>IKBKB</i>	inhibitor of nuclear factor kappa B kinase subunit beta
	<i>IKBKG</i>	inhibitor of nuclear factor kappa B kinase subunit gamma
	<i>NFKB1</i>	nuclear factor kappa B subunit 1
	<i>RELA</i>	RELA proto-oncogene, NF-kB subunit
	<i>BAD</i>	BCL2 associated agonist of cell death
	<i>MTOR</i>	mechanistic target of rapamycin kinase
	<i>EIF4EBP1</i>	eukaryotic translation initiation factor 4E binding protein 1
	<i>RPS6KB1</i>	ribosomal protein S6 kinase B1
	<i>RPS6KB2</i>	ribosomal protein S6 kinase B2
	<i>GRB2</i>	growth factor receptor bound protein 2
	<i>SOS1</i>	SOS Ras/Rac guanine nucleotide exchange factor 1
	<i>SOS2</i>	SOS Ras/Rho guanine nucleotide exchange factor 2
	<i>HRAS</i>	HRas proto-oncogene, GTPase
	<i>NRAS</i>	NRAS proto-oncogene, GTPase
	<i>KRAS</i>	KRAS proto-oncogene, GTPase
Acute myeloid leukemia		

	<i>ARAF</i>	A-Raf proto-oncogene, serine/threonine kinase
	<i>BRAF</i>	B-Raf proto-oncogene, serine/threonine kinase
	<i>RAF1</i>	Raf-1 proto-oncogene, serine/threonine kinase
	<i>MAP2K1</i>	mitogen-activated protein kinase kinase 1
	<i>MAP2K2</i>	mitogen-activated protein kinase kinase 2
	<i>MAPK1</i>	mitogen-activated protein kinase 1
	<i>MAPK3</i>	mitogen-activated protein kinase 3
	<i>STAT3</i>	signal transducer and activator of transcription 3
	<i>STAT5A</i>	signal transducer and activator of transcription 5A
	<i>STAT5B</i>	signal transducer and activator of transcription 5B
	<i>PIM1</i>	Pim-1 proto-oncogene, serine/threonine kinase
	<i>PIM2</i>	Pim-2 proto-oncogene, serine/threonine kinase
	<i>RUNX1</i>	runt related transcription factor 1
	<i>CSF1R</i>	colony stimulating factor 1 receptor
	<i>MPO</i>	myeloperoxidase
	<i>CSF2</i>	colony stimulating factor 2
	<i>IL3</i>	interleukin 3
	<i>RUNX1T1</i>	RUNX1 translocation partner 1
	<i>PML</i>	promyelocytic leukemia
	<i>RARA</i>	retinoic acid receptor alpha
	<i>ZBTB16</i>	zinc finger and BTB domain containing 16
	<i>CEBPA</i>	CCAAT/enhancer binding protein alpha
	<i>PER2</i>	period circadian clock 2
	<i>SPI1</i>	Spi-1 proto-oncogene
	<i>CD14</i>	CD14 molecule
	<i>ITGAM</i>	integrin subunit alpha M
	<i>FCGR1A</i>	Fc fragment of IgG receptor Ia
	<i>CEBPE</i>	CCAAT/enhancer binding protein epsilon
	<i>BCL2A1</i>	BCL2 related protein A1
	<i>MYC</i>	MYC proto-oncogene, bHLH transcription factor
	<i>DUSP6</i>	dual specificity phosphatase 6
	<i>JUP</i>	junction plakoglobin
	<i>TCF7</i>	transcription factor 7
	<i>TCF7L1</i>	transcription factor 7 like 1
	<i>TCF7L2</i>	transcription factor 7 like 2
	<i>LEF1</i>	lymphoid enhancer binding factor 1
	<i>CCND1</i>	cyclin D1
	<i>PPARD</i>	peroxisome proliferator activated receptor delta
	<i>CCNA1</i>	cyclin A1
	<i>RUNX1</i>	runt related transcription factor 1
	<i>CSF1R</i>	colony stimulating factor 1 receptor
	<i>MPO</i>	myeloperoxidase
	<i>CSF2</i>	colony stimulating factor 2
	<i>IL3</i>	interleukin 3
	<i>RUNX1T1</i>	RUNX1 translocation partner 1
	<i>HDAC1</i>	histone deacetylase 1
	<i>HDAC2</i>	histone deacetylase 2
	<i>SIN3A</i>	SIN3 transcription regulator family member A
	<i>NCOR1</i>	nuclear receptor corepressor 1
	<i>CEBPA</i>	CCAAT/enhancer binding protein alpha
	<i>PER2</i>	period circadian clock 2
	<i>SPI1</i>	Spi-1 proto-oncogene
	<i>CD14</i>	CD14 molecule
	<i>ITGAM</i>	integrin subunit alpha M
	<i>FCGR1A</i>	Fc fragment of IgG receptor Ia
	<i>JUP</i>	junction plakoglobin
	<i>PML</i>	promyelocytic leukemia
	<i>RARA</i>	retinoic acid receptor alpha
	<i>CEBPE</i>	CCAAT/enhancer binding protein epsilon
	<i>BCL2A1</i>	BCL2 related protein A1
	<i>ZBTB16</i>	zinc finger and BTB domain containing 16
	<i>MYC</i>	MYC proto-oncogene, bHLH transcription factor
	<i>DUSP6</i>	dual specificity phosphatase 6
	<i>TCF3</i>	transcription factor 3
	<i>PBX1</i>	PBX homeobox 1
	<i>WNT16</i>	Wnt family member 16
	<i>ETV6</i>	ETS variant 6
	<i>ETV7</i>	ETS variant 7
	<i>ELANE</i>	elastase, neutrophil expressed
	<i>GZMB</i>	granzyme B
	<i>KMT2A</i>	lysine methyltransferase 2A
	<i>AFF1</i>	AF4/FMR2 family member 1
	<i>CDK9</i>	cyclin dependent kinase 9
	<i>CCNT1</i>	cyclin T1
	<i>CCNT2</i>	cyclin T2
	<i>MLL1</i>	MLL1, super elongation complex subunit
	<i>MLL3</i>	MLL3, super elongation complex subunit
	<i>DOT1L</i>	DOT1 like histone lysine methyltransferase
	<i>LMO2</i>	LIM domain only 2
	<i>PBX3</i>	PBX homeobox 3
	<i>RUNX2</i>	runt related transcription factor 2
	<i>SMAD1</i>	SMAD family member 1
	<i>KLF3</i>	Kruppel like factor 3
	<i>MEF2C</i>	myocyte enhancer factor 2C
	<i>HOXA9</i>	homeobox A9
	<i>HOXA10</i>	homeobox A10
	<i>JMJD1C</i>	jumonji domain containing 1C
	<i>HMGGA2</i>	high mobility group AT-hook 2
	<i>KDM6A</i>	lysine demethylase 6A

Transcriptional
misregulation in
cancer

UTY	ubiquitously transcribed tetratricopeptide repeat containing, Y-linked
SUPT3H	SPT3 homolog, SAGA and STAGA complex component
PROM1	prominin 1
FLT3	fms related tyrosine kinase 3
BMP2K	BMP2 inducible kinase
IGF1R	insulin like growth factor 1 receptor
CDKN1B	cyclin dependent kinase inhibitor 1B
CDK14	cyclin dependent kinase 14
MEIS1	Meis homeobox 1
HOXA11	homeobox A11
SIX1	SIX homeobox 1
SIX4	SIX homeobox 4
EYA1	EYA transcriptional coactivator and phosphatase 1
CDKN2C	cyclin dependent kinase inhibitor 2C
HPGD	15-hydroxyprostaglandin dehydrogenase
GRIA3	glutamate ionotropic receptor AMPA type subunit 3
FUT8	fucosyltransferase 8
TLX3	T-cell leukemia homeobox 3
TLX1	T-cell leukemia homeobox 1
BCL11B	B-cell CLL/lymphoma 11B
LDB1	LIM domain binding 1
LYL1	LYL1, basic helix-loop-helix family member
HHEX	hematopoietically expressed homeobox
PTCRA	pre T-cell antigen receptor alpha
REL	REL proto-oncogene, NF-kB subunit
CCND2	cyclin D2
TRAF1	TNF receptor associated factor 1
BCL2L1	BCL2 like 1
CD86	CD86 molecule
CD40	CD40 molecule
BCL6	B-cell CLL/lymphoma 6
IGH	putative V-set and immunoglobulin domain-containing-like protein IGHV4OR15-8
MAF	MAF bZIP transcription factor
ITGB7	integrin subunit beta 7
NSD2	nuclear receptor binding SET domain protein 2
H3F3C	H3 histone family member 3C
H3F3B	H3 histone family member 3B
HIST1H3D	histone cluster 1 H3 family member d
HIST1H3C	histone cluster 1 H3 family member c
HIST1H3A	histone cluster 1 H3 family member a
H3F3A	H3 histone family member 3A
HIST3H3	histone cluster 3 H3
HIST2H3C	histone cluster 2 H3 family member c
HIST2H3A	histone cluster 2 H3 family member a
HIST2H3D	histone cluster 2 H3 family member d
HIST1H3E	histone cluster 1 H3 family member e
HIST1H3I	histone cluster 1 H3 family member i
HIST1H3G	histone cluster 1 H3 family member g
HIST1H3J	histone cluster 1 H3 family member j
HIST1H3H	histone cluster 1 H3 family member h
HIST1H3B	histone cluster 1 H3 family member b
HIST1H3F	histone cluster 1 H3 family member f
PAX5	paired box 5
PAX8	paired box 8
PPARG	peroxisome proliferator activated receptor gamma
RXRA	retinoid X receptor alpha
RXRB	retinoid X receptor beta
RXRG	retinoid X receptor gamma
PRCC	papillary renal cell carcinoma (translocation-associated)
TFE3	transcription factor binding to IGDM enhancer 3
CDKN1A	cyclin dependent kinase inhibitor 1A
TMPRSS2	transmembrane protease, serine 2
ERG	ERG, ETS transcription factor
PLAU	plasminogen activator, urokinase
PLAT	plasminogen activator, tissue type
MMP3	matrix metalloproteinase 3
MMP9	matrix metalloproteinase 9
IL1R2	interleukin 1 receptor type 2
SPINT1	serine peptidase inhibitor, Kunitz type 1
ETV1	ETS variant 1
ETV4	ETS variant 4
ETV5	ETS variant 5
SLC45A3	solute carrier family 45 member 3
ELK4	ELK4, ETS transcription factor
DDX5	DEAD-box helicase 5
MYCN	MYCN proto-oncogene, bHLH transcription factor
MAX	MYC associated factor X
MDM2	MDM2 proto-oncogene
PTK2	protein tyrosine kinase 2
TP53	tumor protein p53
BMI1	BMI1 proto-oncogene, polycomb ring finger
COMMD3-BMI1	COMMD3-BMI1 readthrough
SP1	Sp1 transcription factor
ZBTB17	zinc finger and BTB domain containing 17
NTRK1	neurotrophic receptor tyrosine kinase 1
NGFR	nerve growth factor receptor
MEN1	menin 1
EWSR1	EWS RNA binding protein 1
FLI1	Fli-1 proto-oncogene, ETS transcription factor

	<i>IGF1</i>	insulin like growth factor 1
	<i>ID2</i>	inhibitor of DNA binding 2, HLH protein
	<i>TGFBR2</i>	transforming growth factor beta receptor 2
	<i>IGFBP3</i>	insulin like growth factor binding protein 3
	<i>FEV</i>	FEV, ETS transcription factor
	<i>ATF1</i>	activating transcription factor 1
	<i>ARN12</i>	aryl hydrocarbon receptor nuclear translocator 2
	<i>ATM</i>	ATM serine/threonine kinase
	<i>MITF</i>	melanogenesis associated transcription factor
	<i>WT1</i>	Wilms tumor 1
	<i>PDGFA</i>	platelet derived growth factor subunit A
	<i>IL2RB</i>	interleukin 2 receptor subunit beta
	<i>BAIAP3</i>	BAI1 associated protein 3
	<i>TSPAN7</i>	tetraspanin 7
	<i>MLF1</i>	myeloid leukemia factor 1
	<i>NR4A3</i>	nuclear receptor subfamily 4 group A member 3
	<i>TAF15</i>	TATA-box binding protein associated factor 15
	<i>FUS</i>	FUS RNA binding protein
	<i>DDIT3</i>	DNA damage inducible transcript 3
	<i>CEBPB</i>	CCAAT/enhancer binding protein beta
	<i>IL6</i>	interleukin 6
	<i>NFKBIZ</i>	NFKB inhibitor zeta
	<i>NFKB1</i>	nuclear factor kappa B subunit 1
	<i>RELA</i>	RELA proto-oncogene, NF-kB subunit
	<i>CXCL8</i>	C-X-C motif chemokine ligand 8
	<i>FOXO1</i>	forkhead box O1
	<i>FLT1</i>	fms related tyrosine kinase 1
	<i>SS18</i>	SS18, nBAF chromatin remodeling complex subunit
	<i>SSX1</i>	SSX family member 1
	<i>SSX2</i>	SSX family member 2
	<i>SSX2B</i>	SSX family member 2B
	<i>NUPR1</i>	nuclear protein 1, transcriptional regulator
	<i>ASPSCR1</i>	ASPSCR1, UBX domain containing tether for SLC2A4
	<i>MET</i>	MET proto-oncogene, receptor tyrosine kinase
	<i>GADD45A</i>	growth arrest and DNA damage inducible alpha
	<i>GADD45B</i>	growth arrest and DNA damage inducible beta
	<i>GADD45G</i>	growth arrest and DNA damage inducible gamma
	<i>BAX</i>	BCL2 associated X, apoptosis regulator
	<i>BAK1</i>	BCL2 antagonist/killer 1
	<i>DDB2</i>	damage specific DNA binding protein 2
	<i>POLK</i>	DNA polymerase kappa
	<i>DEFA3</i>	defensin alpha 3
	<i>BIRC3</i>	baculoviral IAP repeat containing 3
	<i>PAX3</i>	paired box 3
	<i>PAX7</i>	paired box 7
	<i>ZEB1</i>	zinc finger E-box binding homeobox 1
	<i>CCNA1</i>	cyclin A1
Signaling pathways regulating pluripotency of stem cells	<i>LIF</i>	LIF, interleukin 6 family cytokine
	<i>LIFR</i>	LIF receptor alpha
	<i>IL6ST</i>	interleukin 6 signal transducer
	<i>JAK1</i>	Janus kinase 1
	<i>JAK2</i>	Janus kinase 2
	<i>JAK3</i>	Janus kinase 3
	<i>STAT3</i>	signal transducer and activator of transcription 3
	<i>KLF4</i>	Kruppel like factor 4
	<i>SOX2</i>	SRY-box 2
	<i>MYC</i>	MYC proto-oncogene, bHLH transcription factor
	<i>GRB2</i>	growth factor receptor bound protein 2
	<i>MAP2K1</i>	mitogen-activated protein kinase kinase 1
	<i>MAP2K2</i>	mitogen-activated protein kinase kinase 2
	<i>MAPK1</i>	mitogen-activated protein kinase 1
	<i>MAPK3</i>	mitogen-activated protein kinase 3
	<i>PIK3CA</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha
	<i>PIK3CD</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit delta
	<i>PIK3CB</i>	phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit beta
	<i>PIK3R1</i>	phosphoinositide-3-kinase regulatory subunit 1
	<i>PIK3R2</i>	phosphoinositide-3-kinase regulatory subunit 2
	<i>PIK3R3</i>	phosphoinositide-3-kinase regulatory subunit 3
	<i>AKT1</i>	AKT serine/threonine kinase 1
	<i>AKT2</i>	AKT serine/threonine kinase 2
	<i>AKT3</i>	AKT serine/threonine kinase 3
	<i>TBX3</i>	T-box 3
	<i>NANOG</i>	Nanog homeobox
	<i>INHBA</i>	inhibin beta A subunit
	<i>INHBB</i>	inhibin beta B subunit
	<i>INHBC</i>	inhibin beta C subunit
	<i>INHBE</i>	inhibin beta E subunit
	<i>NODAL</i>	nodal growth differentiation factor
	<i>ACVR1B</i>	activin A receptor type 1B
	<i>ACVR1C</i>	activin A receptor type 1C
	<i>ACVR2A</i>	activin A receptor type 2A
	<i>ACVR2B</i>	activin A receptor type 2B
	<i>SMAD2</i>	SMAD family member 2
	<i>SMAD3</i>	SMAD family member 3
	<i>BMP4</i>	bone morphogenetic protein 4
	<i>BMPR1A</i>	bone morphogenetic protein receptor type 1A
	<i>BMPR1B</i>	bone morphogenetic protein receptor type 1B
<i>ACVR1</i>	activin A receptor type 1	
<i>BMPR2</i>	bone morphogenetic protein receptor type 2	

<i>SMAD1</i>	SMAD family member 1
<i>SMAD5</i>	SMAD family member 5
<i>SMAD9</i>	SMAD family member 9
<i>SMAD4</i>	SMAD family member 4
<i>ID1</i>	inhibitor of DNA binding 1, HLH protein
<i>ID2</i>	inhibitor of DNA binding 2, HLH protein
<i>ID3</i>	inhibitor of DNA binding 3, HLH protein
<i>ID4</i>	inhibitor of DNA binding 4, HLH protein
<i>DUSP9</i>	dual specificity phosphatase 9
<i>MAPK11</i>	mitogen-activated protein kinase 11
<i>MAPK12</i>	mitogen-activated protein kinase 12
<i>MAPK13</i>	mitogen-activated protein kinase 13
<i>MAPK14</i>	mitogen-activated protein kinase 14
<i>WNT1</i>	Wnt family member 1
<i>WNT2</i>	Wnt family member 2
<i>WNT2B</i>	Wnt family member 2B
<i>WNT3</i>	Wnt family member 3
<i>WNT3A</i>	Wnt family member 3A
<i>WNT4</i>	Wnt family member 4
<i>WNT5A</i>	Wnt family member 5A
<i>WNT5B</i>	Wnt family member 5B
<i>WNT6</i>	Wnt family member 6
<i>WNT7A</i>	Wnt family member 7A
<i>WNT7B</i>	Wnt family member 7B
<i>WNT8A</i>	Wnt family member 8A
<i>WNT8B</i>	Wnt family member 8B
<i>WNT9A</i>	Wnt family member 9A
<i>WNT9B</i>	Wnt family member 9B
<i>WNT10B</i>	Wnt family member 10B
<i>WNT10A</i>	Wnt family member 10A
<i>WNT11</i>	Wnt family member 11
<i>WNT16</i>	Wnt family member 16
<i>FZD1</i>	frizzled class receptor 1
<i>FZD7</i>	frizzled class receptor 7
<i>FZD2</i>	frizzled class receptor 2
<i>FZD3</i>	frizzled class receptor 3
<i>FZD4</i>	frizzled class receptor 4
<i>FZD5</i>	frizzled class receptor 5
<i>FZD8</i>	frizzled class receptor 8
<i>FZD6</i>	frizzled class receptor 6
<i>FZD10</i>	frizzled class receptor 10
<i>FZD9</i>	frizzled class receptor 9
<i>DVL3</i>	dishevelled segment polarity protein 3
<i>DVL2</i>	dishevelled segment polarity protein 2
<i>DVL1</i>	dishevelled segment polarity protein 1
<i>GSK3B</i>	glycogen synthase kinase 3 beta
<i>AXIN1</i>	axin 1
<i>AXIN2</i>	axin 2
<i>APC</i>	APC, WNT signaling pathway regulator
<i>APC2</i>	APC2, WNT signaling pathway regulator
<i>CTNNB1</i>	catenin beta 1
<i>TCF3</i>	transcription factor 3
<i>ESRRB</i>	estrogen related receptor beta
<i>HNF1A</i>	HNF1 homeobox A
<i>POU5F1</i>	POU class 5 homeobox 1
<i>POU5F1B</i>	POU class 5 homeobox 1B
<i>FGF2</i>	fibroblast growth factor 2
<i>FGFR1</i>	fibroblast growth factor receptor 1
<i>FGFR2</i>	fibroblast growth factor receptor 2
<i>FGFR3</i>	fibroblast growth factor receptor 3
<i>FGFR4</i>	fibroblast growth factor receptor 4
<i>HRAS</i>	HRas proto-oncogene, GTPase
<i>KRAS</i>	KRAS proto-oncogene, GTPase
<i>NRAS</i>	NRAS proto-oncogene, GTPase
<i>RAF1</i>	Raf-1 proto-oncogene, serine/threonine kinase
<i>IGF1</i>	insulin like growth factor 1
<i>IGF1R</i>	insulin like growth factor 1 receptor
<i>HESX1</i>	HESX homeobox 1
<i>ZIC3</i>	Zic family member 3
<i>SKIL</i>	SKI like proto-oncogene
<i>SMARCAD1</i>	SWI/SNF-related, matrix-associated actin-dependent regulator of chromatin, subfamily a, containing DEAD/H box 1
<i>KAT6A</i>	lysine acetyltransferase 6A
<i>SETDB1</i>	SET domain bifurcated 1
<i>JARID2</i>	jumonji and AT-rich interaction domain containing 2
<i>REST</i>	RE1 silencing transcription factor
<i>RIF1</i>	replication timing regulatory factor 1
<i>PCGF1</i>	polycomb group ring finger 1
<i>PCGF2</i>	polycomb group ring finger 2
<i>PCGF3</i>	polycomb group ring finger 3
<i>BMI1</i>	BMI1 proto-oncogene, polycomb ring finger
<i>COMMD3-BMI1</i>	COMMD3-BMI1 readthrough
<i>PCGF5</i>	polycomb group ring finger 5
<i>PCGF6</i>	polycomb group ring finger 6
<i>PAX6</i>	paired box 6
<i>MEIS1</i>	Meis homeobox 1
<i>LHX5</i>	LIM homeobox 5
<i>OTX1</i>	orthodenticle homeobox 1
<i>NEUROG1</i>	neurogenin 1
<i>HAND1</i>	heart and neural crest derivatives expressed 1

	<i>DLX5</i>	distal-less homeobox 5
	<i>MYF5</i>	myogenic factor 5
	<i>ONECUT1</i>	one cut homeobox 1
	<i>ISL1</i>	ISL LIM homeobox 1
	<i>ZFH3</i>	zinc finger homeobox 3
	<i>ESX1</i>	ESX homeobox 1
	<i>HOXB1</i>	homeobox B1
	<i>LEFTY2</i>	left-right determination factor 2
Myeloid genes	<i>FLT3</i>	fms related tyrosine kinase 3
	<i>NPM1</i>	Nucleophosmin
	<i>DNMT3A</i>	DNA methyltransferase 3 alpha
	<i>NRAS</i>	NRAS proto-oncogene, GTPase
	<i>TET2</i>	Tet methylcytosine dioxygenase 2
	<i>IDH2</i>	Isocitrate dehydrogenase (NADP(+)) 2
	<i>CEBPA</i>	CCAAT/enhancer binding protein alpha
	<i>RUNX1</i>	runt related transcription factor 1
	<i>PTPN11</i>	protein_tyrosine_phosphatase_non-receptor_type_11
	<i>IDH1</i>	Isocitrate dehydrogenase (NADP(+)) 1
	<i>TP53</i>	tumor protein p53
	<i>SRSF2</i>	serine and arginine rich splicing factor 2
	<i>WT1</i>	Wilms tumor 1
	<i>KRAS</i>	KRAS proto-oncogene, GTPase
	<i>ASXL1</i>	Additional sex combs like 1, transcriptional regulator
	<i>KIT</i>	KIT proto-oncogene receptor tyrosine kinase
	<i>STAG2</i>	stromal antigen 2
	<i>RAD21</i>	RAD21 cohesin complex component
	<i>EZH2</i>	Enhancer of zeste 2 polycomb
	<i>PHF6</i>	PHD finger protein 6
	<i>SF3B1</i>	splicing factor 3b subunit 1
	<i>GATA2</i>	GATA2 binding protein
	<i>BCOR</i>	BCL6 corepressor
	<i>CBL</i>	Cbl proto-oncogene
	<i>U2AF1</i>	U2 small nuclear RNA auxiliary factor 1
	<i>NF1</i>	neurofibromin 1
	<i>MYC</i>	v-myc_avian_myelocytomatosis_viral_oncogene_homolog
	<i>EP300</i>	E1A binding protein p300
	<i>ETV6</i>	ETS variant 6
	<i>KDM5A</i>	Lysine demethylase 5A
	<i>ZRSR2</i>	Zinc finger CCCH-type, RNA binding motif and serine/arginine rich 2
	<i>JAK2</i>	Janus kinase 2
	<i>CREBBP</i>	CREB binding protein
	<i>KDM6A</i>	lysine demethylase 6A
	<i>BRAF</i>	B-Raf proto-oncogene, serine/threonine kinase
	<i>FBXW7</i>	F-box and WD repeat domain containing 7
	<i>ATRX</i>	ATRX, chromatin remodeler
	<i>CUX1</i>	Cut like homeobox 1
	<i>RB1</i>	RB_transcriptional_corepressor_1
	<i>MPL</i>	MPL proto-oncogene, thrombopoietin receptor
	<i>CDKN2A</i>	cyclin-dependent_kinase_inhibitor_2A
	<i>GNAS</i>	GNAS complex locus
	<i>SF1</i>	splicing factor 1
	<i>U2AF2</i>	U2 small nuclear RNA auxiliary factor 2
	<i>CBLB</i>	Cbl proto-oncogene_B
	<i>IKZF1</i>	IKAROS family zinc finger 1
	<i>SF3A1</i>	splicing factor 3a subunit 1
<i>SH2B3</i>	SH2B adaptor protein 3	
<i>KMT2A</i>	lysine methyltransferase 2A	
<i>KMT2B</i>	lysine methyltransferase 2B	
<i>KMT2C</i>	lysine methyltransferase 2C	
<i>KMT2E</i>	lysine methyltransferase 2E	
<i>KMT2D</i>	lysine methyltransferase 2D	
Cancer predisposition	<i>ACD</i>	ACD, shelterin complex subunit and telomerase recruitment factor
	<i>AIP</i>	Aryl hydrocarbon receptor interacting protein
	<i>APC</i>	APC, WNT signaling pathway regulator
	<i>ATM</i>	ATM serine/threonine kinase
	<i>ATR</i>	ATR serine/threonine kinase
	<i>AXIN2</i>	axin 2
	<i>BAP1</i>	BRCA1 associated protein 1
	<i>BARD1</i>	BRCA1 associated ring domain 1
	<i>BLM</i>	Bloom syndrome RecQ like helicase
	<i>BMPR1A</i>	bone morphogenetic protein receptor type 1A
	<i>BRCA1</i>	BRCA1 DNA_repair_associated
	<i>BRCA2</i>	BRCA2 DNA_repair_associated
	<i>BRIP1</i>	BRCA1 interacting protein C-terminal helicase 1
	<i>BUB1</i>	BUB1 mitotic checkpoint serine/threonine kinase
	<i>CDH1</i>	cadherin 1
	<i>CDK4</i>	cyclin dependent kinase 4
	<i>CDKN1B</i>	cyclin dependent kinase inhibitor 1B
	<i>CDKN2A</i>	cyclin-dependent_kinase_inhibitor_2A
	<i>CHEK2</i>	checkpoint kinase 2
	<i>DDB2</i>	damage specific DNA binding protein 2
	<i>DICER1</i>	Dicer 1, ribonuclease III
	<i>DIS3L2</i>	
	<i>DKC1</i>	Dyskerin pseudouridine synthase 1
	<i>ELANE</i>	elastase, neutrophil expressed
	<i>EPAS1</i>	Endothelial PAS domain protein 1
	<i>EPCAM</i>	Epithelial cell adhesion molecule
	<i>ERCC1</i>	ERCC excision repair 1, endonuclease non-catalytic subunit
	<i>ERCC2</i>	ERCC excision repair 2, endonuclease non-catalytic subunit

ERCC3	ERCC excision repair 3, endonuclease non-catalytic subunit
ERCC4	ERCC excision repair 4, endonuclease non-catalytic subunit
ERCC5	ERCC excision repair 5, endonuclease non-catalytic subunit
ERCC6	ERCC excision repair 6, endonuclease non-catalytic subunit
FANCA	Fanconi anemia complementation group A
FANCB	Fanconi anemia complementation group B
FANCC	Fanconi anemia complementation group C
FANCD2	Fanconi anemia complementation group D2
FANCE	Fanconi anemia complementation group E
FANCF	Fanconi anemia complementation group F
FANCG	Fanconi anemia complementation group G
FANCI	Fanconi anemia complementation group I
FANCL	Fanconi anemia complementation group L
FANCM	Fanconi anemia complementation group M
FH	Fumarate hydratase
FLCN	folliculin
G6PC3	glucose-6-phosphatase catalytic subunit 3
GFI1	Growth factor independent 1 transcriptional repressor
GREM1	Gremlin 1. DAN family BMP antagonist
HOXB13	Homeobox B13
JAGN1	Jagunal homolog 1
KIF1B	Kinesin family member 1B
KIT	KIT proto-oncogene receptor tyrosine kinase
MAX	MYC associated factor X
MDH2	malate dehydrogenase 2
MEN1	menin 1
MET	MET proto-oncogene, receptor tyrosine kinase
MITF	melanogenesis associated transcription factor
MLH1	MutL homolog 1
MNX1	Motor neuron and pancreas homeobox 1
MSH2	MutS homolog 2
MSH6	MutS homolog 6
MSR1	Macrophage scavenger receptor 1
MUTYH	MutY DNA glycosylase
NBN	nibrin
NF2	neurofibromin 2
NFIX	Nuclear factor I X
NHP2	NHP2 ribonucleoprotein
NOP10	NOP10 ribonucleoprotein
NSD1	nuclear receptor binding SET domain protein 1
NTHL1	Nth like DNA glycosylase 1
PALB2	Partner and localizer of BRCA2
PARN	Poly(A)-specific ribonuclease
PDGFRA	Platelet derived growth factor receptor alpha
PMS1	PMS1 homolog 1, mismatched repair system component
POLD1	DNA polymerase delta 1, catalytic subunit
POLE	DNA polymerase epsilon, catalytic subunit
POLH	DNA polymerase eta
POT1	Protection of telomeres 1
PRKARIA	Protein kinase cAMP-dependent type I regulatory subunit alpha
PTCH1	patched 1
PTEN	phosphatase_and_tensin_homolog
RAD50	RAD50 double strand break repair protein
RAD51	RAD51 recombinase
RAD51C	RAD51 paralogue C
RAD51D	RAD51 paralogue D
RB1	RB_transcriptional_corepressor_1
RECQL	RecQ like helicase
RECQL4	RecQ like helicase 4
RET	Ret proto-oncogene
RTEL1	regulator of telomere elongation helicase 1
SCG5	Secretogranin V
SLX4	SLX4 structure-specific endonuclease subunit
SMAD4	SMAD family member 4
SMARCA4	SWI/SNF related, matrix associated, actin dependent regulator of chromatin, subfamily a, member 4
STK11	serine/threonine kinase 11
SUFU	SUFU negative regulator of hedgehog signaling
TERC	Telomerase RNA component
TERT	Telomerase reverse transcriptase
TINF2	TERF1 interacting nuclear factor 2
TMEM127	Transmembrane protein 127
TP53	tumor protein p53
TSC1	TSC complex subunit 1
TSC2	TSC complex subunit 2
UBE2T	Ubiquitin conjugation enzyme E2
VHL	Von Hippel-Lindau tumor suppressor
VPS45	Vacuolar protein sorting 45 homolog
WAS	Wiskott-Aldrich syndrome
WRN	Werner syndrome RecQ like helicase
WT1	Wilms tumor 1
XPA	XPA, DNA damage recognition and repair factor
XPC	XPC complex subunit, DNA damage recognition and repair factor
XRCC2	X-ray repair cross complementing 2
SRP72	Signal recognition particle 72
HAX1	HCLS1 associated protein X-1
RBBP6	Rb-binding protein 6, ubiquitin ligase
PAX5	paired box 5
HOXD4	Homeobox D4
HOXB5	Homeobox B5

	<i>HOXB7</i>	Homeobox B7
	<i>HOXD9</i>	Homeobox B9
	<i>HOXD10</i>	Homeobox B10
	<i>HOXD12</i>	Homeobox B12
	<i>FANCV</i>	Mitotic arrest deficient 2 like 2
	<i>SAMD9</i>	Sterile alpha motif domain containing 9
	<i>SAMD9L</i>	Sterile alpha motif domain containing 9 like
	<i>ATG2B</i>	Autophagy related 2B
	<i>GSKIP</i>	GSK3B interacting protein
	<i>CTC1</i>	CST telomere replication complex component 1
	<i>WRAP53</i>	WD repeat containing antisense to TP53
	<i>NAF1</i>	Nuclear assembly factor 1 ribonucleoprotein
	<i>STN1</i>	STN1, CST complex subunit
	<i>USB1</i>	U6 snRNA biogenesis phosphodiesterase 1
	<i>IL2RG</i>	interleukin_2_receptor_subunit_gamma
	<i>JAK3</i>	Janus kinase 3
	<i>IL7R</i>	interleukin_7_receptor
	<i>PTPRC</i>	protein_tyrosine_phosphatase_receptor_type_C
	<i>CD3D</i>	CD3d_molecule
	<i>CORO1A</i>	coronin_1A
	<i>CD3E</i>	CD3e_molecule
	<i>CD3G</i>	CD3g_molecule
	<i>RAG1</i>	recombination activating 1
	<i>RAG2</i>	recombination activating 2
	<i>DCLRE1C</i>	DNA cross-link repair 1C
	<i>PRKDC</i>	protein kinase, DNA-activated, catalytic polypeptide
	<i>AK2</i>	Adenylate kinase 2
	<i>ADA</i>	Adenosin deaminase
	<i>LIG4</i>	DNA ligase 4
	<i>NHEJ1</i>	Non-homologous end joining factor 1
	<i>PNP</i>	Purine nucleoside phosphorylase
	<i>CD8A</i>	CD8a_molecule
	<i>ZAP70</i>	zeta_chain_of_T_cell_receptor_associated_protein_kinase_70kDa
	<i>TAP2</i>	Transporter 2, ATP binding cassette subfamily B member
	<i>ORAI1</i>	ORAI calcium release-activated calcium modulator 1
	<i>STIM1</i>	Stromal interaction molecule 1
	<i>TAP1</i>	transporter_1_ATP-binding_cassette_sub-family_B_MDR_TAP
	<i>RFK5</i>	Regulatory factor X5
	<i>FOXP1</i>	Forkhead box N1
	<i>TBX1</i>	T-box 1
	<i>RFXAP</i>	Regulatory factor X associated protein
	<i>TAPBP</i>	TAP binding protein
	<i>CIITA</i>	class_II_major_histocompatibility_complex_transactivator
	<i>RFXANK</i>	Regulatory factor X associated ankyrin containing protein
	<i>RMRP</i>	RNA component of mitochondrial RNA processing endoribonuclease
	<i>IKZF1</i>	IKAROS family zinc finger 1
	<i>STAT5B</i>	signal transducer and activator of transcription 5B
	<i>ITK</i>	IL2 inducible T-cell kinase
	<i>MAGT1</i>	Magnesium transporter 1
	<i>DOCK8</i>	Dedicator of cytokinesis 8
	<i>WAS</i>	Wiskott-Aldrich syndrome
	<i>ATM</i>	ATM serine/threonine kinase
	<i>MRE11A</i>	MRE11A homolog A, double strand break repair nuclease.
	<i>NBN</i>	nibrin
	<i>RECQL3</i>	Bloom syndrome RecQ like helicase
	<i>DNMT3B</i>	DNA methyltransferase 3 beta
	<i>PMS2</i>	PMS1 homolog 1, mismatched repair system component
	<i>RNF168</i>	Ring finger protein 168
	<i>SMARCA1</i>	SWI/SNF related, matrix associated, actin dependent regulator of chromatin, subfamily a like 1
	<i>SPINK5</i>	Serine peptidase inhibitor, Kazal type 5
	<i>TYK2</i>	tyrosine kinase 2
	<i>SP110</i>	SP110 nuclear body protein
	<i>DCK1</i>	U2 small nuclear RNA auxiliary factor 2
	<i>NOLA3</i>	NOP10 ribonucleoprotein
	<i>TERC</i>	Telomerase RNA component
	<i>BTK</i>	Bruton tyrosine kinase
	<i>IGHM</i>	Immunoglobulin heavy constant mu
	<i>IGLL1</i>	Immunoglobulin lambda like polypeptide 1
	<i>CD79A</i>	CD79a_molecule
	<i>CD79B</i>	CD79b_molecule
	<i>EOMES</i>	Eomesodermin
	<i>ICOS</i>	inducible T-cell costimulator
	<i>CD19</i>	CD19_molecule
	<i>CD81</i>	CD81_molecule
	<i>CD20</i>	CD20_molecule
	<i>TNFRSF3B</i>	Tumor necrosis factor receptor superfamily, member 3B
	<i>TNFRSF3C</i>	Tumor necrosis factor receptor superfamily, member 3C
	<i>CD40LG</i>	CD40_ligand
	<i>CD40</i>	CD40_molecule
	<i>AICDA</i>	Activation induced cytidine deaminase
	<i>UNG</i>	Uracil DNA glycosylase
	<i>IGKC</i>	Immunoglobulin kappa constant
	<i>LYST</i>	Lysosomal trafficking regulator
	<i>RAB27A</i>	RAB27A, member RAS oncogene family
	<i>AP3B1</i>	Adaptor related protein complex 3 subunit beta 1
	<i>PRF1</i>	perforin_1
	<i>UNC13D</i>	unc-13 homolog D
	<i>STX11</i>	Syntaxin 11
	<i>STXBP2</i>	Syntaxin binding protein

Primary
Immunodeficiency

	SH2D1A	SH2 domain containing 1A
	XIAP	X-linked inhibitor of apoptosis
	FAS	Fas_cell_surface_death_receptor
	FASLG	Fas_ligand
	CASP10	caspase 10
	CASP8	caspase 18
	FADD	Fas associated via death domain
	AIRE	Autoimmune regulator
	FOXP3	forkhead_box_P3
	IL2RA	interleukin_2_receptor_subunit_alpha
	ITCH	Itchy E3 ubiquitin protein ligase
	ELANE	elastase, neutrophil expressed
	GFI1	Growth factor independent 1 transcriptional repressor
	HAX1	HCLS1 associated protein X-1
	G6PC3	glucose-6-phosphatase catalytic subunit 3
	SLC37A4	Solute carrier family 37 member 4
	WAS	Wiskott-Aldrich syndrome
	LAMTOR2	late endosomal/lysosomal adaptor, MAPK and MTOR activator 2
	TAZ	Tafazzin
	VPS13B	Vacuolar protein sorting 13 homolog B
	USB1	U6 snRNA biogenesis phosphodiesterase 1
	ITGB2	integrin_subunit_beta_2
	SLC35C1	Solute carrier family 35 member C1
	KIND3	Fermitin family member 3
	RAC2	Rac family small GTPase 2
	ACTB	actin beta
	FPR1	Formyl peptide receptor 1
	CTSC	cathepsin C
	CEBPE	CCAAT/enhancer binding protein epsilon
	SBDS	SBDS, ribosome maturation factor
	CYBB	Cytochrome b-245 beta chain
	CYBA	Cytochrome b-245 alpha chain
	IL12RB1	interleukin 12 receptor subunit beta 1
	IL12B	interleukin_12B
	IFNGR1	interferon gamma receptor 1
	IFNGR2	interferon gamma receptor 2
	STAT1	signal transducer and activator of transcription 1
	IRF8	Interferon regulatory factor 8
	NCF1	neutrophil_cytosolic_factor_1
	NCF2	neutrophil_cytosolic_factor_2
	NCF4	neutrophil_cytosolic_factor_4
	GATA2	GATA2 binding protein
	CSF2RA	colony stimulating factor 2 receptor alpha subunit
	IKBKG	inhibitor of nuclear factor kappa B kinase subunit gamma
	NFKBIA	NFKB_inhibitor_alpha
	IRAK4	Interleukin 1 receptor associated kinase 4
	MYD88	Myeloid differentiation primary response 88
	CXCR4	C-X-C_motif_chemokine_receptor_4
	TLR3	toll_like_receptor_3
	UNC93B1	Unc-93 homolog B1, TLR signaling regulator
	CARD9	Caspase recruitment domain family member 9
	IL17RA	interleukin 17 receptor A
	IL17F	interleukin_17F
	APOL1	Apolipoprotein L1
	ADGRE5	Adhesion G protein-coupled receptor E5
	ADORA2A	adenosine_A2a_receptor
	AIF1	allograft_inflammatory_factor_1
	AKT1	AKT serine threonine kinase 1
	ALOX15B	arachidonate_15-lipoxygenase_type_B
	ARG1	arginase_1
	AXL	AXL_receptor_tyrosine_kinase
	B3GAT1	beta-13-glucuronyltransferase_1
	BAGE	B_melanoma_antigen
	BATF	basic_leucine_zipper_ATF-like_transcription_factor
	BCL2	B-cell_CLL_lymphoma_2
	BCL2L11	BCL2_like_11
	BCL6	B-cell_CLL_lymphoma_6
	BRCA1	BRCA1_DNA_repair_associated
	BRCA2	BRCA2_DNA_repair_associated
	BST2	bone_marrow_stromal_cell_antigen_2
	BTLA	B_and_T_lymphocyte_associated
	BUB1	BUB1 mitotic checkpoint serine threonine kinase
	C10orf54	chromosome_10_open_reading_frame_54
	C1QA	complement_component_1_q_subcomponent_A_chain
	C1QB	complement_component_1_q_subcomponent_B_chain
	CA4	carbonic_anhydrase_4
	CBLB	Cbl proto-oncogene B
	CCL17	C-C_motif_chemokine_ligand_17
	CCL18	C-C_motif_chemokine_ligand_18
	CCL2	C-C_motif_chemokine_ligand_2
	CCL20	C-C_motif_chemokine_ligand_20
	CCL21	C-C_motif_chemokine_ligand_21
	CCL22	C-C_motif_chemokine_ligand_22
	CCL3	C-C_motif_chemokine_ligand_3
	CCL4	C-C_motif_chemokine_ligand_4
	CCL5	C-C_motif_chemokine_ligand_5
	CCNB2	cyclin B2
	CCR1	C-C_motif_chemokine_receptor_1
	CCR2	C-C_motif_chemokine_receptor_2

Immune response

CCR4	C-C_motif_chemokine_receptor_4
CCR5	C-C_motif_chemokine_receptor_5_gene_pseudogene
CCR6	C-C_motif_chemokine_receptor_6
CCR7	C-C_motif_chemokine_receptor_7
CD14	CD14_molecule
CD160	CD160_molecule
CD163	CD163_molecule
CD19	CD19_molecule
CD1C	CD1c_molecule
CD1D	CD1d_molecule
CD2	CD2_molecule
CD209	CD209_molecule
CD22	CD22_molecule
CD226	CD226_molecule
CD244	CD244_molecule
CD247	CD247_molecule
CD27	CD27_molecule
CD274	CD274_molecule
CD276	CD276_molecule
CD28	CD28_molecule
CD33	CD33_molecule
CD37	CD37_molecule
CD38	CD38_molecule
CD3D	CD3d_molecule
CD3E	CD3e_molecule
CD3G	CD3g_molecule
CD4	CD4_molecule
CD40	CD40_molecule
CD40LG	CD40_ligand
CD44	CD44_molecule_indian_blood_group
CD47	CD47_molecule
CD48	CD48_molecule
CD52	CD52_molecule
CD53	CD53_molecule
CD6	CD6_molecule
CD63	CD63_molecule
CD68	CD68_molecule
CD69	CD69_molecule
CD70	CD70_molecule
CD74	CD74_molecule
CD79A	CD79a_molecule
CD79B	CD79b_molecule
CD80	CD80_molecule
CD83	CD83_molecule
CD86	CD86_molecule
CD8A	CD8a_molecule
CD8B	CD8b_molecule
CDK1	cyclin-dependent_kinase_1
CDKN2A	cyclin-dependent_kinase_inhibitor_2A
CDKN3	cyclin-dependent_kinase_inhibitor_3
CEACAM1	carcinoembryonic_antigen_related_cell_adhesion_molecule_1
CEACAM8	carcinoembryonic_antigen_related_cell_adhesion_molecule_8
CIITA	class_II_major_histocompatibility_complex_transactivator
CLEC4C	C-type_lectin_domain_family_4_member_C
CMKLR1	chemerin_chemokine-like_receptor_1
CORO1A	coronin_1A
CRTAM	cytotoxic_and_regulatory_T-cell_molecule
CSF1R	colony_stimulating_factor_1_receptor
CSF2RB	colony_stimulating_factor_2_receptor_beta_common_subunit
CTAG1B	cancer_testis_antigen_1B
CTAG2	cancer_testis_antigen_2
CTLA4	cytotoxic_T-lymphocyte_associated_protein_4
CTSS	cathepsin_S
CX3CL1	C-X3-C_motif_chemokine_ligand_1
CX3CR1	C-X3-C_motif_chemokine_receptor_1
CX3CR1	C-X3-C_motif_chemokine_receptor_1
CX3CR1	C-X3-C_motif_chemokine_receptor_1
CX3CR1	C-X3-C_motif_chemokine_receptor_1
CXCL1	C-X-C_motif_chemokine_ligand_1
CXCL10	C-X-C_motif_chemokine_ligand_10
CXCL11	C-X-C_motif_chemokine_ligand_11
CXCL13	C-X-C_motif_chemokine_ligand_13
CXCL8	C-X-C_motif_chemokine_ligand_8
CXCL9	C-X-C_motif_chemokine_ligand_9
CXCR2	C-X-C_motif_chemokine_receptor_2
CXCR3	C-X-C_motif_chemokine_receptor_3
CXCR4	C-X-C_motif_chemokine_receptor_4
CXCR5	C-X-C_motif_chemokine_receptor_5
CXCR6	C-X-C_motif_chemokine_receptor_6
CYBB	cytochrome_b-245_beta_chain
DDX58	DEXD_H-box_helicase_58
DGAT2	diacylglycerol_O-acyltransferase_2
DMBT1	deleted_in_malignant_brain_tumors_1
EBI3	Epstein-Barr_virus_induced_3
EFNA4	ephrin_A4
EGFR	epidermal_growth_factor_receptor
EGR2	early_growth_response_2
EGR3	early_growth_response_3
EIF2AK2	eukaryotic_translation_initiation_factor_2_alpha_kinase_2

ENTPD1	ectonucleoside triphosphate diphosphohydrolase 1
EOMES	eomesodermin
FAS	Fas_cell_surface_death_receptor
FASLG	Fas_ligand
FCER1G	Fc_fragment_of_IgE_receptor_Ig
FCGR1A	Fc_fragment_of_IgG_receptor_Ia
FCGR2B	Fc_fragment_of_IgG_receptor_IIb
FCGR3A	Fc_fragment_of_IgG_receptor_IIIa
FCGR3B	Fc_fragment_of_IgG_receptor_IIIb
FCRLA	Fc_receptor_like_A
FOXM1	forkhead_box_M1
FOXO1	forkhead_box_O1
FOXP3	forkhead_box_P3
FUT4	fucosyltransferase_4
FYB	FYN_binding_protein
GADD45GIP1	GADD45G_interacting_protein_1
GAGE1,GAGE12I,GAGE12F	G_antigen_1
GAGE10	G_antigen_10
GAGE12J	G_antigen_12J
GAGE13	G_antigen_13
GAGE2C,GAGE2A,GAGE2E	G_antigen_2C
GATA3	GATA_binding_protein_3
GBP1	guanylate_binding_protein_1
GNLY	granulysin
GPR18	G_protein-coupled_receptor_18
GRAP2	GRB2-related_adaptor_protein_2
GZMA	granzyme_A
GZMB	granzyme_B
GZMH	granzyme_H
GZMK	granzyme_K
HAVCR2	hepatitis_A_virus_cellular_receptor_2
HERC6	HECT_and_RLD_domain_containing_E3_ubiquitin_protein_ligase_family_member_6
HGF	hepatocyte_growth_factor
HIF1A	hypoxia_inducible_factor_1_alpha_subunit
HLA-A	major_histocompatibility_complex_class_I_A
HLA-B	major_histocompatibility_complex_class_I_B
HLA-C	major_histocompatibility_complex_class_I_C
HLA-DMA	major_histocompatibility_complex_class_II_DM_alpha
HLA-DMB	major_histocompatibility_complex_class_II_DM_beta
HLA-DOA	major_histocompatibility_complex_class_II_DO_alpha
HLA-DOB	major_histocompatibility_complex_class_II_DO_beta
HLA-DPA1	major_histocompatibility_complex_class_II_DP_alpha_1
HLA-DPB1	major_histocompatibility_complex_class_II_DP_beta_1
HLA-DQA1	major_histocompatibility_complex_class_II_DQ_alpha_1
HLA-DQA2	major_histocompatibility_complex_class_II_DQ_alpha_2
HLA-DQB2	major_histocompatibility_complex_class_II_DQ_beta_2
HLA-DRA	major_histocompatibility_complex_class_II_DR_alpha
HLA-DRB1	major_histocompatibility_complex_class_II_DR_beta_1
HLA-E	major_histocompatibility_complex_class_I_E
HLA-F	major_histocompatibility_complex_class_I_F
HLA-F-AS1	HLA-F_antisense_RNA_1
HLA-G	major_histocompatibility_complex_class_I_G
ICAM1	intercellular_adhesion_molecule_1
ICOS	inducible_T-cell_costimulator
ICOSLG	inducible_T-cell_costimulator_ligand
ID2	inhibitor_of_DNA_binding_2_HLH_protein
ID3	inhibitor_of_DNA_binding_3_HLH_protein
IDO1	indoleamine_23-dioxygenase_1
IDO2	indoleamine_23-dioxygenase_2
IFI27	interferon_alpha_inducible_protein_27
IFI35	interferon_induced_protein_35
IFI44L	interferon_induced_protein_44_like
IFI6	interferon_alpha_inducible_protein_6
IFIH1	interferon_induced_with_helicase_C_domain_1
IFIT1	interferon_induced_protein_with_tetratricopeptide_repeats_1
IFIT2	interferon_induced_protein_with_tetratricopeptide_repeats_2
IFIT3	interferon_induced_protein_with_tetratricopeptide_repeats_3
IFITM1	interferon_induced_transmembrane_protein_1
IFITM2	interferon_induced_transmembrane_protein_2
IFNA17	interferon_alpha_17
IFNB1	interferon_beta_1
IFNG	interferon_gamma
IGF1R	insulin_like_growth_factor_1_receptor
IGSF6	immunoglobulin_superfamily_member_6
IKZF1	IKAROS_family_zinc_finger_1
IKZF2	IKAROS_family_zinc_finger_2
IKZF3	IKAROS_family_zinc_finger_3
IKZF4	IKAROS_family_zinc_finger_4
IL10	interleukin_10
IL10RA	interleukin_10_receptor_subunit_alpha
IL12A	interleukin_12A
IL12B	interleukin_12B
IL13	interleukin_13
IL15	interleukin_15
IL17A	interleukin_17A
IL17F	interleukin_17F
IL18	interleukin_18
IL1A	interleukin_1_alpha
IL1B	interleukin_1_beta

IL2	interleukin_2
IL21	interleukin_21
IL22	interleukin_22
IL23A	interleukin_23_subunit_alpha
IL2RA	interleukin_2_receptor_subunit_alpha
IL2RB	interleukin_2_receptor_subunit_beta
IL2RG	interleukin_2_receptor_subunit_gamma
IL3RA	interleukin_3_receptor_subunit_alpha
IL4	interleukin_4
IL6	interleukin_6
IL7	interleukin_7
IL7R	interleukin_7_receptor
IRF1	interferon_regulatory_factor_1
IRF4	interferon_regulatory_factor_4
IRF9	interferon_regulatory_factor_9
IRS1	insulin_receptor_substrate_1
ISG15	ISG15_ubiquitin-like_modifier
ISG20	interferon_stimulated_exonuclease_gene_20
ITGA1	integrin_subunit_alpha_1
ITGAE	integrin_subunit_alpha_E
ITGAL	integrin_subunit_alpha_L
ITGAM	integrin_subunit_alpha_M
ITGAX	integrin_subunit_alpha_X
ITGB1	integrin_subunit_beta_1
ITGB2	integrin_subunit_beta_2
ITGB7	integrin_subunit_beta_7
ITK	IL2_inducible_T-cell_kinase
JAML	junction_adhesion_molecule_like
JCHAIN	joining_chain_of_multimeric_IgA_and_IgM
KIAA0101	KIAA0101
KIR2DL1	killer_cell_immunoglobulin_like_receptor_two_Ig_domains_and_long_cytoplasmic_tail_1
KIR2DL2	killer_cell_immunoglobulin_like_receptor_two_Ig_domains_and_long_cytoplasmic_tail_2
KIR2DL3	killer_cell_immunoglobulin_like_receptor_two_Ig_domains_and_long_cytoplasmic_tail_3
KLF2	Kruppel_like_factor_2
KLRB1	killer_cell_lectin_like_receptor_B1
KLRD1	killer_cell_lectin_like_receptor_D1
KLRF1	killer_cell_lectin_like_receptor_F1
KLRG1	killer_cell_lectin_like_receptor_G1
KLRK1	killer_cell_lectin_like_receptor_K1
KREMEN1	kringle_containing_transmembrane_protein_1
KRT5	keratin_5
KRT7	keratin_7
LAG3	lymphocyte_activating_3
LAMP1	lysosomal_associated_membrane_protein_1
LAMP3	lysosomal_associated_membrane_protein_3
LAPTM5	lysosomal_protein_transmembrane_5
LCK	LCK_proto-oncogene_Src_family_tyrosine_kinase
LCN2	lipocalin_2
LEXM	lymphocyte_expansion_molecule
LILRB1	leukocyte_immunoglobulin_like_receptor_B1
LILRB2	leukocyte_immunoglobulin_like_receptor_B2
LRG1	leucine_rich_alpha-2-glycoprotein_1
LST1	leukocyte_specific_transcript_1
LY9	lymphocyte_antigen_9
LYZ	lysozyme
M6PR	mannose-6-phosphate_receptor_cation_dependent
MAD2L1	MAD2_mitotic_arrest_deficient-like_1_yeast
MADCAM1	mucosal_vascular_addressin_cell_adhesion_molecule_1
MAGEA1	MAGE_family_member_A1
MAGEA10	MAGE_family_member_A10
MAGEA12	MAGE_family_member_A12
MAGEA3	MAGE_family_member_A3
MAGEA4	MAGE_family_member_A4
MAGEC2	MAGE_family_member_C2
MAPK1	mitogen-activated_protein_kinase_1
MAPK14	mitogen-activated_protein_kinase_14
MELK	maternal_embryonic_leucine_zipper_kinase
MIF	macrophage_migration_inhibitory_factor_glycosylation-inhibiting_factor
MKI67	marker_of_proliferation_Ki-67
MLANA	melan-A
MMP2	matrix_metalloproteinase_2
MMP9	matrix_metalloproteinase_9
MPO	myeloperoxidase
MRC1	mannose_receptor_C_type_1
MS4A1	membrane_spanning_4-domains_A1
MTOR	mechanistic_target_of_rapamycin
MX1	MX_dynamin_like_GTPase_1
MYC	v-myc_avian_myelocytomatosis_viral_oncogene_homolog
NCAM1	neural_cell_adhesion_molecule_1
NCF1	neutrophil_cytosolic_factor_1
NCR1	natural_cytotoxicity_triggering_receptor_1
NCR3	natural_cytotoxicity_triggering_receptor_3
NECTIN2	nectin_cell_adhesion_molecule_2
NFATC1	nuclear_factor_of_activated_T-cells_1
NFKBIA	NFKB_inhibitor_alpha
NKG7	natural_killer_cell_granule_protein_7
NOS2	nitric_oxide_synthase_2
NOTCH3	notch_3
NRP1	neuropilin_1

NT5E	5-nucleotidase_ecto
NTN3	netrin_3
OAS1	2-5-oligoadenylate_synthetase_1
OAS2	2-5-oligoadenylate_synthetase_2
OAS3	2-5-oligoadenylate_synthetase_3
PDCD1	programmed_cell_death_1
PDCD1LG2	programmed_cell_death_1_ligand_2
PECAM1	platelet_and_endothelial_cell_adhesion_molecule_1
PGF	placental_growth_factor
PIK3CA	phosphatidylinositol-45-bisphosphate_3-kinase_catalytic_subunit_alpha
PIK3CD	phosphatidylinositol-45-bisphosphate_3-kinase_catalytic_subunit_delta
PMEL	premelanosome_protein
POU2AF1	POU_class_2_associating_factor_1
PRDM1	PR_domain_1
PRF1	perforin_1
PSMB9	proteasome_subunit_beta_9
PTEN	phosphatase_and_tensin_homolog
PTGS2	prostaglandin-endoperoxide_synthase_2
PTK7	protein_tyrosine_kinase_7_inactive
PTPN11	protein_tyrosine_phosphatase_non-receptor_type_11
PTPN6	protein_tyrosine_phosphatase_non-receptor_type_6
PTPN7	protein_tyrosine_phosphatase_non-receptor_type_7
PTPRC	protein_tyrosine_phosphatase_receptor_type_C
PTPRCAP	protein_tyrosine_phosphatase_receptor_type_C_associated_protein
PVR	poliovirus_receptor
PYGL	phosphorylase_glycogen_liver
RB1	RB_transcriptional_corepressor_1
RORC	RAR_related_orphan_receptor_C
RP56	ribosomal_protein_56
S100A8	S100_calcium_binding_protein_A8
S100A9	S100_calcium_binding_protein_A9
SAMHD1	SAM_and_HD_domain_containing_deoxynucleoside_triphosphate_triphosphohydrolase_1
SELL	selectin_L
SH2D1A	SH2_domain_containing_1A
SH2D1B	SH2_domain_containing_1B
SIT1	signaling_threshold_regulating_transmembrane_adaptor_1
SKAP2	src_kinase_associated_phosphoprotein_2
SLAMF7	SLAM_family_member_7
SLAMF8	SLAM_family_member_8
SNAI1	snail_family_transcriptional_repressor_1
SNAI2	snail_family_transcriptional_repressor_2
SRGN	serglycin
SSX2	SSX_family_member_2
STAT1	signal_transducer_and_activator_of_transcription_1
STAT3	signal_transducer_and_activator_of_transcription_3
STAT4	signal_transducer_and_activator_of_transcription_4
STAT5A	signal_transducer_and_activator_of_transcription_5A
STAT6	signal_transducer_and_activator_of_transcription_6
TAGAP	T-cell_activation_RhoGTPase_activating_protein
TAP1	transporter_1_ATP-binding_cassette_sub-family_B_MDR_TAP
TARP	TCR_gamma_alternate_reading_frame_protein
TBX21	T-box_21
TCF7	transcription_factor_7_T-cell_specific_HMG-box
TDO2	tryptophan_23-dioxygenase
TGFB1	transforming_growth_factor_beta_1
TIGIT	T-cell_immunoreceptor_with_Ig_and_ITIM_domains
TLR3	toll_like_receptor_3
TLR7	toll_like_receptor_7
TLR8	toll_like_receptor_8
TLR9	toll_like_receptor_9
TNF	tumor_necrosis_factor
TNFAIP8	TNF_alpha_induced_protein_8
TNFRSF14	tumor_necrosis_factor_receptor_superfamily_member_14
TNFRSF17	tumor_necrosis_factor_receptor_superfamily_member_17
TNFRSF18	tumor_necrosis_factor_receptor_superfamily_member_18
TNFRSF4	tumor_necrosis_factor_receptor_superfamily_member_4
TNFRSF9	tumor_necrosis_factor_receptor_superfamily_member_9
TNFSF10	tumor_necrosis_factor_superfamily_member_10
TNFSF13B	tumor_necrosis_factor_superfamily_member_13b
TNFSF14	tumor_necrosis_factor_superfamily_member_14
TNFSF18	tumor_necrosis_factor_superfamily_member_18
TNFSF4	tumor_necrosis_factor_superfamily_member_4
TNFSF9	tumor_necrosis_factor_superfamily_member_9
TOP2A	topoisomerase_DNA_II_alpha
TP63	tumor_protein_p63
TRIM29	tripartite_motif_containing_29
TWIST1	twist_family_bHLH_transcription_factor_1
TYROBP	TYRO_protein_tyrosine_kinase_binding_protein
VCAM1	vascular_cell_adhesion_molecule_1
VEGFA	vascular_endothelial_growth_factor_A
VTCN1	V-set_domain_containing_T_cell_activation_inhibitor_1
XAGE1B	X_antigen_family_member_1B
ZAP70	zeta_chain_of_T_cell_receptor_associated_protein_kinase_70kDa
ZBTB46	zinc_finger_and_BTb_domain_containing_46
ZEB1	zinc_finger_E-box_binding_homeobox_1

Table S2. Cancer associated genes analyzed in the donors.

Donor	Gene	Nt. Change	Protein Change	Cancer association	VAF	EXAC P. frequency	RefSeq
1	Monosomy 7	-	-	Hematological neoplasm	-	-	-
2	<i>KLLN</i>	c.445T>A	p.Trp149Arg	Breast cancer	0.48	0.009	NM_001126049
3	<i>HOXD4</i>	c.242A>T	p.Glu81Val	Acute lymphoblastic leukemia	0.48	0.0008	NM_014621
4	<i>MSR1</i>	c.877C>T	p.Arg293X	Prostate cancer	0.44	0.007	NM_138715
5	<i>HOXD12</i>	c.213T>C	p.Leu77Pro	Acute lymphoblastic leukemia	0.48	0.001	NM_021193
	<i>MOS</i>	c.426_432dupTGGCAAC	p.Val145TrpfsTer17	-	0.4	-	NM_005372
6	<i>SETBP1</i>	c.3962G>A	p.Arg1321His	Hematological neoplasm	0.42	0.0004	NM_015559
7	<i>MAD1L1</i>	c.851A>G	p.Glu284Gly	Lymphoma and prostate cancer	0.44	0.000008	NM_003550

Table S3. Genetic risk variants in donors.

Figures

Figure S1. BM samples selected from patients at different time points from allo-HSCT to DCMN diagnosis and follow-up

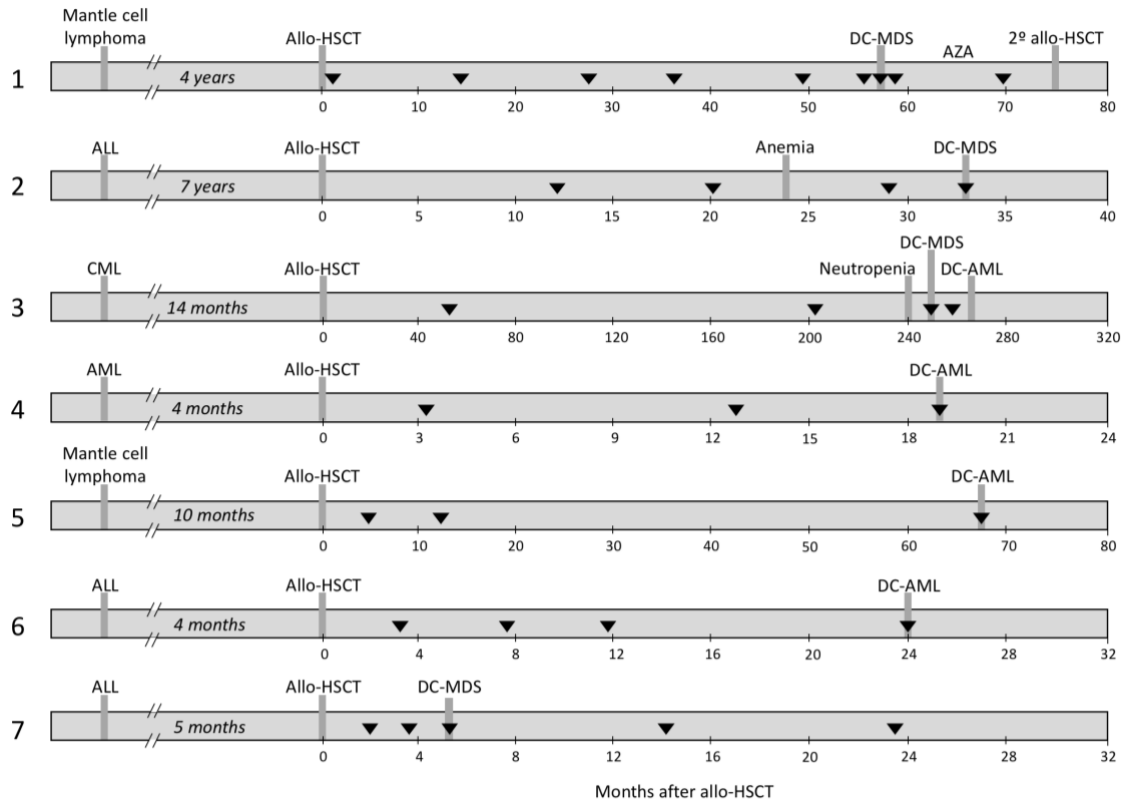


Figure S2. Chimerism analysis.

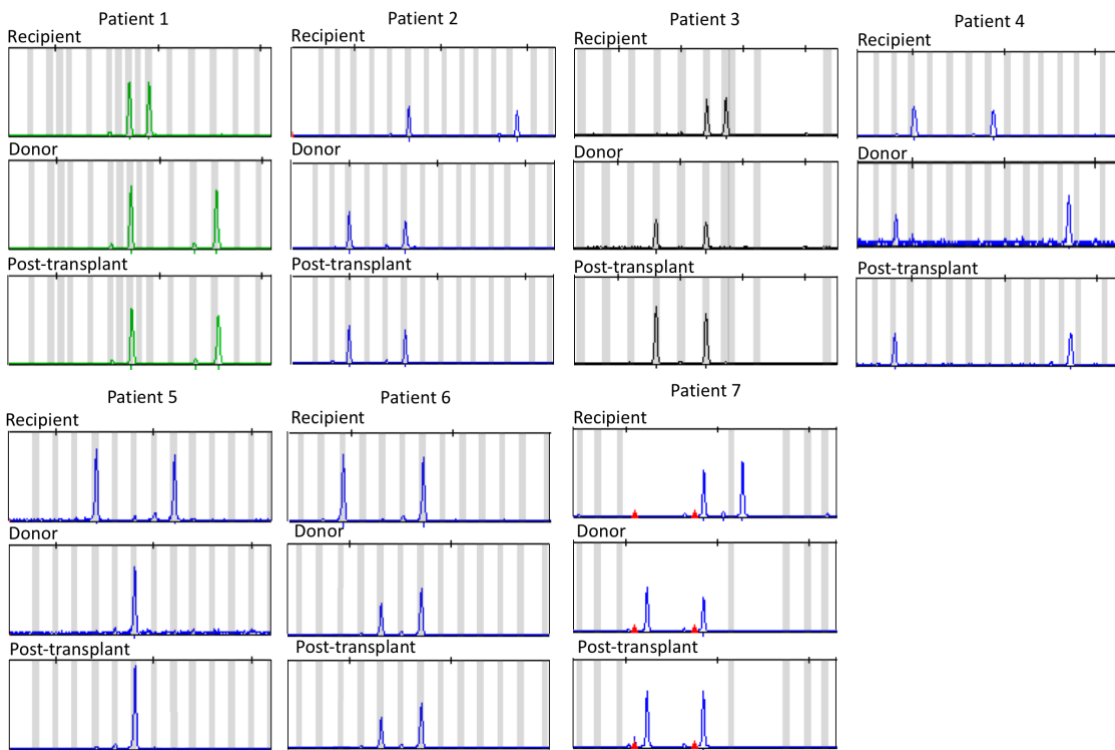


Figure S3. CNV acquisition across the post-allo-HSCT samples in patient #1.

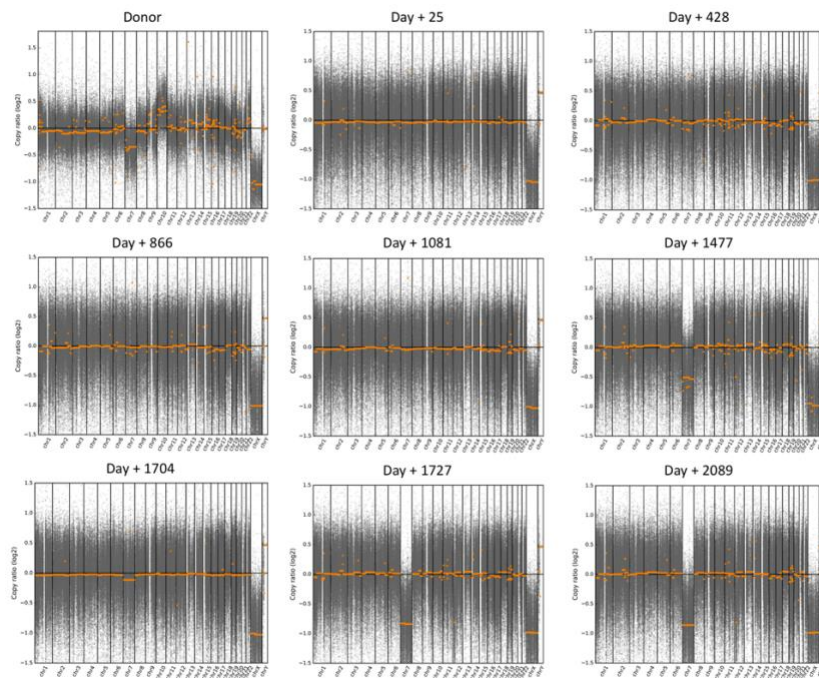


Figure S4. CNV acquisition across the post-allo-HSCT samples in patient #2.

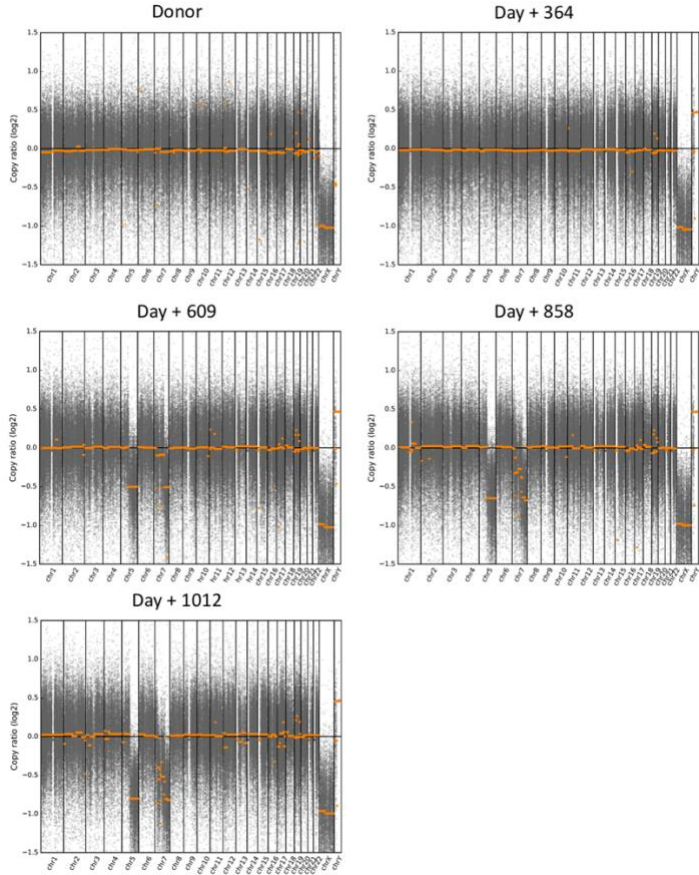


Figure S5. CNV acquisition across the post-allo-HSCT samples in patient #3.

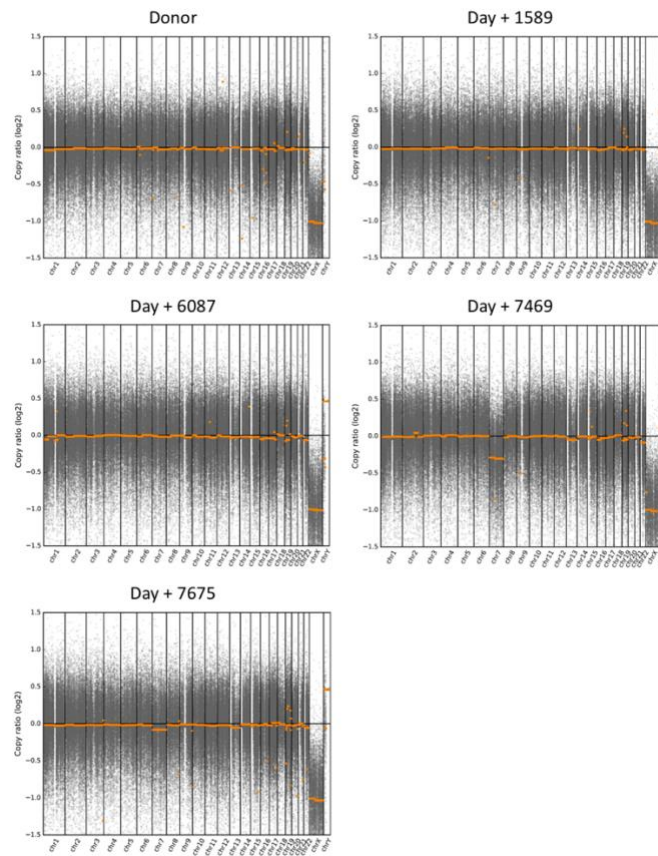


Figure S6. CNV acquisition across the post-allo-HSCT samples in patient #4.

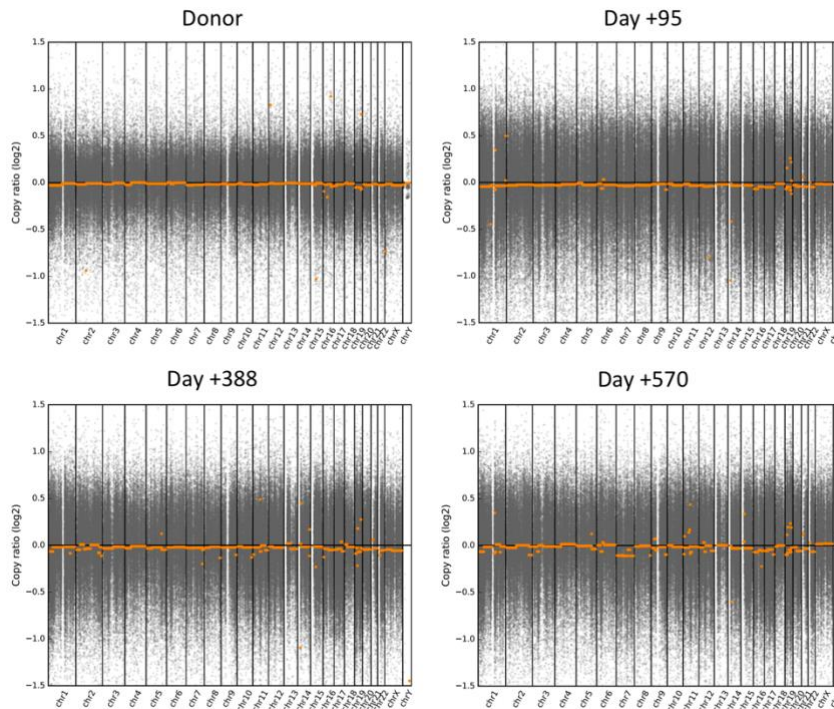


Figure S7. CNV acquisition across the post-allo-HSCT samples in patient #5.

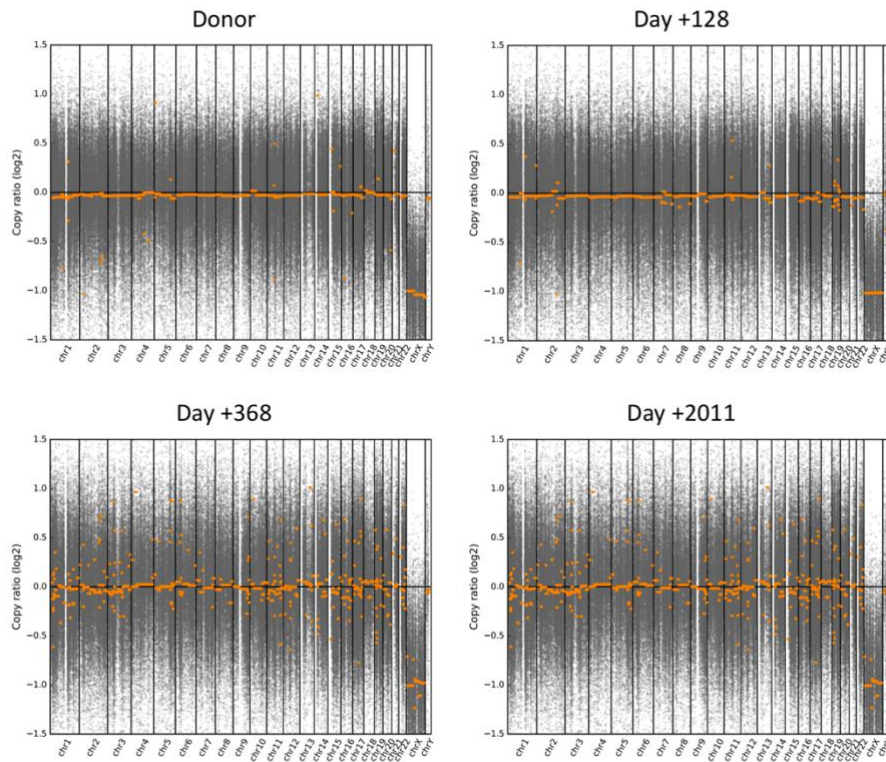


Figure S8. CNV acquisition across the post-allo-HSCT samples in patient #6.

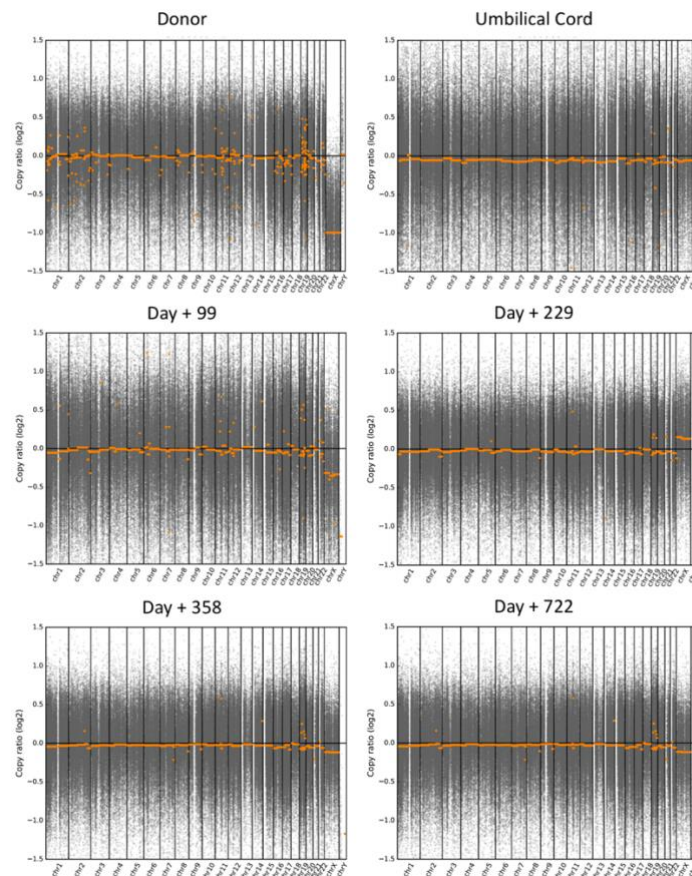
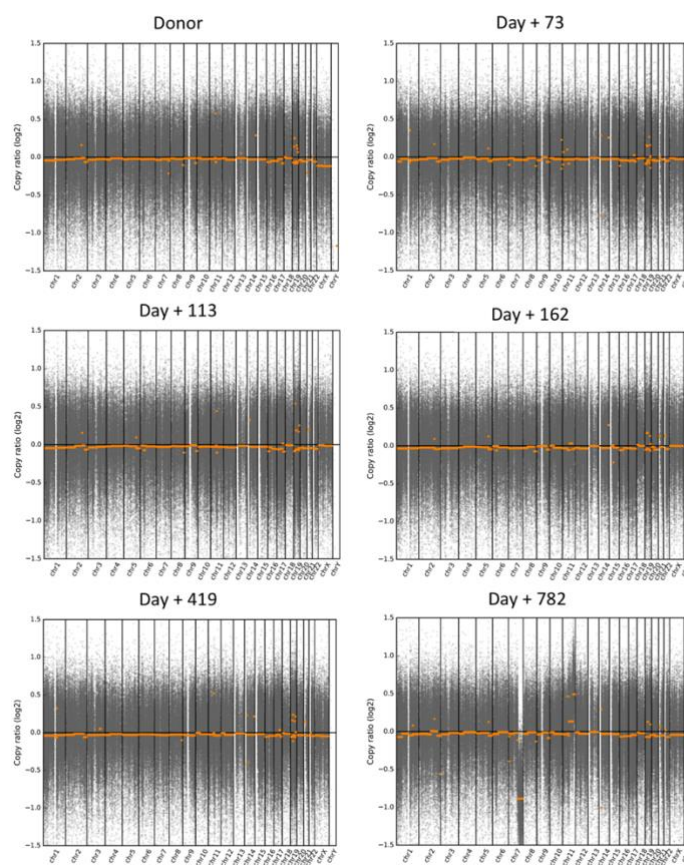


Figure S9. CNV acquisition across the post-allo-HSCT samples in patient #7.



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