RNA sequencing unravels the genetics of refractory/relapsed T-cell acute lymphoblastic leukemia. Prognostic and therapeutic implications

Valentina Gianfelici,[1]* Sabina Chiaretti,[1]* Sofie Demeyer,[2,3]* Filomena Di Giacomo,[1,4] Monica Messina,[1] Roberta La Starza,[5] Nadia Peragine,[1] Francesca Paoloni,[6] Ellen Geerdens,[2,3] Valentina Pierini,[5] Loredana Elia,[1] Marco Mancini,[1] Maria Stefania De Propris,[1] Valerio Apicella,[1] Gianluca Gaidano,[7] Anna Maria Testi,[1] Antonella Vitale,[1] Marco Vignetti,[1,6] Cristina Mecucci,[5] Anna Guarini,[1] Jan Cools,[2,3] and Robin Foà[1]

[1]Hematology, Department of Cellular Biotechnologies and Hematology, Sapienza University, Rome, Italy; [2]Center for Human Genetics, KU Leuven, Belgium; [3]Center for the Biology of Disease, VIB, Leuven, Belgium; [4]Department of Molecular Biotechnology and Health Science and Center for Experimental Research and Medical Studies (CeRMS), University of Turin, Italy; [5]Hematology and Bone Marrow Transplantation Unit, Department of Medicine, University of Perugia, Italy; [6]GIMEMA Data Center, Rome, Italy; and [7]Division of Hematology, Department of Translational Medicine, Amedeo Avogadro University of Eastern Piedmont, Novara, Italy

** VG, SC and SD contributed equally to this work.*

 doi:10.3324/haematol.2015.139410

Received: November 12, 2015.

Accepted: April 29, 2016.

Pre-published: May 5, 2016.

rfoa@bce.uniroma1.it

SUPPLEMENTAL MATERIALS AND METHODS

FISH analysis

FISH was performed as previously described[1] using probes selected from the genomic databases "NCBI" (National Center for Biotechnology Information, Annotation Release 106 and previous assembly) and "UCSC" (University of California, Santa Cruz, Genome Browser Feb. 2009, GRCh37/hg19) (Supplementary Table S11). Analyses were carried out using a fluorescence microscope Olympus BX61 (Olympus, Milan, Italy) equipped with a high sensitive camera JAI (Copenhagen, Denmark) and driven by CytoVision 4.5.4 software (Genetix, New Milton, Hampshire, UK). At least 200 interphase nuclei and/or 7 abnormal metaphases were analyzed in each experiment.

In vitro assays for sensitivity to inhibitors

Specific inhibitors, namely the JAK1/2 inhibitor ruxolitinib, the JAK3 selective inhibitor tofacitinib, rapamycin and BEZ235 for PI3K/AKT, quizartinib and crenolanib for FLT3 positive cases (Selleck Chemicals, Houston, TX) were tested on 5 primary diagnostic samples. For *in vitro* assays, thawed cells were cultured in triplicate in 96-well flat-bottomed plates ($1x10^5$ cells/well) with increasing concentrations of the drug, ranging from 0.001 to 10 µM. Following 48 hours of incubation at 37°C in 5% CO2 humidified air, proliferation and viability were determined by (^{3}H)-thymidine and MTT (3-[4,5-dimethylthiazolyl-2]-2,5-diphenyltetrazolium bromide, Sigma Aldrich, St Louis, Mo), respectively, performed according to the manufacturer's instructions. Data are shown as mean ± SD of 3 replicates.

Statistical analyses on the validation cohort

Patient characteristics were compared by Fisher's exact test for categorical variables and Wilcoxon test for continuous variables. The relationship between mutated genes and treatment response were estimated by means of Fisher's exact test.

OS was calculated starting from the date of diagnosis until the date of death or last follow-up. DFS was calculated only for patients in CR, starting from date of response, until relapse, death in CR or last follow-up. EFS was calculated starting from date of diagnosis, until date of resistance, death, relapse or last follow-up.

As only one patient died in CR, CIR (calculated from the date of CR to recurrence or death using estimation of competing risks) was quite similar to DFS and the information given by competing risks analysis was not different from that one given by DFS.

OS, DFS and EFS curves were estimated by means of Kaplan-Meier product-limit method and compared using the log-rank test. All tests were 2-sided, accepting $p<0.05$ as indicative of statistical significance. All analyses were performed using the SAS software v9.4 (SAS Institute, Cary, NC). When analyzing the impact of mutations targeting one pathway, samples harboring mutations of the other pathway were filtered out from the WT cohort.

SUPPLEMENTAL RESULTS

Efficacy of target specific inhibition in refractory/early relapsed cases

The JAK inhibitor ruxolitinib was able to reduce the proliferation and viability of primary T-ALL cells from 3 patients carrying JAK/STAT mutations. In contrast, negative cases were not affected by JAK inhibitor exposure (Figure S6A). We also observed a different sensitivity to JAK inhibitors among the 3 cases harboring different combinations of JAK/STAT alterations. Following 48 hours of ruxolitinib exposure, primary cells from case G97 harboring a *JAK1* mutation alone proved more sensitive than cells from case R14 harboring *JAK1* and *PTPRC* alterations, with an IC50 value of around 0.01 µM and 1 µM, respectively. Notably, viability was not affected by tofacitinib even at the highest dose proving a selective sensitivity to ruxolitinib. Furthermore, primary cells carrying *JAK1* and *JAK3* mutations in association with a *STAT5A* alteration were poorly sensitive to both ruxolitinib and tofacitinib.

We also tested the sensitivity of primary cells to crenolanib and quizartinib (FLT3/PDGFR inhibitors). After treatment, we observed a decrease in cell survival in the case overexpressing *FLT3*, whereas primary cells from patients harboring JAK/STAT alterations were not affected (Figure S6B). As expected, ruxolitinib and tofacitinib proved ineffective for the treatment of the FLT3 overexpressing cells.

Similarly, a decrease in proliferation and viability was observed in primary cells from a sample harboring a *PTEN* frameshift mutation when exposed to the PI3K/mTOR inhibitors BEZ235 or

rapamycin (Figures S7A-B). The highest sensitivity was observed after treatment with BEZ235, which reduced the proliferation of the cells to 14.2±12% already at the lowest dose (0.01 μM) whereas upon rapamycin treatment the percentage of proliferating cells remained 65.9±22%. Tofacitinib has no effect on the proliferation of these cells.

SUPPLEMENTAL TABLES:

Table S1 (Excel). Features of the 19 T-ALL discovery cases analyzed by RNAseq

Table S2 (Excel). Novel fusion transcript validated by RT-PCR and Sanger sequencing

Table S3 (Excel). Primers used for mutational analysis

Table S4 (Excel). Features of the 49 T-ALL screening cases analyzed by Sanger sequencing

Table S5 (Excel). RNAseq coverage

Table S6 (Excel). Number of lesions detected in refractory/early relapsed cases

Table S7 (Excel). SNVs calling

Table S8 (Excel). DAVID: functional annotation

Table S9 (Excel). ENDEAVOUR gene ranking

Table S10 (Excel). Results (validation cohort)

Table S11 (Excel). Probes used for FISH validation

SUPPLEMENTAL FIGURE LEGENDS:

Figure S1. Flow chart for RNAseq data analysis. A) For gene expression profiling analysis, reads were mapped to the human reference genome (assembly GRCh37.68) using TopHat v.2.0.5.[2] Then, bioinformatic analysis determined gene-expression levels through normalizations and batch effect removal.[3] B) The deFuse algorithm was applied to detect fusion transcript events. Filtering steps are specified.[4] C) SAMTools were used for SNV and INDEL identifications.[5] Filtering steps are specified. In particular, known variants present in dbSNP[6], 1000 genomes[7], the Complete Genomics genomes[8] and those detected in normal thymus cells were removed. However, variants present in the COSMIC database[9] were retained, as they are known to be disease-specific. DAVID[10] and ENDEAVOUR[11] were used for functional annotation and gene prioritization, respectively. Non-silent mutations were tested for their consequences by PolyPhen-2 and SIFT[12].

Figure S2. Experimental strategy. The flow chart shows the material and the experimental strategy used to study the discovery cohort a) and the validation cohort b), respectively.

Figure S3. FISH validation. A) Validation of TRB-HOXA fusion in a case with normal karyotype. Metaphase FISH with RP11-1220K2+RP11-556I13 (green) for TRB and RP1-167F23+RP5-1103I5 (orange) for HOXA shows: 1 green signal; 1 orange signal; and 1 fusion signal on each chromosome 7 as expected for a t(7;7)(p15;q34). B) Experiment with RP11-242H9 (orange) for the 5'*TRA*D and RP11-252I11 (green) for the 5'*SOX8* shows 1 fusion, 1 green and 1 orange signal. C) Experiment with RP1-167F23+RP5-1103I5 (orange) for *HOXA* and RP11-455F11 (green) for the 1q31-q32 shows 2 fusions, 1 green and 1 orange signal.

Figure S4. FISH validation of 19p13 fusion and amplification. A) Experiment with RP11-769G24 (orange) for the 5'*MAST3* and RP11-615O9 (green) for the 3'*C19orf10* shows fusion signals. B) Experiment with RP11-937H1 (orange) spanning *NOTCH3* shows multiple signals. C) Experiment with RP11-124K10 (orange) spanning *JAK3* shows multiple signals.

Figure S5. Comparison span reads paired diagnosis-relapse samples. The histogram compares the number of reads harboring the fusion transcripts on the diagnostic and relapse samples. An increment of reads carrying the fusion transcripts was detected at relapse in all the 3 cases**.** The values were normalized on the total number of reads.

Figure S6. In vitro assays on primary T-ALL cells. a) Effects of ruxolitinib on cell viability measured using the MTT assay. A decrease in cell viability was observed in *JAK1* positive cases (R7, G97, R14). In contrast, negative cases were not affected by JAK inhibitor exposure. The highest sensitivity was observed in the G97 case carrying a JAK1 mutation alone, whereas the lowest sensitivity was observed in the R7 case carrying concomitant *JAK1, JAK3*, and *STAT5* mutations. Viability was not affected by tofacitinib even at the highest dose proving a selective sensitivity to ruxolitinib. b) Effects of crenolanib and quizartinib on cell viability in the R31 case. A decrease in cell viability was observed in the R31 case overexpressing *FLT3* whereas primary cells from patients harboring JAK/STAT alterations were not affected.

Figure S7. In vitro assays on primary T-ALL cells carrying a *PTEN* mutation. a) MTT assay. Rapamycin and BEZ235 affected viability of cells carrying a *PTEN* frame shift mutation. b) (3H)-thymidine assay. A decrease in cell proliferation was observed after exposure to BEZ235 and rapamicyn, while proliferation was not affected when T-ALL cells carrying *PTEN* mutations were exposed to tofacitinib.

References

1) La Starza R, Lettieri A, Pierini V, et al. Linking genomic lesions with minimal residual disease improves prognostic stratification in children with T-cell acute lymphoblastic leukaemia. Leuk Res. 2013; 37(8):928-935.
2) Kim D, Pertea G, Trapnell C, Pimentel H, Kelley R, Salzberg SL. TopHat2: accurate alignment of transcriptomes in the presence of insertions, deletions and gene fusions. Genome Biol. 2013;14(4):R36.
3) Anders S, Pyl PT, Huber W. HTSeq – a Python framework to work with high-throughput sequencing data. Bioinformatics. 2015;31(2): 166-169. Doi: 10.1093/bioinformatics/btu638.
4) McPherson A, Hormozdiari F, Zayed A, et al. deFuse: an algorithm for gene fusion discovery in tumor RNA-Seq data. PLoS Comput Biol. 2011;7(5):e1001138.
5) Li H, Handsaker B, Wysoker A, et al; 1000 Genome Project Data Processing Subgroup. The Sequence Alignment/Map format and SAMtools. Bioinformatics. 2009; 25(16):2078–2079.
6) Sherry ST, Ward MH, Kholodov M, et al. dbSNP: the NCBI database of genetic variation. Nucleic Acids Res. 2001; 29(1):308–311.
7) 1000 Genomes Project Consortium, Abecasis GR, Auton A, Brooks LD, et al. An integrated map of genetic variation from 1,092 human genomes. Nature. 2012; 491 (7422):56–65.
8) Drmanac R, Sparks AB, Callow MJ, et al. Human genome sequencing using unchained base reads on self-assembling DNA nanoarrays. Science. 2010; 327(5961):78–81.
9) Forbes SA, Bhamra G, Bamford S, et al. 2008. The Catalogue of Somatic Mutations in Cancer (COSMIC). Curr Protoc Hum Genet Chapter 10: Unit10.11.
10) Huang W, Sherman BT, Lempicki RA. Systematic and integrative analysis of large gene lists using DAVID bioinformatics resources. Nat Protoc. 2009; 4(1):44-57.

11) Aerts S, Lambrechts D, Maity S, et al. Gene prioritization through genomic data fusion. Nature Biotechnology. 2006; 24(5): 537–544.

12) Adzhubei IA, Schmidt S, Peshkin L, et al. A method and server for predicting damaging missense mutations. Nat Methods. 2010; 7(4):248-249.

Table S1. Features of the 19 T-ALL discovery cases analyzed by RNAseq

ID	Sex	Age (years)	Immunophenotype	Cytogenetics	Molecular Biology	Protocol*	Response	Time to relapse (months from CR)	RNAseq at the relapse	Salivary DNA available
				Young adolescents						
R16	M	14	ETP	NA	NEGATIVE	AIEOPP2009	Refractory	_	_	Yes
R22	M	11	PRE-T	46, xy [20]	NEGATIVE	AIEOPP2009	Refractory	_	_	Yes
R26	M	13	ETP	48,XY,+2mar[3]/46,XY[22]	NEGATIVE	AIEOPP2009	Refractory	_	_	No
				Adolescents/young adults						
R12	M	34	Tn.c.	46, xy [20]	NEGATIVE	GIMEMA LAL2000	Relapse	1	_	No
R19	M	31	PRE-T	46,XY,t(7,11)(q33;p15)[8]/46,idem,del(6)(q13q21)[5]/46,XY[1]	NEGATIVE	GIMEMA LAL0904	Relapse	4	_	No
R21	M	20	ETP	NA	SET-NUP214	GIMEMA LAL2000	Relapse	9	Yes	No
R24	M	22	Cortical	NA	STIL-TAL1	GIMEMA LAL0904	Relapse	2	_	No
R27	F	16	ETP	46, xx [15]	NEGATIVE	GIMEMA LAL0496	Refractory	_	_	No
R28	F	28	PRO-T	NA	SET-NUP214	GIMEMA LAL0496	Refractory	_	_	No
R31	M	32	ETP	46XY,i(17)(q10)[19]/46XY[3]	NEGATIVE	GIMEMA LAL1308	Refractory	_	_	Yes
				Adults						
R11	M	55	Tn.c.	t(1;14)(p32;q13)	NEGATIVE	GIMEMA LAL2000	Refractory	_	_	No
R13	M	36	Cortical	NA	NEGATIVE	NILG-ALL10/07	Refractory	_	_	Yes
R14	M	49	PRE-T	46, xy [20]	NEGATIVE	NILG-ALL10/07	Refractory	_	_	Yes
R15	M	39	PRO-T	47-48,XY,+8,-9,der(11)t(9;11)(q13;p15),-19,-19,-22,+4mar[cp]	NEGATIVE	GIMEMA LAL0904	Refractory	_	_	No
R17	M	47	PRE-T	46, xy [20]	NEGATIVE	GIMEMA LAL0904	Relapse	4	_	No
R18	M	36	PRO-T	46, xy [20]	NEGATIVE	GIMEMA LAL0904	Relapse	6	_	Yes
R20	F	52	Cortical	NA	SET-NUP214	GIMEMA LAL0904	Relapse	16	Yes	No
R23	F	44	PRE-T	46, xx [20]	NEGATIVE	GIMEMA LAL0904	Relapse	9	Yes	No
R25	F	41	Tn.c.	NA	NEGATIVE	GIMEMA LAL2000	Refractory	_	_	No

Abbreviations: ETP, early T-cell precursor; NA, Not avaluable; Tn.c, T not further classified

*__Protocol number (www.clinicaltrials.gov):__ GIMEMA LAL2000: NCT00537550; GIMEMA LAL0904: NCT00458848; GIMEMA LAL0496: NCT00439920; NILG-ALL10/07: NCT00795756; AIEOP 2009: NCT01117441; GIMEMA LAL1308: NCT01156883

Table S2. Novel Fusion Transcript validated by RT-PCR and Sanger sequencing

Sample	Gene1	Gene2	Chr1	Chr2	Position1	Position2	Forward Primer	Reverse Primer	RT-PCR on Normal thymus cells
R11	GATA3	GS1-756B1.2	10p14	10p14	EXON 5	3'	CAAAATGAACGGACAGAACC	TACCTTTGTGCCCTCTTCTG	Negative
R13	PTEN	FAS	10q23	10q23	EXON 2	3'	GACATGACAGCCATCATCAA	GGGCACCTCTGCTGTACTAA	Negative
R13	PAGE2B	ALAS2	Xp11	Xp11	EXON 2	INTRON 1-2	TCTCCCCACTAGGTGCAATA	ACATAGGCCTCTTTCCAGGT	Negative
R14	XG	SRY	Xp22	Yp11	EXON 3	EXON 1	CACTGAGGTTCTTGCATCCT	AGTGCAACTGGACAACAGGT	Negative
R15	MAST3	c19orf10	19p13	19p13	EXON 10	EXON 3	CTGCTGATCATCATCTCACG	ATGGCGTACTCAATCTCAGC	Negative
R15	GLT25D1	AC020911.1	19p13	19p13	EXON 3	3'	GTTTGTACCATTCCGTGGAG	CACCAGACCCTGATGTTCTC	Negative
R15	TRBV23-1	CPSF6	7q34	12q15	EXON 2	EXON 10	TCGACGTCATAAATCCCGTA	CTGACATTTCAGTGCTGTGG	Negative
R19	NAIP	OCLN	5q13	5q13	EXON 16	EXON 5	GGCGTGGATTTATAGGAAGA	GGTTCTCTTAGTAACCTGGAAGAA	Negative
R23	TRBC2	HOXA-AS4	7q34	7p15	EXON 6	EXON 2	AGGAGCCTCGTGTCTTTCTC	TGTGGGAGATCTCTGCTTCT	Negative
R24	TRAC	SOX8	14q11	16p13	EXON 10	5'	CACTGTTGCTCTTGAAGTCC	CACACACACACACACACAGC	Negative
R27	MIR181A1HG	HOXA11-AS1	1q32	7p15	EXON 1	EXON 5	CTGTGGAGCTCCTGAGAAAG	AAGGGATGTCTGAGCACAAG	Negative
R27	ETV6	SLC15A5	12p13	12p13	EXON 2	INTRON 7-8	TTCCTGATCTCTCTCGCTGT	TCCCATTTCTTCTTGTCCTG	Negative
R28	GXYLT1	YAF2	12q12	12q12	EXON 2	EXON 4	CGTGTCGGACAGGTGTAAAG	ACTCCGATCCACATTTTTCA	Negative
R28	HNRNPA2B1	DDX5	7p15	17q12	EXON 2	EXON 1	TCCTCGCAGAGTTGTTTCTC	GTTTCCACCTCTTGTGCTGT	Negative
R28	WT1	THEM7P	11p13	11p13	EXON 5	EXON 2	AATGCATGACCTGGAATCAG	GTCTGGATGGGCAAGAAGTA	Negative
R12, R24	TTTY15	USP9Y	Yq11	Yq11	EXON 4	EXON 3	GTATTTGCCGTTGGTGATTC	TCCTACTGGAGAGCCATGAG	Positive
R15	PSENEN	LIN37	19q13	19q13	EXON 3	5'	TATGAACCTGGAGCGAGTGT	CCCTGTCCATGTGACTCTTC	Positive
R11, R15	PYHIN1	IFI16	1q23	1q23	UTR3'	UTR5'	ACAAACCAGAGAAGCCATGA	TCCCATCTTTACAGACATAAGTGA	Positive
R15, R21	KIAA1267	LRRC37A	17q21	17q21	EXON 2	EXON 6	AGTGGCATAGCCAACTTGAG	CCATATGGCTAGGTAAGATCAGTT	Positive
R16, R20, R23	G6PC3	HDAC5	17q21	17q21	EXON 5	EXON 23	CTAATAACTGGCGCTGTCCT	CATTGGAGACGTGGAGTACC	Positive
R15, R20	POLA2	CDC42EP2	11q13	11q13	EXON 17	EXON 2	GGCCGAGGAGATCAGTAGTT	AAAGGACGGCAAACTCTTCT	Positive
R15	GMIP	LPAR2	19p13	19p13	EXON 20	EXON 5	CCAGTCCTAGCCTCAGACC	GCTGCTATGACCAGCAGATT	Positive
R20	MYST1	BCKDK	16p11	16p11	EXON 2	EXON 11	ATCGCTCACAAAGATCTGGA	CTTTTGGCTCCGGGTCAG	Positive
R15	C5orf58	LCP2	5q35	5q35	5'	EXON 20	GGGACTCAGATGAATGCAAA	TAGGATGGCACATTTCTGGT	Positive
R14, R12	SMG5	PAQR6	1q22	1q22	UTR3'	UTR5'	ATCTAAGGGAGGGCTGAAGA	GTCCAGATGTTGACCGTCTC	Positive

Table S3. Primers used for mutational analysis

Gene_exon	Forward Primer	Reverse Primer
JAK1_EXON8	ccagatatgaaagcccagga	tccctctcatcaccagatcc
JAK1_EXON10	ttggtgtgagctctttctcc	agagacccaggcttttcagt
JAK1_EXON11	catgcagcttcccctaatgt	ttttggtcgatctgggtctc
JAK1_EXON12	cgttaccctctgagctcctg	acaaagcctgaccaaaccac
JAK1_EXON13	cttcagggcacagagaggtc	tctcaacccattgtgttcca
JAK1_EXON14	gctctgcatcctgttaggtt	caaaaagaaaggcaagaagc
JAK1_EXON15	gccgagtagtgtccactgaa	gcacacctttgttcaaccac
JAK1_EXON16	ccagggttggaaatagaatg	gagaaggcaggagatcaaga
JAK1_EXON17	tctggctgcagtgacagtaa	gaggtcacacacccagtagg
JAK1_EXON18_19	tggggctgagaagtttgtag	aatgcagtaaggtgctttcg
JAK1_EXON20	acatgcatctttccctccag	ccaccagctagcatgtcaga
JAK1_EXON21	gctgaggatcttgaggcata	ggacagagtgcctgatgtct
JAK3_EXON3	ttggaagctggaatagttgc	accctctctggtctgtttcc
JAK3_EXON4	ccccaccataatgtcactcc	ccaacttcaagccctgttgt
JAK3_EXON5	aacaacagggcttgaagttg	ttcagggtcaggtatgagga
JAK3_EXON10	ggcatctgtagtcccagcta	caccttgacctgcagtttct
JAK3_EXON11	ggggacttttcacctctgat	acgcatctgagtctctggac
JAK3_EXON13	cccgtatcagaaaatcatgg	tgaaaccaaggctcagaaag
JAK3_EXON15_16	caagtgggttttgaaggatg	gtgagaggagcagtcggtaa
JAK3_EXON18_19	cacagcaagtcaactcagga	taatcacgttcccagcctac
JAK3_EXON18_19	cacagcaagtcaactcagga	taatcacgttcccagcctac
JAK3_EXON20_21	tgcggttcccatattacagt	gagccagtgctgttgagg
JAK3_EXON22	ggactgacctgctcacagtc	gggtcagaaaggtgaggaag
IL7RA_EXON5	gggactaaaggaatcccaat	aggcaagtcattctccaaag
IL7RA_EXON6	atttcaagtggcagatgctc	atccccttttgtggttttctc
STAT5A_EXON13	aaagcagattgggcatgttg	gcagggacagagatgcagac
STAT5B_EXON11	tggtctttgaggggaacaac	cagggtgaggtcagtccatt
STAT5B_EXON16	actgcactccaacctggtaa	tgtgtgggttttcacacaag
STAT6_EXON7	gaatgccagaggagtgagaa	ggacaactgccaccacttac

TYK2_EXON9	GCCTGTACCTCATTCACTGG	GATTGGAGGTTTCTCCTGGT
PTPRC_EXON14_16_Cdna	ATTGCGATTTCCGTGTAAAA	ACAAGCTCCTGCTGTTCATC
NOTCH1_EXON26	AGGCCAGCATGCAGTTCTAA	AGAGTACTGCTTGCCATGGC
NOTCH1_EXON27	agggtagctgctgtcagacc	caacttcaaatcgctgcact
NOTCH1_EXON34.1	GCTTCCTCTGGTGATGGAAC	CGCAGAGGGTTGTATTGGTT
NOTCH1_EXON34.2	TCCACCAGTTTGAATGGTCA	aaggcttgggaaaggaagc
NOTCH2_EXON21	GGAGCTACTGTGAGGAGCAA	CAGTTGACACCCTGATAGCC
NOTCH3_EXON8	ACCGATGTCAACGAGTGTCT	gggtcctaaggccaagaata
FBW7_EXON9	GTGATGGGATCATTTTATACGG	GAAGTCCCAACCATGACAAG
FBW7_EXON10	ACCTTGACTAAATCTACCATGT	TATGATTCATCAGGAGAGCATT
FBW7_EXON12	CATCAGAGTGCTGTGACCTG	GGGCAGGGAGTATATCGTCT
ITPKB_EXON2	AAGAACCTCAGTGCCCTCCT	GTTTCTGCTGGTCCAGGGTA
PIK3R1_EXON15	atgcctagggaagacagcaa	AGGCATAGCAGCCCTGTTTA
ITPR1_EXON29	caccaccctctgcaatcttt	ggcacatcccatgttcctac
NRAS_EXON2	CCAAATGGAAGGTCACACTAGG	GAACTCAACACTGAGTTTGCAATAG
NRAS_EXON3	caatttgagggacaaaccag	cctggcctatcttttccatt
NRAS_EXON4	AGCAGTCTGCCCTCCTCA	TGCACAAATGCTGAAAGCTG
NRAS_EXON5	GCCTGTTCTTGTGATTCAATAGG	TGTGCAGAAGAGGATAGGCAG
KRAS_EXON2	TCTTAAGCGTCGATGGAGGAG	TTGAAACCCAAGGTACATTTCAG
KRAS_EXON3	cgtcatctttggagcaggaac	atgcatggcattagcaaagac
KRAS_EXON4	TGGTGTAGTGGAAACTAGGAATTACAT	TGGATTAAGAAGCAATGCCCT
KRAS_EXON5	TCAGTTGCCTGAAGAGAAACATAA	TAACAGTCTGCATGGAGCAGG
FLT3_EXON14	TCTGCAGAACTGCCTATTCC	AAACATTTGGCACATTCCAT
FLT3_EXON21	AAGAACTGCAGCCACCATAG	CAGACTGCTGTGAGGGTTTT
PTEN_EXON1	TTTCCATCCTGCAGAAGAAG	AGTCACCCAAACTACGGACA
PTEN_EXON2	TGGGGAAAACTTTCTTTTCA	GGTGACCAGCATTTTATGGA
PTEN_EXON3	CATAGAAGGGGTATTTGTTGGA	TATGGGCTAGATGCCAAGTC
PTEN_EXON4	TAAAGATTCAGGCAATGTTTGT	TGCAATACTTTTTCCTAAAACACA
PTEN_EXON5	TGAATAAAATGGGGGAAAAT	GGAAGAGGAAAGGAAAAACA
PTEN_EXON6	ACGACCCAGTTACCATAGCA	TTGCTTTTGGCTTCTTTAGC
PTEN_EXON7	TGAAGGTTCAAACTGGAGAA	CTCACCAATGCCAGAGTAAG

PTEN_EXON8	AACATAGGTGACAGATTTTCTTTTT	TAAATTGGAAGGCAGACAGG
PTEN_EXON9	TGTTCATCTGCAAAATGGAAT	TTTCATGGTGTTTTATCCCTCT
PHF6_EXON2	ttaacattgtcgcccttctt	ctgttgctgccggtatactt
PHF6_EXON3	gcaacagagaccttgaaacg	ataagataaacccggccttg
PHF6_EXON4	ttccggttattctaaggagaga	gcagtacacttcacccaattc
PHF6_EXON5	gggtgaagtgtactgctcgt	gaaaattgctcgaacctgaa
PHF6_EXON6	acattgggtggctttattga	ttcatggtgcaacaaaagtaag
PHF6_EXON7	CTGGAGCCCTCATCACCTAA	tgggcttaaaagaaccatgc
PHF6_EXON9	gaaacatcaggggatgacaa	ctggcacataggaagcctaa
PHF6_EXON8	ttaatcttggctccacactgg	gcttgcaaatgccttgaaat
PHF6_EXON10	gcctcatccactaatgttgg	tgcaagcctacaaaatcctc
NCOR1_EXON41	tttgctccttctcctgaatg	tggggtcacggttagaaata
DNMT1_EXON9	gcacaagtgatcctctcacc	acacagcaagactccgtctc
CNOT3_EXON4	ggtcctcgagtccctagcat	gcagtccactctcccagttc
SF3B1_EXON16	GCCTTTATGGAAGGGTATCCG	AAATCAACTGACCTGAAATGAAGAG
H3F3A_EXON1	GATTTTGGGTAGACGTAATCTTCA	TTTCCTGTTATCCATCTTTTTGTT
EZH2_EXON18	cactgggctgtgcttacttt	tggtgtcagtgagcatgaag
EZH2_EXON19	ccctttttcagtcctgtgatg	cttatctggaaaacgctcca
MLL5_EXON7	AACTGAACTGGGTCTGCAAG	aaaccatgctgcttacaagg
MLL_EXON27	CAGGCGTCACAGTACCTCTT	GAGCTCTTGGAACTCAGCAC
KDM3A_EXON12	ccaggaattgagaagggagt	GACTGTCCAAGCGACACTCT
KDM3A_EXON13	gtgacagagcgagactccat	agagtcagccttcccattct
GMPR_EXON4	gttgcatgtgtcttgagcag	aaggcataggttgcagtgag
NT5DC1_EXON7	tgctaggtcggtcaaacctt	aaacctggacattcggtgag
DOK2_EXON4	attaactgccttcgccttct	ctcacccctctttgttcgta
GMPS_EXON16	gcagaggggaataggttcat	AGCCGTAGATTTTTGCTGTG
GMPS_EXON10	ggcttctttcctccctgtag	tccctaaccatcctttcctt

Table S4. Features of the 49 T-ALL screening cases analyzed by Sanger sequencing/RT-PCR

ID	Age	Sex	Immunophenotype	Cytogenetic	Molecular Biology	Protocol	Response	Relapse	Survival status
G40	20.158795	male	PRE-T	46,XY; del(6)(q21-q26)	STIL-TAL1	LAL0904	CR	YES	dead
G75	26.507871	female	PRE-T	NA	NEG	LAL0904	CR		alive or lost
G28	37.587953	female	CORTICAL-T	NA	NUP214-ABL1	LAL0904	CR	YES	alive or lost
G26	26.483231	male	CORTICAL-T	46,XY,t(X;10)(p11;p12),add(1)(p36),del(9)(p11p24)[10]46,idem,del(6q15)[1]46,XY[11]	DDX3X-MLLT10	LAL0904	CR		alive or lost
G39	45.029432	male	PRO-T	46,XY	NEG	LAL0904	CR	YES	dead
G79	31.392197	male	CORTICAL-T	46,XY	NEG	LAL0904	CR		dead
G53	39.589322	male	CORTICAL-T	NA	NEG	LAL0904	CR	YES	dead
G80	35.715264	male	PRE-T	46,XY; add17p13	NEG	LAL0904	CR	YES	dead
G60	16.361396	male	CORTICAL-T	NA	NEG	LAL0904	CR	YES	dead
G52	37.103354	male	CORTICAL-T	NA	NEG	LAL0904	CR		alive or lost
G5	36.944559	male	PRE-T	46,XY	STIL-TAL1	LAL0904	CR		alive or lost
G58	51.003422	male	Tn.c.	NA	NEG	LAL0904	CR		alive or lost
G7	38.57358	male	MATURE-T	NA	DDX3X-MLLT10	LAL0904	CR	YES	dead
G47	33.678303	male	ETP	NA	NEG	LAL0904	REF		dead
R5	19.86037	male	Tn.c.	NA	NUP98-PSIP1	LAL2000	CR		alive or lost
G74	48.238193	male	ETP	46,XY,add(19)(q13)[10] 46,XY[5]	NEG	LAL0904	ID		dead
G56	58.521561	male	ETP	NA	NEG	LAL0904	CR		alive or lost
G38	48.377823	male	CORTICAL-T	NA	NEG	LAL0904	CR	YES	dead
G48	26.896646	male	CORTICAL-T	NA	NEG	LAL0904	CR	YES	dead
G61	47.140315	male	PRE-T	46,XY [13]	NEG	LAL0904	CR		alive or lost
G36	58.606434	male	CORTICAL-T	46,XY	NEG	LAL0904	ID		dead
G64	36.240931	male	CORTICAL-T	46,XY	NEG	LAL0904	CR		alive or lost
G59	44.476386	female	ETP	NA	NEG	LAL0904	ID		dead
G21	24.36961	male	CORTICAL-T	46,XY	NEG	LAL0904	CR	YES	alive or lost
G76	38.297057	male	CORTICAL-T		NEG	LAL0904	ID		dead
G54	24.465435	female	CORTICAL-T	NA	NEG	LAL0904	CR	YES	dead
G71	24.610541	male	Tn.c.	NA	STIL-TAL1	LAL0904	CR	YES	dead
G51	24.635181	female	PRE-T	46,XX,del(6)(q21),del(14)(q22) [10] / 46,XX [10]	NEG	LAL2000	REF		dead
G27	38.568104	male	CORTICAL-T	NA	NEG	LAL0904	CR		alive or lost
G41	51.162218	female	PRE-T	NA	NEG	LAL0904	REF		dead
G49	31.690623	male	CORTICAL-T	NA	NEG	LAL0904	CR	YES	alive or lost
G55	37.686516	female	CORTICAL-T	45,XX;der2t(2;17)(q26q12)del(2)(p11)/46,XX	NEG	LAL0904	CR	YES	dead
G50	22.212183	male	Tn.c.	NA	NEG	LAL2000	.		alive or lost
G66	39.512663	female	PRE-T	46,XY [6]	NEG	LAL2000	CR		alive or lost
G12	50.652977	female	PRO-T	NA	NEG	LAL0904	CR	YES	dead
G65	24.511978	female	Tn.c.	NA	STIL-TAL1	LAL2000	CR	YES	alive or lost
G68	14.863792	male	Tn.c.	NA	STIL-TAL1	LAL2000	CR	YES	alive or lost
G46	39.318275	male	Tn.c.	NA	NEG	LAL2000	CR	YES	alive or lost
R7	37.330595	female	CORTICAL-T	47,XX,del(9p),t(10;11)(p13;q14),+der(11)t(10;11)	PICALM-MLLT10	LAL2000	CR	YES	dead
G44	20.506502	male	CORTICAL-T	46,XY,-6,+marker[2cell]/46,XY[8cell]	NEG	LAL2000	CR		alive or lost
G45	20.459959	male	CORTICAL-T	46,XY[15]	NEG	LAL2000	REF		alive or lost
G63	36.440794	male	CORTICAL-T	NA	NEG	LAL0904	REF		dead
G25	22.740589	male	CORTICAL-T	NA	NEG	LAL2000	CR	YES	alive or lost
G6	19.802875	male	PRE-T	45,XY [13], del(19(p34) add(2)(q36) de(7)t(4?;7)(q21?;q35), -9, del(11)(q14), del(14)(q21), der(15)t(1;15)(q25;q25), +mar/46xy [7]	NEG	LAL2000	REF		alive or lost
G89	40.418891	male	CORTICAL-T	t(7;10)(p15;q22) [9]/46,XY [11]	NEG	LAL2000	CR	YES	dead
G42	53.158111	female	CORTICAL-T	t(7;11)(q34;p13),del(9p)	NEG	LAL2000	ID		dead
G16	20	male	CORTICAL-T	NA	STIL-TAL1	NOT IN PROTOCOL	dead		dead
G18	39.5	male	PRE-T	47,xy,i(7)(q10),add(14)(q32),+mar1,+mar2[cp18]/ 46,XY[2]	NEG	NOT IN PROTOCOL	REF		dead
G97	55.3	female	Tn.c.	NA	NEG	LAL0904	REF		alive or lost

Abbreviations: CR, complete remission; ETP, early T-cell precursor; ID, induction death; NA, Not avaluable; REF, refractory; Tn.c, T not further classified

Table S5A. RNAseq coverage in primary T-ALL

SAMPLE	TOTAL_CLEAN_READS	TOTAL_MAPPED_READS	ON_TARGET_BASES	MEAN_TARGET_COVERAGE	PCT_TARGET_BASES_2X	PCT_TARGET_BASES_10X	PCT_TARGET_BASES_20X	PCT_TARGET_BASES_30X
R11	94579604	73155537	2814233905	96.268181	0.593716	0.451216	0.386094	0.341809
R12	32221472	27058840	934012140	36.874995	0.486763	0.327925	0.236905	0.178506
R13	66067408	44081634	2197216791	77.22239	0.512891	0.357252	0.279846	0.232272
R14	113714966	85515936	3462961840	115.681552	0.607171	0.480836	0.424643	0.383539
R15	98356888	68008717	2625182488	89.538577	0.594192	0.461235	0.399978	0.354157
R16	53033434	43261621	1748324028	64.519115	0.533199	0.403986	0.338136	0.288878
R17	64641944	30082210	1193753031	62.429613	0.266778	0.126777	0.091838	0.074978
R18	52730110	37199172	1436904414	54.264826	0.475361	0.293396	0.216889	0.174578
R19	80565948	61684014	2688102709	92.654254	0.575001	0.443684	0.378261	0.330645
R20	243422722	77032484	2830252039	95.709554	0.605628	0.475688	0.41677	0.374573
R21	209194792	51768761	2645548250	89.389929	0.562316	0.421574	0.351071	0.305246
R22	140669646	41029523	1662040293	59.069118	0.533089	0.378196	0.297998	0.245392
R23	168659574	45173172	1847501199	65.038665	0.559181	0.42461	0.348931	0.289155
R24	202352326	93483680	3130727389	105.178938	0.62047	0.474443	0.400942	0.348799
R25	142012248	50036455	1553525206	55.754465	0.555314	0.393205	0.297904	0.236924
R26	159597328	81072292	2999028339	102.644333	0.594504	0.465491	0.408379	0.369835
R27	149605122	71003584	2361965584	78.764699	0.612731	0.464674	0.395708	0.347501
R28	197333332	79212369	3013672761	105.974121	0.575639	0.43306	0.361424	0.314055
R31	82847546	67506251	3538511747	73.8822	0.51561	0.38191	0.25373	0.20087
AVERAGE	123768758.4	59335065.89	2351761271	80.04523816	0.546292316	0.403113579	0.330813	0.283774316

Table S5B. RNAseq coverage in relapsed T-ALL samples

SAMPLE	TOTAL_CLEAN_READS	TOTAL_MAPPED_READS	ON_TARGET_BASES	MEAN_TARGET_COVERAGE	PCT_TARGET_BASES_2X	PCT_TARGET_BASES_10X	PCT_TARGET_BASES_20X	PCT_TARGET_BASES_30X
R20Q	85176842	80296768	6015783497	65.132277	0.557135	0.384239	0.303825	0.254886
R21Q	81544136	74837676	5548951148	65.085649	0.512705	0.340969	0.265664	0.21857
R23Q	98016642	93078809	6667807335	72.67505	0.520384	0.35822	0.280788	0.233274
AVERAGE	88245873.33	82737751	6077513993	67.630992	0.530074667	0.361142667	0.283425667	0.235576667

Table S6(a). Number of lesions detected in refractory/early relapsed cases

Sample	# fusions	# SNV	#INDEL
R11	6	73	61
R12	1	60	51
R13	4	53	55
R14	12	99	68
R15	6	95	69
R16	1	65	56
R17	0	17	30
R18	3	59	44
R19	6	78	61
R20	36	91	57
R21	3	78	50
R22	2	60	61
R23	8	104	63
R24	17	105	82
R25	10	78	79
R26	25	82	56
R27	6	93	66
R28	6	80	59
R31	31	157	47
Sum	**183**	**1527**	**1115**
Median	**6**	**78**	**59**
Average	**9.631578947**	**80.36842105**	**58.68421053**

Table S6(b). Number of lesions detected in RCC cases (Kalender Atak Z, et al. PLOS Genetics 2013)

Sample	# fusions	#SNV	#INDEL
TUG1	14	58	49
TUG2	6	47	34
TUG4	4	108	62
TUG7	18	65	52
TLE76	14	57	32
TLE80	14	71	47
TLE90	26	97	31
TLE91	23	79	36
Sum	**119**	**582**	**343**
Median	**14**	**68**	**41.5**
Average	**14.875**	**72.75**	**42.875**

Table S7. SNVs calling

sample	location	alt	amino acids	protein position	codons	gene	AF	SIFT	PP2
R11	9:133753909	T	R/C	460	Cgc/Tgc	ABL1	0.496	0.245	0.218
R11	9:4719280	G	E/A	100	gAa/gCa	AK3	0.535714	0.007	0.945
R11	19:15473061	C	I/V	388	Att/Gtt	AKAP8	0.52381	0.094	0.647
R11	6:24505109	G	S/G	208	Agt/Ggt	ALDH5A1	0.142857	0.031	0.944
R11	12:46125043	G	N/S	77	aAc/aGc	ARID2	0.556818	0.171	0.051
R11	7:97481575	A	A/V	561	gCt/gTt	ASNS	0.573248	0.213	0.131
R11	11:108124626	C	F/L	662	Ttt/Ctt	ATM	0.133333	0.8	0.146
R11	X:76937047	C	V/G	1234	gTg/gGg	ATRX	1	0	0.454
R11	8:103841636	C	S/G	367	Agc/Ggc	AZIN1	0.160633	0.596	0
R11	20:36147563	C	Q/R	5	cAg/cGg	BLCAP	0.12766	0.054	0.997
R11	15:91354530	T	H/Y	1324	Cac/Tac	BLM	0.486486	0.337	0.031
R11	8:86242066	T	R/Q	174	cGa/cAa	CA1	0.50304	1	0.01
R11	17:77768675	A	G/V	310	gGc/gTc	CBX8	0.558824	0.015	0.361
R11	17:37627139	C	S/P	352	Tcc/Ccc	CDK12	0.589552	0.155	0.012
R11	7:39990344	G	Q/R	35	cAg/cGg	CDK13	0.166667	0	0.004
R11	7:39990548	G	Q/R	103	cAg/cGg	CDK13	0.533333	0.204	0.003
R11	1:243362389	T	E/K	202	Gaa/Aaa	CEP170	0.182927	0.148	0.002
R11	12:120313948	A	R/W	9	Cgg/Tgg	CIT	0.431818	0.002	0.824
R11	13:46090371	G	I/V	635	Att/Gtt	COG3	0.231481	1	0.493
R11	1:160302244	C	I/V	164	Att/Gtt	COPA	0.181818	0.022	0.01
R11	8:68062098	C	V/L	716	Gtt/Ctt	CSPP1	0.52	0.082	0.976
R11	6:43163873	G	I/V	819	Atc/Gtc	CUL9	0.470588	0.745	0
R11	7:101870887	T	P/L	1124	cCg/cTg	CUX1	0.514563	0.002	0.997
R11	5:54586070	T	E/K	295	Gaa/Aaa	DHX29	0.123288	0.013	0.044
R11	11:6519827	A	G/S	128	Ggt/Agt	DNHD1	0.55102	0.202	0.002
R11	7:76109831	T	A/V	2	gCc/gTc	DTX2	0.333333	0.004	0.967
R11	16:2283631	A	V/M	417	Gtg/Atg	E4F1	0.482759	0.082	0.998
R11	4:84383816	A	H/Y	346	Cat/Tat	FAM175A	0.492063	0.002	0.392
R11	10:47909775	T	T/M	291	aCg/aTg	FAM21B	0.266667	0.148	0.05
R11	7:5545071	C	H/R	70	cAc/cGc	FBXL18	0.583333	0.419	0.672
R11	19:40408740	T	A/T	1367	Gcc/Acc	FCGBP	0.190476	0.387	0.021
R11	2:36808537	A	P/L	177	cCg/cTg	FEZ2	0.272727	0.002	1
R11	3:37343742	A	A/T	385	Gct/Act	GOLGA4	0.472527	0.072	0.136
R11	3:37365607	A	E/K	744	Gag/Aag	GOLGA4	0.448718	0.055	0.809
R11	6:29911916	G	M/V	213	Atg/Gtg	HLA-A	1	0.282	0.064
R11	9:95397590	T	G/E	306	gGa/gAa	IPPK	0.135135	0.186	0.993
R11	1:200961451	A	R/W	782	Cgg/Tgg	KIF21B	0.484979	0	1
R11	19:18775087	A	G/R	34	Ggg/Agg	KLHL26	0.615385	0.109	0.716
R11	12:75900298	C	Q/R	162	cAa/cGa	KRR1	0.497674	0.034	0.961
R11	1:113661855	A	G/D	894	gGt/gAt	LRIG2	0.55102	0.241	0.972
R11	1:90400219	G	A/G	531	gCt/gGt	LRRC8D	0.486486	0.021	0.098
R11	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	0.94	0.748	0
R11	3:179093018	T	S/L	329	tCg/tTg	MFN1	0.280702	0.006	0.087
R11	1:1562227	A	R/H	421	cGc/cAc	MIB2	0.656716	0.04	0.015
R11	12:6859452	T	G/D	97	gGc/gAc	MLF2	0.508587	0.02	0
R11	11:118373374	A	S/N	2253	aGt/aAt	MLL	0.418182	0.205	0
R11	1:45797507	A	Q/*	182	Cag/Tag	MUTYH	0.492308	-	-
R11	19:59074542	A	R/C	368	Cgc/Tgc	MZF1	0.511628	0.19	0.999
R11	18:55268939	C	Y/C	531	tAt/tGt	NARS	0.517857	0.033	0.986
R11	15:75646086	G	K/R	242	aAa/aGa	NEIL1	0.421053	0.089	0.036
R11	2:178097289	A	S/L	142	tCa/tTa	NFE2L2	0.483333	0.006	0.361
R11	6:116542370	A	L/H	228	cTt/cAt	NT5DC1	0.545455	0.11	1
R11	22:21167723	T	V/I	252	Gtc/Atc	PI4KA	0.405263	0.493	0.39
R11	19:14582589	A	G/D	947	gGc/gAc	PKN1	0.392523	0.009	0.994
R11	1:150131221	A	E/K	245	Gaa/Aaa	PLEKHO1	0.182891	0.014	0.361
R11	1:97235421	A	G/E	93	gGa/gAa	PTBP2	0.133333	0.017	0.098
R11	2:102038847	T	A/T	54	Gca/Aca	RFX8	0.430556	0.123	0.999
R11	2:152317715	G	T/A	1047	Act/Gct	RIF1	0.443038	0.191	0.021
R11	11:18101992	A	A/V	460	gCt/gTt	SAAL1	0.52381	0.004	0.197
R11	7:92760661	T	E/K	1542	Gaa/Aaa	SAMD9L	0.130435	0.107	0.005
R11	14:94849227	C	I/M	116	atC/atG	SERPINA1	0.25	0.026	0.645
R11	12:7970471	G	W/R	434	Tgg/Cgg	SLC2A14	0.157895	0	1
R11	10:98806436	C	R/G	610	Cgg/Ggg	SLIT1	0.428571	0.09	0.82
R11	9:139276298	G	R/S	765	agA/agC	SNAPC4	0.1875	0.001	0.979
R11	2:96947655	C	I/V	1641	Atc/Gtc	SNRNP200	0.473684	0.181	0.011
R11	13:80911389	G	R/P	151	cGg/cCg	SPRY2	0.414013	0.004	0.996
R11	3:136062740	G	R/P	1127	cGg/cCg	STAG1	0.556818	0.108	0.001
R11	1:211545529	A	L/M	387	Ctg/Atg	TRAF5	0.469697	0.041	0.775
R11	11:5686160	G	I/T	454	aTc/aCc	TRIM5	0.424658	0	0.201
R11	18:662212	C	D/H	116	Gac/Cac	TYMS	0.526178	0.002	0.597
R11	7:102280780	A	T/I	119	aCa/aTa	UPK3BL	0.433333	0.009	1
R11	19:12246629	G	Y/H	32	Tac/Cac	ZNF20	0.125	0.007	0.999
R11	1:91404944	A	A/V	656	gCt/gTt	ZNF644	0.137931	0.45	0.001
R12	2:219131256	C	N/D	197	Aac/Gac	AAMP	0.355932	0.506	0.013
R12	3:179292227	C	F/L	150	Ttc/Ctc	ACTL6A	0.130435	0.005	0.141

R12	10:51465046	C	N/K	470	aaC/aaG	AGAP7	0.407407	0	1
R12	10:51225357	T	R/Q	542	cGg/cAg	AGAP8	0.3	0.271	0.175
R12	5:77458774	T	T/N	411	aCc/aAc	AP3B1	0.352941	0.008	0.872
R12	8:103841636	C	S/G	367	Agc/Ggc	AZIN1	0.236111	0.596	0
R12	2:160295143	T	E/K	322	Gaa/Aaa	BAZ2B	0.185185	0.002	0.734
R12	10:124921822	G	K/R	216	aAg/aGg	BUB3	0.459459	0.29	0.389
R12	9:27548412	T	G/E	423	gGa/gAa	C9orf72	0.142857	0.076	1
R12	20:32211030	C	I/T	207	aTt/aCt	CBFA2T2	0.4	1	0
R12	11:44621753	C	D/H	37	Gac/Cac	CD82	0.49505	0.001	1
R12	1:100928338	T	L/F	247	Ctc/Ttc	CDC14A	0.5625	0.001	0.999
R12	1:243362389	T	E/K	202	Gaa/Aaa	CEP170	0.163934	0.148	0.002
R12	3:33617737	T	R/Q	793	cGa/cAa	CLASP2	0.625	0.002	0.341
R12	1:160302244	C	I/V	164	Att/Gtt	COPA	0.388889	0.022	0.01
R12	20:2777710	A	A/V	288	gCg/gTg	CPXM1	0.468182	0.368	0.002
R12	6:43153227	T	Q/L	210	cAg/cTg	CUL9	0.137931	0.001	0.991
R12	7:6449815	A	P/L	589	cCt/cTt	DAGLB	0.302632	0.039	0.017
R12	15:48623889	A	S/R	59	agC/agA	DUT	0.363636	0.001	0.028
R12	14:102500367	A	E/K	3490	Gaa/Aaa	DYNC1H1	0.126984	0.004	0.975
R12	16:2278378	A	D/N	55	Gac/Aac	E4F1	0.521739	0.007	0.997
R12	8:110348390	T	A/S	14	Gca/Tca	ENY2	0.411765	0.572	0.017
R12	5:107700452	C	E/G	454	gAa/gGa	FBXL17	0.15	0.078	0.828
R12	4:190873406	G	N/D	75	Aat/Gat	FRG1	0.277778	0.051	0.005
R12	11:33373759	A	R/H	1040	cGt/cAt	HIPK3	0.380952	0.001	0.999
R12	21:34635393	T	T/M	379	aCg/aTg	IFNAR2	0.576923	0.318	0.007
R12	15:78786544	T	A/S	845	Gca/Tca	IREB2	0.530303	0.005	0.984
R12	2:86702002	A	V/I	610	Gtt/Att	KDM3A	0.509091	0.182	0.989
R12	19:10602802	C	Q/R	259	cAg/cGg	KEAP1	0.666667	0.33	0.003
R12	12:71978462	G	P/R	891	cCa/cGa	LGR5	0.5625	0.094	0.916
R12	2:44200761	T	E/K	452	Gaa/Aaa	LRPPRC	0.153846	0.149	0.007
R12	1:9995638	G	L/P	50	cTg/cCg	LZIC	0.185185	0.002	0.994
R12	15:91461900	G	T/S	1072	aCc/aGc	MAN2A2	0.490196	0.111	0
R12	11:63668345	T	R/W	328	Cgg/Tgg	MARK2	0.65625	0	1
R12	6:52144382	A	P/S	183	Ccc/Tcc	MCM3	0.5	0.08	0.994
R12	X:70348991	A	G/E	1168	gGg/gAg	MED12	1	0.001	1
R12	3:179093018	T	S/L	329	tCg/tTg	MFN1	0.2	0.006	0.087
R12	4:2933648	T	R/H	273	cGc/cAc	MFSD10	0.526316	0.008	1
R12	11:1492537	T	P/T	129	Ccc/Acc	MOB2	0.478261	0	1
R12	17:17070945	A	E/K	991	Gag/Aag	MPRIP	0.25	0.412	0.414
R12	13:28014392	T	G/E	65	gGa/gAa	MTIF3	0.137931	0.28	0.091
R12	19:1357089	A	E/K	47	Gaa/Aaa	MUM1	0.131579	0.093	0.429
R12	8:90993682	T	E/K	81	Gaa/Aaa	NBN	0.151515	0.009	0.996
R12	X:49029768	A	Y/N	95	Tac/Aac	PLP2	1	0	0.971
R12	8:145725661	A	D/N	198	Gac/Aac	PPP1R16A	0.55	0.002	0.607
R12	2:179312244	C	N/S	102	aAt/aGt	PRKRA	0.541667	0.147	0.057
R12	1:97235421	A	G/E	93	gGa/gAa	PTBP2	0.173913	0.017	0.098
R12	16:53499470	A	E/K	607	Gaa/Aaa	RBL2	0.153846	0.106	0.505
R12	7:92161810	A	R/K	132	aGa/aAa	RBM48	0.16	0.211	0.993
R12	7:150069445	G	P/R	429	cCc/cGc	REPIN1	0.34	0.039	0.005
R12	2:100019196	G	C/S	1151	tGt/tCt	REV1	0.478261	0.862	0
R12	19:47634249	A	R/Q	21	cGg/cAg	SAE1	0.555556	0	1
R12	22:42607057	T	P/T	1419	Cca/Aca	TCF20	0.484848	0.025	0.012
R12	11:8974850	T	L/H	114	cTt/cAt	TMEM9B	0.481481	0.004	1
R12	1:186302479	C	T/A	1744	Aca/Gca	TPR	0.722222	0.564	0.001
R12	7:142423681	G	S/G	106	Agt/Ggt	TRBV27	0.292683		0.777
R12	17:30213042	G	E/D	220	gaG/gaC	UTP6	0.130435	0.02	0.839
R12	15:62266540	C	M/V	829	Atg/Gtg	VPS13C	0.352941	0.689	0
R12	3:101383533	T	G/E	550	gGa/gAa	ZBTB11	0.12766	0.007	0.999
R12	16:75138703	G	A/G	181	gCg/gGg	ZNRF1	0.681818	0.399	0.892
R13	10:45954715	G	W/R	142	Tgg/Cgg	08-mar	0.166667	0.001	1
R13	15:58253392	C	T/S	451	aCt/aGt	ALDH1A2	0.488525	0.04	0.882
R13	X:100880075	A	E/K	36	Gaa/Aaa	ARMCX3	0.129032	1	0.01
R13	17:79513976	A	S/L	711	tCg/tTg	C17orf70	0.5	0.006	1
R13	22:19434990	T	V/I	35	Gtc/Atc	C22orf39	0.453782	0.904	0.996
R13	3:156877871	T	P/T	5	Cct/Act	CCNL1	0.396552	0	0
R13	1:26595073	T	R/C	481	Cgc/Tgc	CEP85	0.48	0	1
R13	10:115608774	T	R/K	697	aGa/aAa	DCLRE1A	0.153846	0.105	0.047
R13	2:25471045	G	V/A	239	gTg/gCg	DNMT3A	0.130435	0.362	0.118
R13	8:21768285	A	R/W	173	Cgg/Tgg	DOK2	0.330357	0	1
R13	15:40289187	A	G/E	930	gGa/gAa	EIF2AK4	0.454545	0	1
R13	10:47909775	T	T/M	291	aCg/aTg	FAM21B	0.354839	0.148	0.05
R13	11:64056132	T	R/W	324	Cgg/Tgg	GPR137	0.65625	0.002	1
R13	1:110200288	G	N/S	85	aAc/aGc	GSTM4	0.310811	0.017	0.006
R13	1:226252135	T	K/M	28	aAg/aTg	H3F3A	0.478379	NA	0.899
R13	14:102551314	T	E/K	351	Gaa/Aaa	HSP90AA1	0.458961	0.007	0.978
R13	19:55789084	A	A/V	117	gCg/gTg	HSPBP1	0.467213	0.087	0.118
R13	7:48015239	T	E/K	171	Gaa/Aaa	HUS1	0.125	0.006	0.97
R13	9:27009104	G	E/G	225	gAa/gGa	IFT74	0.333333	0.031	0.702

R13	5:61649188	A	E/K	182	Gaa/Aaa	KIF2A	0.136364	0.377	0.036
R13	5:145547698	T	G/E	142	gGa/gAa	LARS	0.157895	0.001	0.984
R13	2:44200761	T	E/K	452	Gaa/Aaa	LRPPRC	0.114286	0.149	0.007
R13	21:47642584	T	Y/N	130	Tac/Aac	LSS	0.16	0.001	1
R13	10:102765237	G	H/R	364	cAc/cGc	LZTS2	0.47619	1	0
R13	11:65380987	A	E/*	81	Gag/Tag	MAP3K11	0.657143	-	-
R13	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	1	0.748	0
R13	8:6299588	A	S/Y	194	tCt/tAt	MCPH1	0.333333	0.001	0.951
R13	14:21460289	T	S/F	124	tCt/tTt	METTL17	0.497817	0.078	0
R13	22:31328577	G	L/P	901	cTg/cCg	MORC2	0.181818	0.53	0
R13	1:1684453	A	R/W	411	Cgg/Tgg	NADK	0.423729	0.007	0.977
R13	15:75646086	G	K/R	242	aAa/aGa	NEIL1	0.634146	0.089	0.036
R13	10:96099668	C	N/S	597	aAt/aGt	NOC3L	0.538462	0.144	0.711
R13	16:56857758	A	S/N	265	aGt/aAt	NUP93	0.367089	0.102	0.074
R13	2:242054729	C	R/G	1058	Agg/Ggg	PASK	0.444444	0.045	0.649
R13	4:517692	C	W/R	687	Tgg/Cgg	PIGG	0.55	0	1
R13	1:150131221	A	E/K	245	Gaa/Aaa	PLEKHO1	0.162011	0.014	0.361
R13	7:92161810	A	R/K	132	aGa/aAa	RBM48	0.137931	0.211	0.993
R13	1:104084043	A	R/K	280	aGa/aAa	RNPC3	0.108108	0.157	1
R13	1:156703820	C	R/P	219	cGt/cCt	RRNAD1	0.192308	0.082	0
R13	3:160134135	A	E/K	457	Gaa/Aaa	SMC4	0.136364	0.003	0.998
R13	2:55831128	T	E/K	95	Gaa/Aaa	SMEK2	0.15	0.103	0.993
R13	14:88892934	T	T/I	244	aCt/aTt	SPATA7	0.133333	0	1
R13	2:201305434	T	R/C	239	Cgc/Tgc	SPATS2L	0.125	0	1
R13	11:64897551	A	S/F	444	tCt/tTt	SYVN1	0.42	0.53	0
R13	1:150471467	G	S/C	499	tCt/tGt	TARS2	0.5	0	0.996
R13	X:102864284	A	E/K	98	Gaa/Aaa	TCEAL3	0.927536	0.12	1
R13	19:55663279	A	R/W	186	Cgg/Tgg	TNNI3	0.460317	0.013	0.999
R13	1:185089195	G	S/P	720	Tca/Cca	TRMT1L	0.407407	0.042	0.93
R13	9:135277952	T	R/K	86	aGa/aAa	TTF1	0.2	0.429	0.002
R13	8:100883890	G	Q/E	3904	Cag/Gag	VPS13B	0.28	0.142	0.955
R13	7:12383848	T	G/R	1351	Gga/Aga	VWDE	0.384615	0.002	0.993
R13	19:56114232	A	E/K	252	Gag/Aag	ZNF524	0.346154	0.199	0.025
R13	19:42584404	A	R/Q	549	cGg/cAg	ZNF574	0.48	0.015	0.999
R14	9:133730280	C	I/L	116	Atc/Ctc	ABL1	0.568421	0.045	0.01
R14	17:7252446	A	G/D	604	gGc/gAc	ACAP1	0.50489	0.363	0.22
R14	22:40762503	A	V/M	478	Gtg/Atg	ADSL	0.506024	0.363	0.07
R14	9:117113218	A	P/S	1048	Ccc/Tcc	AKNA	0.577586	0.101	0.906
R14	6:24520671	G	M/V	318	Atg/Gtg	ALDH5A1	0.56	0.001	0.984
R14	2:73717069	T	E/D	2660	gaA/gaT	ALMS1	0.68	1	0
R14	22:39448293	G	D/G	313	gAt/gGt	APOBEC3F	0.2	0.497	0.009
R14	16:28508096	C	E/D	569	gaG/gaC	APOBR	0.438356	0	0.969
R14	16:28508352	C	G/R	655	Gga/Cga	APOBR	0.382353	0	0.461
R14	3:5214384	G	L/V	111	Cta/Gta	ARL8B	0.430851	0.001	1
R14	14:93761201	T	D/E	55	gaC/gaA	BTBD7	0.133333	0.31	0.994
R14	22:42089971	A	A/T	241	Gct/Act	C22orf46	0.347826	0.196	0.187
R14	11:73850854	A	P/L	168	cCt/cTt	C2CD3	0.454545	0.009	1
R14	19:47764016	T	R/C	128	Cgt/Tgt	CCDC9	0.65625	0.103	1
R14	1:207498976	T	C/F	163	tGc/tTc	CD55	0.521505	0.001	1
R14	19:42083903	A	R/H	139	cGt/cAt	CEACAM21	0.257426	1	0.181
R14	15:78401655	T	D/N	90	Gac/Aac	CIB2	0.551724	0.128	0.689
R14	13:46090371	G	I/V	635	Att/Gtt	COG3	0.139535	1	0.493
R14	9:137623385	T	E/V	403	gAg/gTg	COL5A1	0.428571	0.153	0.265
R14	7:137565277	T	G/E	503	gGg/gAg	CREB3L2	0.472222	0.028	0.842
R14	21:34963488	A	K/N	310	aaG/aaT	CRYZL1	0.407767	0.026	0.476
R14	1:68948434	T	E/K	353	Gaa/Aaa	DEPDC1	0.15	0.096	0.004
R14	2:39050335	T	D/N	1031	Gat/Aat	DHX57	0.416667	0.01	0.322
R14	19:10904484	T	R/*	361	Cga/Tga	DNM2	0.226277	-	-
R14	15:65804807	C	R/G	45	Cgg/Ggg	DPP8	0.517647	0.371	0.009
R14	7:76109831	T	A/V	2	gCc/gTc	DTX2	0.27907	0.004	0.967
R14	7:73609116	C	G/A	172	gGc/gCc	EIF4H	0.445302	0.384	0.178
R14	16:20851149	C	S/P	486	Tca/Cca	ENSG0000(	0.46875	0.263	0.002
R14	16:22545050	T	P/L	249	cCt/cTt	ENSG0000(	0.258065	0.043	0.945
R14	2:67624701	T	R/C	41	Cgc/Tgc	ETAA1	0.413793	0.09	0.049
R14	12:12022837	G	M/V	315	Atg/Gtg	ETV6	0.458699	0.698	0
R14	3:45017809	G	I/V	14	Atc/Gtc	EXOSC7	0.385621	0.086	0.035
R14	2:96076723	A	D/N	212	Gac/Aac	FAHD2A	0.336449	0	0.991
R14	10:47909775	T	T/M	291	aCg/aTg	FAM21B	0.337079	0.148	0.05
R14	10:47926170	A	D/E	591	gaC/gaA	FAM21B	0.76	0.515	0.121
R14	4:153244092	A	R/W	689	Cgg/Tgg	FBXW7	0.978723	0.029	1
R14	9:115931907	T	E/K	1028	Gaa/Aaa	FKBP15	0.409722	0.063	0.002
R14	5:153792548	C	A/P	496	Gcc/Ccc	GALNT10	0.558824	0.291	0.534
R14	12:120575709	C	Q/R	2130	cAg/cGg	GCN1L1	0.443182	0.501	0.001
R14	17:649535	C	T/S	583	aCt/aGt	GEMIN4	0.175439	0.674	0.001
R14	16:85695354	A	R/Q	748	cGg/cAg	GSE1	0.434211	0.006	0.882
R14	15:28474849	T	E/K	1652	Gaa/Aaa	HERC2	0.142857	0.067	0.629
R14	5:55237518	T	E/K	717	Gaa/Aaa	IL6ST	0.148148	0.021	0.862

R14	1:65310517	T	R/H	724	cGt/cAt	JAK1	0.288184	0	1
R14	9:5944881	T	R/K	791	aGa/aAa	KIAA2026	0.111111	0.397	0.1
R14	12:53005089	T	G/S	337	Ggc/Agc	KRT73	0.491363	0.04	0.922
R14	4:103585975	T	I/K	451	aTa/aAa	MANBA	0.964286	0.01	0.924
R14	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	0.833333	0.748	0
R14	16:1810503	A	R/H	475	cGt/cAt	MAPK8IP3	0.394649	0.002	0.992
R14	X:70355014	T	R/*	1646	Cga/Tga	MED12	0.863158	-	-
R14	11:60235747	A	E/K	234	Gaa/Aaa	MS4A1	0.114583	0.027	0.989
R14	16:56717947	G	S/G	58	Agc/Ggc	MT1X	0.2	0.001	0.643
R14	1:93602454	T	S/F	551	tCc/tTc	MTF2	0.516807	0.002	1
R14	11:67379887	T	Q/H	451	caG/caT	NDUFV1	0.577419	0.09	0
R14	15:75646086	G	K/R	242	aAa/aGa	NEIL1	0.258065	0.089	0.036
R14	14:50295439	T	G/E	440	gGa/gAa	NEMF	0.162162	0.161	1
R14	6:44233163	A	P/L	113	cCg/cTg	NFKBIE	0.28	0.179	0.001
R14	16:15039796	A	R/H	132	cGt/cAt	NPIP	0.240566	0.292	0.004
R14	17:3592841	T	R/Q	233	cGa/cAa	P2RX5	0.606285	0.013	0.996
R14	6:170123969	A	P/L	20	cCa/cTa	PHF10	0.469388	0.01	0.198
R14	17:27237372	G	M/T	744	aTg/aCg	PHF12	0.494898	0.121	0.137
R14	X:133549137	A	R/Q	274	cGa/cAa	PHF6	0.884615	0.003	0.998
R14	1:204438621	C	N/D	104	Aac/Gac	PIK3C2B	0.318841	0.037	0
R14	3:138474815	G	W/R	60	Tgg/Cgg	PIK3CB	0.625	0.001	0.94
R14	17:1438561	G	C/S	187	tGc/tCc	PITPNA	0.527174	0.618	0.281
R14	3:38049343	T	R/H	752	cGc/cAc	PLCD1	0.617647	0.052	0.815
R14	19:40883745	A	R/H	413	cGt/cAt	PLD3	0.514599	0	1
R14	10:79759822	C	T/A	845	Act/Gct	POLR3A	0.272727	0.011	0.913
R14	19:619972	T	G/S	958	Ggc/Agc	POLRMT	0.174157	0.19	0.327
R14	21:43256287	T	A/T	771	Gca/Aca	PRDM15	0.380952	0.013	0.051
R14	6:30525189	A	R/Q	23	cGg/cAg	PRR3	0.534884	0.009	0.006
R14	15:56388713	T	V/M	308	Gtg/Atg	RFX7	0.523077	0.001	0.997
R14	15:56394431	T	R/K	83	aGa/aAa	RFX7	0.108108	0.02	0.952
R14	22:30782077	T	N/K	161	aaC/aaA	RNF215	0.596491	0.007	0.998
R14	19:50154769	A	G/S	375	Ggt/Agt	SCAF1	0.5	0.005	0.011
R14	3:112301555	A	S/N	416	aGt/aAt	SLC35A5	0.518519	0.066	0.001
R14	9:99084312	C	F/L	294	ttC/ttG	SLC35D2	0.548387	0.002	0.988
R14	3:160131304	A	E/K	342	Gaa/Aaa	SMC4	0.113924	0.318	0.001
R14	2:55831128	T	E/K	95	Gaa/Aaa	SMEK2	0.171975	0.103	0.993
R14	1:227935540	G	R/G	80	Agg/Ggg	SNAP47	0.634409	0.088	0.763
R14	5:64036890	T	E/K	67	Gaa/Aaa	SREK1IP1	0.166667	0.087	0.083
R14	16:31049880	T	A/V	205	gCc/gTc	STX4	0.477901	0.004	0.379
R14	4:26638842	A	E/K	102	Gaa/Aaa	TBC1D19	0.142857	0.004	0.999
R14	15:90168114	A	V/M	1525	Gtg/Atg	TICRR	0.258065	0.134	0.012
R14	2:27261050	G	P/A	397	Ccc/Gcc	TMEM214	0.485714	0.314	0
R14	11:5701371	T	V/M	13	Gtg/Atg	TRIM5	0.521739	0.02	0.995
R14	15:43299327	C	K/R	1122	aAa/aGa	UBR1	0.483871	1	0.06
R14	1:19470582	C	P/A	2691	Cct/Gct	UBR4	1	0.397	0.043
R14	6:30888492	C	V/A	482	gTc/gCc	VARS2	0.589286	0.001	1
R14	13:41654782	A	E/K	253	Gaa/Aaa	WBP4	0.138889	0.323	0.001
R14	6:2766251	C	S/T	132	aGc/aCc	WRNIP1	0.432432	0.078	0.001
R14	3:101383533	T	G/E	550	gGa/gAa	ZBTB11	0.141176	0.007	0.999
R14	3:44611497	A	G/R	299	Ggg/Agg	ZKSCAN7	0.26	0.207	0.024
R14	19:19824960	T	G/E	44	gGa/gAa	ZNF14	0.363636	0.051	0.985
R14	12:133683184	C	Y/H	441	Tat/Cat	ZNF140	0.157895	0.046	0.486
R14	19:44803884	C	E/G	6	gAg/gGg	ZNF235	0.130435	0.013	0.361
R14	6:43323454	G	G/R	540	Ggg/Cgg	ZNF318	0.5	0.001	1
R14	19:58198311	G	Y/C	223	tAc/tGc	ZNF551	0.121212	0.262	0.107
R14	19:21281623	G	I/V	17	Att/Gtt	ZNF714	0.142857	0.178	0.005
R15	19:8491635	A	E/K	107	Gag/Aag	02-mar	0.480769	0	0.936
R15	14:23532743	C	E/G	938	gAg/gGg	ACIN1	0.396476	0.015	0.99
R15	1:247014138	C	M/V	1724	Atg/Gtg	AHCTF1	0.416667	0.129	0
R15	6:135639695	T	E/K	1130	Gaa/Aaa	AHI1	0.15	0.01	0.028
R15	2:73799757	G	K/E	3584	Aag/Gag	ALMS1	0.555556	0.002	0.297
R15	13:111545493	T	N/K	191	aaT/aaA	ANKRD10	0.5328	0.018	0.996
R15	22:36055446	A	E/K	279	Gag/Aag	APOL6	0.338028	0.002	0.997
R15	22:36055447	T	E/V	279	gAg/gTg	APOL6	0.338028	0.001	1
R15	14:58814450	A	E/K	420	Gaa/Aaa	ARID4A	0.121212	0.088	0.583
R15	20:36147563	C	Q/R	5	cAg/cGg	BLCAP	0.123894	0.054	0.997
R15	15:91304138	A	G/E	512	gGa/gAa	BLM	0.125	1	0
R15	10:70515146	C	G/A	493	gGc/gCc	CCAR1	0.181818	0.091	0.016
R15	12:102433749	T	S/N	111	aGt/aAt	CCDC53	0.459459	0.199	0.008
R15	1:243362389	T	E/K	202	Gaa/Aaa	CEP170	0.140351	0.148	0.002
R15	6:109484123	A	H/N	445	Cat/Aat	CEP57L1	0.416667	0.018	0.339
R15	16:11001840	A	G/S	831	Ggc/Agc	CIITA	0.375	0.827	0
R15	13:77574791	C	N/T	255	aAc/aCc	CLN5	0.481481	0.29	0.998
R15	1:9804537	T	E/K	384	Gag/Aag	CLSTN1	0.459016	0.111	0.977
R15	13:46090371	G	I/V	635	Att/Gtt	COG3	0.229508	1	0.493
R15	16:67645908	A	S/*	279	tCa/tAa	CTCF	0.214724	-	-
R15	6:35289090	T	S/I	600	aGc/aTc	DEF6	0.481793	0.007	0.005

R15	1:182848519	C	V/A	829	gTg/gCg	DHX9	0.409766	0.001	0.994
R15	3:132166250	A	G/E	77	gGa/gAa	DNAJC13	0.166667	0.131	0.964
R15	7:76109831	T	A/V	2	gCc/gTc	DTX2	0.818182	0.004	0.967
R15	1:184692957	T	E/K	261	Gaa/Aaa	EDEM3	0.148148	0.745	0.045
R15	17:77080009	T	P/L	473	cCg/cTg	ENGASE	0.376518	0.086	0.271
R15	1:220157598	C	L/V	1014	Ttg/Gtg	EPRS	0.555556	0	0.999
R15	1:220195791	G	L/S	338	tTg/tCg	EPRS	0.52381	0.001	0.988
R15	1:43308683	A	G/E	403	gGa/gAa	ERMAP	0.148148	0.003	1
R15	9:133569206	A	A/T	10	Gct/Act	EXOSC2	0.652174	0.581	0.001
R15	6:146126988	A	A/V	185	gCt/gTt	FBXO30	0.393939	0.189	0.999
R15	15:34674220	C	S/A	468	Tca/Gca	GOLGA8A	0.346154	1	0
R15	6:105244588	A	P/L	253	cCg/cTg	HACE1	0.428571	0.002	0.118
R15	1:32757783	G	Q/E	5	Cag/Gag	HDAC1	0.465461	0.888	0.139
R15	6:82920562	C	Y/*	826	taC/taG	IBTK	0.347826	-	-
R15	7:1519184	T	R/H	1404	cGt/cAt	INTS1	0.539326	0.037	0.958
R15	19:17945969	T	R/Q	657	cGg/cAg	JAK3	0.897103	0	0.999
R15	17:40273156	T	G/D	56	gGc/gAc	KAT2A	0.428571	0.091	0.012
R15	12:121890937	A	R/W	649	Cgg/Tgg	KDM2B	0.373913	0	1
R15	2:86697371	G	K/E	522	Aag/Gag	KDM3A	0.523256	0.002	0.948
R15	2:86697372	G	K/R	522	aAg/aGg	KDM3A	0.511905	0.219	0.054
R15	9:5923285	C	D/G	904	gAt/gGt	KIAA2026	0.977273	0.289	0.01
R15	17:43006274	T	E/K	567	Gaa/Aaa	KIF18B	0.12	0.009	0.799
R15	6:33372926	T	R/W	352	Cgg/Tgg	KIFC1	0.490909	0.003	1
R15	14:24785510	C	R/P	218	cGc/cCc	LTB4R	0.559322	0.002	1
R15	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	0.867925	0.748	0
R15	20:3845068	A	A/E	264	gCa/gAa	MAVS	0.512195	0.006	0.98
R15	14:75514346	T	N/K	671	aaC/aaA	MLH3	0.130435	0.017	0.024
R15	21:37741722	A	D/N	686	Gat/Aat	MORC3	0.484848	0.037	0.614
R15	22:37425277	G	P/A	206	Cca/Gca	MPST	0.448454	0.003	0.787
R15	8:90993682	T	E/K	81	Gaa/Aaa	NBN	0.163636	0.009	0.996
R15	1:145311114	A	D/N	605	Gat/Aat	NBPF10	0.650602	0.051	0.406
R15	1:147581611	T	D/N	530	Gat/Aat	NBPF24	0.554455	0.086	0.009
R15	15:75646086	G	K/R	242	aAa/aGa	NEIL1	0.25	0.089	0.036
R15	4:170359366	T	E/K	850	Gaa/Aaa	NEK1	0.157895	0.069	0.003
R15	9:139399332	T	V/E	1604	gTg/gAg	NOTCH1	0.384211	0.001	1
R15	1:6046257	C	F/L	31	ttC/ttG	NPHP4	0.52381	0.064	0.487
R15	3:122880761	A	R/Q	505	cGg/cAg	PDIA5	0.580645	0.014	1
R15	17:43553051	A	T/M	113	aCg/aTg	PLEKHM1	0.170455	0.014	1
R15	1:145597043	T	R/H	361	cGc/cAc	POLR3C	0.470588	0.005	0.999
R15	7:72413036	T	A/V	835	gCg/gTg	POM121	0.313043	0.609	0.265
R15	6:30653198	T	P/T	200	Cca/Aca	PPP1R18	0.544444	0.003	0.153
R15	17:40991318	G	Y/C	202	tAt/tGt	PSME3	0.599222	0	0.803
R15	7:56079537	A	N/I	199	aAt/aTt	PSPH	0.540541	0.411	0.877
R15	1:220327398	T	G/E	1186	gGa/gAa	RAB3GAP2	0.111111	0.085	1
R15	7:102240772	T	A/T	192	Gcc/Acc	RASA4	0.184211	0.535	0.001
R15	6:33162468	A	Q/H	531	caA/caT	RXRB	0.367347	0.009	0.012
R15	3:72427648	A	G/V	192	gGg/gTg	RYBP	0.446667	0.003	0.839
R15	X:18283712	T	G/E	314	gGa/gAa	SCML2	0.129032	0.002	1
R15	5:134044419	C	M/I	856	atG/atC	SEC24A	0.558824	0.356	0
R15	3:101047527	T	E/K	920	Gag/Aag	SENP7	0.53719	0.114	0.031
R15	22:38051584	A	A/T	667	Gct/Act	SH3BP1	0.679245	0.068	0.18
R15	2:253011	G	I/L	36	Att/Ctt	SH3YL1	0.7	0.003	0.198
R15	17:79226324	A	A/V	539	gCg/gTg	SLC38A10	0.681592	0.135	0.088
R15	16:89620301	T	A/V	679	gCg/gTg	SPG7	0.475336	0.299	0.002
R15	5:110843124	T	G/D	3	gGc/gAc	STARD4	0.434426	0.339	0
R15	12:57500101	T	E/K	185	Gag/Aag	STAT6	0.467593	0.614	0.324
R15	12:118599751	T	Y/N	661	Tac/Aac	TAOK3	0.528	0.094	0.009
R15	12:110344434	A	E/K	172	Gaa/Aaa	TCHP	0.121212	0.03	0.945
R15	4:83839359	A	R/Q	665	cGa/cAa	THAP9	0.631579	0.447	0
R15	1:36762207	G	D/E	713	gaT/gaG	THRAP3	0.55	0.181	0.712
R15	11:61136155	G	K/E	155	Aag/Gag	TMEM138	0.571429	0.232	0
R15	22:50682439	C	C/W	150	tgC/tgG	TUBGCP6	0.348837	0.099	0.999
R15	9:86294925	A	S/I	159	aGt/aTt	UBQLN1	0.57265	0.033	0.999
R15	1:229772788	A	A/T	810	Gct/Act	URB2	0.257143	0.005	0.964
R15	7:73098130	A	R/S	28	Cgc/Agc	WBSCR22	0.292359	1	0.001
R15	17:1635641	T	R/W	343	Cgg/Tgg	WDR81	0.92	0.001	1
R15	13:46577367	C	Y/C	284	tAt/tGt	ZC3H13	0.464286	0.012	0.993
R15	2:43452812	T	P/H	44	cCc/cAc	ZFP36L2	0.371743	0.007	0.997
R15	19:19824960	T	G/E	44	gGa/gAa	ZNF14	0.166667	0.051	0.985
R15	12:133682932	C	Y/H	357	Tat/Cat	ZNF140	0.133333	0.006	0.993
R15	12:133683184	C	Y/H	441	Tat/Cat	ZNF140	0.107143	0.046	0.486
R15	19:44590112	C	I/L	161	Atc/Ctc	ZNF284	0.2	0.655	0.005
R15	15:64966629	C	K/Q	526	Aag/Cag	ZNF609	0.464789	0.003	0.672
R15	7:99662148	C	Y/H	444	Tac/Cac	ZSCAN21	0.125	0	0.999
R16	11:94602416	A	P/T	848	Ccc/Acc	AMOTL1	0.482759	0.62	0
R16	11:62123866	A	L/Q	87	cTg/cAg	ASRGL1	0.5	0.001	0.95
R16	3:63981345	C	K/T	616	aAa/aCa	ATXN7	0.540984	0.05	0.992

R16	15:91304138	A	G/E	512	gGa/gAa	BLM	0.130435	1	0
R16	22:50170756	A	T/M	885	aCg/aTg	BRD1	0.510204	0.045	1
R16	7:2984040	G	K/Q	164	Aag/Cag	CARD11	0.527778	0.578	0.08
R16	9:70473453	A	S/L	171	tCa/tTa	CBWD5	0.136364	0.001	0.866
R16	6:44390542	T	Q/L	467	cAg/cTg	CDC5L	0.358209	0.323	0.067
R16	1:193172974	T	P/L	341	cCa/cTa	CDC73	0.537037	0.159	0.01
R16	11:46817295	G	I/T	500	aTa/aCa	CKAP5	0.42	0.153	0.001
R16	12:22218142	C	V/A	401	gTt/gCt	CMAS	0.12	1	0
R16	19:54647396	T	R/W	57	Cgg/Tgg	CNOT3	0.462963	0	1
R16	6:43006639	T	Q/K	1461	Cag/Aag	CUL7	0.30303	0.051	0.425
R16	1:20982195	C	N/D	161	Aac/Gac	DDOST	0.456	0.013	0.924
R16	7:44606077	A	K/N	512	aaG/aaT	DDX56	0.581395	0.255	0.079
R16	11:46389234	G	F/L	290	ttC/ttG	DGKZ	0.496454	0.519	0
R16	5:54586070	T	E/K	295	Gaa/Aaa	DHX29	0.16	0.013	0.044
R16	3:132166250	A	G/E	77	gGa/gAa	DNAJC13	0.238095	0.131	0.964
R16	1:184692957	T	E/K	261	Gaa/Aaa	EDEM3	0.135135	0.745	0.045
R16	12:93171428	T	G/E	1302	gGa/gAa	EEA1	0.6	0.007	0.851
R16	15:83102884	G	N/D	187	Aat/Gat	ENSG0000(	0.54386	0.076	0.862
R16	17:74003659	T	R/H	1876	cGc/cAc	EVPL	0.2	0.003	1
R16	10:47909775	T	T/M	291	aCg/aTg	FAM21B	0.6	0.148	0.05
R16	14:39868847	G	I/T	514	aTt/aCt	FBXO33	0.386364	0.115	0.058
R16	3:71247489	A	A/V	15	gCc/gTc	FOXP1	0.424242	0.166	0.003
R16	11:62396312	G	Q/H	725	caG/caC	GANAB	0.514523	0.099	0.001
R16	15:34677275	T	A/T	181	Gcc/Acc	GOLGA8A	0.428571	0.451	0.086
R16	15:34823496	T	A/T	181	Gcc/Acc	GOLGA8B	0.416667	0.452	0.196
R16	15:28771601	C	L/V	106	Ctg/Gtg	GOLGA8G	0.609756	0.018	0.996
R16	11:65480455	G	P/A	104	Ccc/Gcc	KAT5	0.431193	0.045	0.972
R16	16:15702212	T	R/H	1372	cGt/cAt	KIAA0430	0.506173	0.003	1
R16	7:23191727	A	E/K	279	Gaa/Aaa	KLHL7	0.490909	0.276	0.015
R16	19:55107147	G	I/M	235	atA/atG	LILRA1	0.6	0.042	0.283
R16	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	0.980769	0.748	0
R16	16:4731766	C	K/N	449	aaG/aaC	MGRN1	0.547945	0.003	0.64
R16	10:135207768	T	A/V	15	gCc/gTc	MTG1	0.581395	0.297	0.016
R16	1:11850764	G	Q/H	648	caG/caC	MTHFR	0.517241	0.333	0
R16	22:36723527	C	E/G	166	gAa/gGa	MYH9	0.515284	0	0.944
R16	12:54903650	T	L/F	206	Ctc/Ttc	NCKAP1L	0.545455	0.585	0.094
R16	17:15952253	A	E/*	2148	Gag/Tag	NCOR1	0.208955	-	-
R16	4:2010545	A	L/F	48	Ctc/Ttc	NELFA	0.640625	0	0.998
R16	16:21422267	C	T/S	178	aCc/aGc	NPIPL3	0.252809	0.008	0.736
R16	9:135102294	A	E/K	306	Gag/Aag	NTNG2	0.368421	0.014	0.07
R16	1:86826150	T	E/K	376	Gaa/Aaa	ODF2L	0.131579	0.376	0.48
R16	13:25029287	T	E/K	876	Gaa/Aaa	PARP4	0.56338	0.009	1
R16	2:74732276	G	R/S	258	agG/agC	PCGF1	0.5	0	0.909
R16	7:99971954	G	Q/E	118	Cag/Gag	PILRA	0.3	1	0
R16	10:72360630	T	I/N	10	aTc/aAc	PRF1	0.429907	0.008	0.718
R16	9:134361541	T	T/M	1943	aCg/aTg	PRRC2B	0.603448	0.022	0.999
R16	18:20564893	T	P/S	217	Cct/Tct	RBBP8	0.458333	0.213	0.11
R16	3:51430452	A	R/Q	541	cGa/cAa	RBM15B	0.56875	0.003	1
R16	21:45209571	A	E/K	21	Gag/Aag	RRP1	0.428571	NA	0.998
R16	11:64811781	C	D/A	266	gAt/gCt	SAC3D1	0.361702	0.35	0.336
R16	15:90771835	A	R/Q	820	cGg/cAg	SEMA4B	0.444444	0	1
R16	12:122257543	G	L/V	1175	Ctg/Gtg	SETD1B	0.463415	0.719	0.075
R16	7:100463812	T	A/V	777	gCg/gTg	SLC12A9	0.402597	0.31	0.835
R16	2:55831128	T	E/K	95	Gaa/Aaa	SMEK2	0.159091	0.103	0.993
R16	5:35659293	T	A/V	384	gCt/gTt	SPEF2	0.136364	0.003	1
R16	1:109294890	G	T/A	21	Aca/Gca	STXBP3	0.625641	0.37	0
R16	2:98430483	C	N/S	523	aAt/aGt	TMEM131	0.444444	0	0.999
R16	15:42556365	T	E/K	110	Gaa/Aaa	TMEM87A	0.195122	0.727	0.026
R16	14:103996511	C	V/L	66	Gtg/Ctg	TRMT61A	0.483871	0.15	0.022
R16	3:179426580	C	C/R	214	Tgc/Cgc	USP13	0.645161	0	1
R16	14:75279408	T	R/*	1614	Cga/Tga	YLPM1	0.403509	-	-
R16	19:9267326	T	E/*	22	Gaa/Taa	ZNF317	0.472222	-	-
R17	19:15508044	T	A/T	485	Gca/Aca	AKAP8L	0.52657	0.229	0.999
R17	19:49843580	T	R/C	281	Cgt/Tgt	CD37	0.52766	0	0.99
R17	19:4423345	A	E/K	421	Gaa/Aaa	CHAF1A	0.113636	0.009	1
R17	2:74154044	T	A/S	3	Gcg/Tcg	DGUOK	0.535714	0.027	0.036
R17	17:4859264	T	Q/L	298	cAg/cTg	ENO3	0.15873	0	1
R17	3:155655477	G	E/G	693	gAg/gGg	GMPS	0.208955	0	1
R17	5:176308082	A	R/C	922	Cgt/Tgt	HK3	0.479107	0.002	0.004
R17	11:309070	A	A/T	102	Gcc/Acc	IFITM2	0.447016	0.001	0.552
R17	14:23239788	G	Y/C	263	tAc/tGc	OXA1L	0.666667	0.017	0.808
R17	19:1481810	T	R/H	739	cGt/cAt	PCSK4	0.492537	0.138	0.878
R17	19:804536	G	A/G	147	gCc/gGc	PTBP1	0.65	0.025	0.266
R17	14:73572568	A	E/K	386	Gaa/Aaa	RBM25	0.142857	0.419	0.386
R17	19:47226114	G	M/T	627	aTg/aCg	STRN4	0.530612	0.341	0
R17	X:101770019	T	E/K	25	Gaa/Aaa	TMSB15A	0.130435	0.004	0.059
R17	1:184023513	C	I/T	54	aTa/aCa	TSEN15	0.136364	0.02	0.193

R17	2:74687608	T	R/C	204	Cgc/Tgc	WBP1	0.497788	0	1
R17	19:42585226	A	S/Y	823	tCc/tAc	ZNF574	0.392157	0.007	0.891
R18	3:183906758	C	M/T	320	aTg/aCg	ABCF3	0.15	0.567	0.984
R18	12:50475424	G	T/A	573	Acc/Gcc	ASIC1	0.16129	1	0.144
R18	2:160182386	T	G/E	1996	gGa/gAa	BAZ2B	0.125	0.073	0.999
R18	17:40970331	A	E/D	197	gaG/gaT	BECN1	0.529412	0.01	0.987
R18	19:49141380	G	R/P	328	cGc/cCc	CA11	0.484375	0	0.989
R18	19:44128309	C	I/M	338	atA/atG	CADM4	0.65	0.004	0.845
R18	20:60511870	A	G/S	874	Ggc/Agc	CDH4	0.565217	0.006	1
R18	1:153941406	A	G/S	59	Ggc/Agc	CREB3L4	0.605263	0.156	1
R18	2:242684260	T	P/L	274	cCc/cTc	D2HGDH	0.433962	0.134	0.001
R18	4:71891557	T	R/W	192	Cgg/Tgg	DCK	0.658537	0	1
R18	17:4859264	T	Q/L	298	cAg/cTg	ENO3	0.122449	0	1
R18	7:148506462	T	R/S	684	Cgc/Agc	EZH2	0.384298	0.001	0.001
R18	19:10421311	T	D/N	135	Gac/Aac	FDX1L	0.588235	0	1
R18	16:15978045	T	E/K	16	Gaa/Aaa	FOPNL	0.142857	0.008	0.985
R18	16:67709272	T	R/H	315	cGc/cAc	GFOD2	0.5	0.002	1
R18	12:102142879	G	Q/H	1231	caG/caC	GNPTAB	0.671053	0.007	1
R18	10:96361321	C	M/T	820	aTg/aCg	HELLS	0.142857	0.587	0
R18	19:41800280	G	T/S	435	aCc/aGc	HNRNPUL1	0.436508	0.056	0.88
R18	6:31784509	A	L/M	326	Ctg/Atg	HSPA1A	0.109756	1	0.003
R18	19:17945970	A	R/W	657	Cgg/Tgg	JAK3	0.444444	0	1
R18	8:48508458	A	E/K	395	Gaa/Aaa	KIAA0146	0.136364	0.507	0.001
R18	9:139750234	A	V/M	508	Gtg/Atg	MAMDC4	0.35	0.037	0.974
R18	1:117945049	A	E/K	182	Gaa/Aaa	MAN1A2	0.132075	0.262	0.002
R18	17:4635097	A	E/K	38	Gaa/Aaa	MED11	0.133333	0.01	0.77
R18	1:145304565	T	I/F	500	Atc/Ttc	NBPF10	0.369565	0.173	0.75
R18	1:147581611	T	D/N	530	Gat/Aat	NBPF24	0.823529	0.086	0.009
R18	12:6635260	G	N/S	792	aAt/aGt	NCAPD2	0.487179	0	0.998
R18	15:75646086	G	K/R	242	aAa/aGa	NEIL1	0.873684	0.089	0.036
R18	3:25775425	T	A/T	400	Gcc/Acc	NGLY1	0.416107	0.274	0.005
R18	1:86826150	T	E/K	376	Gaa/Aaa	ODF2L	0.178571	0.376	0.48
R18	20:61436329	A	D/N	40	Gac/Aac	OGFR	0.425	0.025	0.968
R18	2:42990611	G	C/R	237	Tgc/Cgc	OXER1	0.695652	0.001	1
R18	5:67592108	T	R/*	642	Cga/Tga	PIK3R1	0.345455	-	-
R18	16:2149662	A	R/W	3345	Cgg/Tgg	PKD1	0.162162	0.001	0.998
R18	8:144995351	G	C/R	3017	Tgc/Cgc	PLEC	0.306122	0.507	0
R18	14:50122544	G	I/T	258	aTt/aCt	POLE2	0.7	0.186	0
R18	X:48370767	T	R/W	143	Cgg/Tgg	PORCN	0.65	0.001	0.999
R18	4:106370513	G	K/N	105	aaA/aaC	PPA2	0.586957	0	1
R18	5:64859204	A	E/K	23	Gaa/Aaa	PPWD1	0.15	0.266	0
R18	2:136432995	G	N/S	714	aAc/aGc	R3HDM1	0.45	0.745	0.004
R18	16:570231	A	R/H	657	cGc/cAc	RAB11FIP3	0.5	0.026	0.877
R18	11:32120070	C	V/A	208	gTt/gCt	RCN1	0.153846	0.031	0.514
R18	1:211486094	G	I/V	370	Att/Gtt	RCOR3	0.481481	0.047	0.768
R18	12:2997411	T	E/V	168	gAa/gTa	RHNO1	0.431034	0.221	0
R18	3:18390798	C	Y/C	719	tAt/tGt	SATB1	0.369565	0.009	0.998
R18	20:34541783	C	R/G	142	Cgc/Ggc	SCAND1	0.439024	0.005	0.959
R18	6:134491489	T	V/I	500	Gtc/Atc	SGK1	0.56	1	0
R18	22:24210704	T	R/C	56	Cgt/Tgt	SLC2A11	0.619048	0	1
R18	9:94800627	G	V/A	386	gTg/gCg	SPTLC1	0.166667	0.783	0
R18	5:179290478	C	S/R	1241	agT/agG	TBC1D9B	0.459459	0	0.994
R18	16:89967175	A	Q/K	452	Cag/Aag	TCF25	0.496855	0.056	0.784
R18	18:260212	T	E/K	117	Gaa/Aaa	THOC1	0.173913	0	0.977
R18	X:122747342	T	E/K	1529	Gaa/Aaa	THOC2	0.119565	0.137	0.039
R18	1:202976628	A	R/H	12	cGc/cAc	TMEM183A	0.571429	0.234	0
R18	2:218669252	A	P/L	1713	cCc/cTc	TNS1	0.243243	0.005	1
R18	9:132640705	G	K/R	833	aAg/aGg	USP20	0.368421	0.534	0.014
R18	19:44732632	C	F/L	32	Ttc/Ctc	ZNF227	0.125	0	0.006
R18	16:2051089	A	P/S	373	Ccc/Tcc	ZNF598	0.380282	0.321	0.002
R18	16:2053689	C	P/R	88	cCc/cGc	ZNF598	0.384615	0.321	0.015
R19	3:128627848	C	M/T	464	aTg/aCg	ACAD9	0.371795	0.112	0.087
R19	16:67692032	A	P/S	441	Ccc/Tcc	ACD	0.467532	0.11	0.352
R19	10:5037999	C	D/G	210	gAc/gGc	AKR1C2	0.15	0.276	0.427
R19	2:112530044	T	D/N	1865	Gat/Aat	ANAPC1	0.517241	0.225	0.002
R19	18:9255426	A	E/K	721	Gaa/Aaa	ANKRD12	0.133333	0.007	0.877
R19	14:24033773	A	R/W	307	Cgg/Tgg	AP1G2	0.491429	0	1
R19	2:219099087	T	V/L	79	Gtg/Ttg	ARPC2	0.501018	0.218	0
R19	11:72533123	G	R/G	143	Cga/Gga	ATG16L2	0.428571	0.043	0.21
R19	7:6639519	G	P/A	214	Cca/Gca	C7orf26	0.562162	0.051	0.705
R19	15:44671938	G	I/V	285	Atc/Gtc	CASC4	0.47482	0.741	0.001
R19	9:70489947	C	K/R	41	aAg/aGg	CBWD5	0.333333	0.302	0.005
R19	6:109467966	G	I/V	56	Att/Gtt	CEP57L1	0.521739	0.548	0.008
R19	18:12678320	A	P/S	471	Ccc/Tcc	CEP76	0.72	0.165	0.006
R19	17:40125811	T	R/C	379	Cgc/Tgc	CNP	0.419847	0.005	0.998
R19	11:67205882	G	E/Q	479	Gag/Cag	CORO1B	0.587302	0.538	0.008
R19	5:172537692	A	E/K	529	Gaa/Aaa	CREBRF	0.181818	0	0.996

R19	12:31244689	A	A/T	376	Gcc/Acc	DDX11	0.254355	0.367	0.986
R19	1:197509099	T	A/T	504	Gct/Act	DENND1B	0.433333	0.489	0.001
R19	7:76109831	T	A/V	2	gCc/gTc	DTX2	0.461538	0.004	0.967
R19	1:1277490	A	T/S	137	Acg/Tcg	DVL1	0.225	0.196	0.105
R19	3:183888259	C	E/Q	623	Gag/Cag	DVL3	0.586667	0.43	0.997
R19	3:73111324	T	P/L	31	cCt/cTt	EBLN2	0.608696	0	0.994
R19	17:4859264	T	Q/L	298	cAg/cTg	ENO3	0.134146	0	1
R19	17:73602027	A	R/H	347	cGc/cAc	ENSG0000(	0.503145		0.004
R19	4:122725789	T	R/C	133	Cgt/Tgt	EXOSC9	0.464516	0	0.995
R19	X:154115673	C	V/L	342	Gtg/Ctg	F8A1	0.209877	0.298	0.274
R19	5:74096834	T	S/Y	325	tCc/tAc	FAM169A	0.421053	0.002	0.999
R19	10:47909775	T	T/M	291	aCg/aTg	FAM21B	0.321429	0.148	0.05
R19	3:13612928	C	H/P	358	cAt/cCt	FBLN2	0.631579	0.768	0
R19	1:110121971	C	D/A	150	gAt/gCt	GNAI3	0.504673	0	1
R19	3:121383457	T	R/Q	3217	cGg/cAg	GOLGB1	0.434783	0.006	1
R19	6:30876901	T	V/L	30	Gta/Tta	GTF2H4	0.333333	0.162	0.004
R19	15:28474849	T	E/K	1652	Gaa/Aaa	HERC2	0.125	0.067	0.629
R19	10:64952707	T	E/K	2023	Gaa/Aaa	JMJD1C	0.132075	0.001	0.998
R19	19:51009818	C	Q/R	95	cAg/cGg	JOSD2	0.384615	0.567	0.451
R19	17:39919401	T	R/H	444	cGt/cAt	JUP	0.374332	0.059	0.171
R19	12:105538103	A	D/E	683	gaT/gaA	KIAA1033	0.383333	0.041	0.111
R19	7:129769377	A	M/I	360	atG/atA	KLHDC10	0.705882	0.017	0.828
R19	2:211302595	A	P/L	231	cCc/cTc	LANCL1	0.466667	0.016	0.998
R19	4:6612945	G	R/G	835	Cgc/Ggc	MAN2B2	0.491803	0.324	0
R19	1:232943304	G	D/E	703	gaT/gaG	MAP10	0.394737	0.489	0.952
R19	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	0.914286	0.748	0
R19	19:45783879	A	R/Q	388	cGg/cAg	MARK4	0.555556	0.055	0.971
R19	6:109766459	C	A/G	941	gCc/gGc	MICAL1	0.48366	0.11	0.201
R19	12:49427431	A	S/F	3686	tCt/tTt	MLL2	0.142857	0	0.978
R19	3:15106697	A	P/L	2	cCc/cTc	MRPS25	0.514493	0.05	0.007
R19	1:146053290	T	E/K	93	Gaa/Aaa	NBPF11	0.85	0.426	0.976
R19	1:148756607	T	V/L	646	Gtg/Ttg	NBPF16	0.913043	0.031	0.094
R19	15:75646086	G	K/R	242	aAa/aGa	NEIL1	0.675676	0.089	0.036
R19	16:68260277	A	M/K	1044	aTg/aAg	NFATC3	0.45	0	0.987
R19	9:95887312	T	A/T	113	Gcc/Acc	NINJ1	0.440252	0.397	0.967
R19	16:69782903	C	K/R	215	aAg/aGg	NOB1	0.391144	0.23	0.001
R19	16:15223766	G	V/L	271	-	NPIPP1	0.4	1	0.945
R19	2:183998313	G	Q/R	120	cAg/cGg	NUP35	0.444444	0.404	0.006
R19	17:45893549	T	G/D	348	gGc/gAc	OSBPL7	0.54902	0.415	0.012
R19	17:1946188	G	F/L	158	ttC/ttG	OVCA2	0.478873	0.711	0
R19	1:154920119	C	Q/R	246	cAg/cGg	PBXIP1	0.446721	0.378	0.004
R19	4:660338	G	K/E	763	Aag/Gag	PDE6B	0.4125	0.002	0.994
R19	1:204400891	C	T/A	1396	Act/Gct	PIK3C2B	0.307692	0.36	0
R19	9:37495928	T	E/*	295	Gaa/Taa	POLR1E	0.26087	-	-
R19	2:48681823	C	R/S	72	agG/agC	PPP1R21	0.6	0.002	1
R19	1:97235421	A	G/E	93	gGa/gAa	PTBP2	0.128205	0.017	0.098
R19	3:47454607	T	R/W	1615	Cgg/Tgg	PTPN23	0.525641	0.009	0.999
R19	9:112166792	G	L/S	630	tTg/tCg	PTPN3	0.630435	0.024	0.997
R19	9:127975727	T	T/I	97	aCa/aTa	RABEPK	0.367816	0.114	0.664
R19	7:102131486	T	V/I	639	Gtc/Atc	RASA4B	0.210526	0.513	0.087
R19	22:24036094	C	L/P	282	cTc/cCc	RGL4	0.47619	0	1
R19	15:41037246	T	D/N	246	Gac/Aac	RMDN3	0.5	0	1
R19	11:124749235	A	P/Q	1228	cCa/cAa	ROBO3	0.675676	0.006	0.856
R19	X:18283712	T	G/E	314	gGa/gAa	SCML2	0.113636	0.002	1
R19	3:47651812	A	E/D	929	gaA/gaT	SMARCC1	0.492212	0.005	0.999
R19	12:121220497	A	L/F	155	Ctc/Ttc	SPPL3	0.483871	0.169	0.001
R19	1:206566161	C	R/P	201	cGg/cCg	SRGAP2	0.227273	0.086	0.301
R19	X:123680790	T	R/Q	862	cGa/cAa	TENM1	0.15	0.032	1
R19	19:11453663	T	S/N	133	aGc/aAc	TMEM205	0.333333	0.261	0.003
R19	X:100274042	T	A/T	436	Gcc/Acc	TRMT2B	1	0.062	0.877
R19	1:119619002	T	E/K	107	Gaa/Aaa	WARS2	0.136364	0.507	0.002
R19	20:21321449	G	P/A	457	Ccg/Gcg	XRN2	0.442308	1	0.001
R20	11:47267289	C	P/A	132	Ccg/Gcg	ACP2	0.48	0.011	0.005
R20	10:51769186	A	W/*	411	tGg/tAg	AGAP6	0.475	-	-
R20	10:51464628	A	R/C	610	Cgc/Tgc	AGAP7	0.251534	0.011	0.99
R20	19:15465757	A	A/V	683	gCa/gTa	AKAP8	0.457364	0.005	0.001
R20	11:94592732	C	A/P	663	Gcc/Ccc	AMOTL1	0.142857	0.007	0.132
R20	10:5929909	A	R/*	146	Cga/Tga	ANKRD16	0.268293	-	-
R20	10:27342311	T	D/N	525	Gac/Aac	ANKRD26	0.12	0.004	0.093
R20	22:39448293	G	D/G	313	gAt/gGt	APOBEC3F	0.2	0.497	0.009
R20	3:142234343	C	Q/R	1466	cAg/cGg	ATR	0.352941	0.373	0.017
R20	14:104026280	A	A/S	449	Gcc/Tcc	BAG5	0.5625	0.036	0.014
R20	1:32193164	A	R/W	1539	Cgg/Tgg	BAI2	0.595745	0.002	0.959
R20	1:32198655	T	V/D	1181	gTc/gAc	BAI2	0.520548	0.004	0.853
R20	2:160294903	G	I/L	402	Ata/Cta	BAZ2B	0.5	0.13	0
R20	9:136901387	G	E/A	568	gAg/gCg	BRD3	0.467391	0.184	0.032
R20	11:36631738	A	E/K	29	Gag/Aag	C11orf74	0.142857	0.01	1

R20	14:91671112	G	I/V	498	Ata/Gta	C14orf159	0.425532	0.147	0.17
R20	9:27548412	T	G/E	423	gGa/gAa	C9orf72	0.142857	0.076	1
R20	3:105438895	G	R/P	468	cGa/cCa	CBLB	0.655172	0.004	0.994
R20	7:39990344	G	Q/R	35	cAg/cGg	CDK13	0.233333	0	0.004
R20	2:169417768	T	R/C	115	Cgc/Tgc	CERS6	0.5	0.182	0.148
R20	12:6703741	T	G/S	733	Ggc/Agc	CHD4	0.525952	0.002	1
R20	13:46090371	G	I/V	635	Att/Gtt	COG3	0.135417	1	0.493
R20	8:145621670	A	R/*	958	Cga/Tga	CPSF1	0.530303	-	-
R20	16:3778228	A	M/L	2274	Atg/Ttg	CREBBP	0.432836	0.153	0
R20	10:12162802	A	R/Q	892	cGg/cAg	DHTKD1	0.613636	0.002	1
R20	17:40263457	A	T/I	76	aCc/aTc	DHX58	0.12	0.107	0.841
R20	19:10279006	A	P/L	268	cCa/cTa	DNMT1	0.403974	1	0
R20	21:38600623	C	C/G	187	Tgt/Ggt	DSCR3	0.46875	0.004	0.993
R20	7:76109831	T	A/V	2	gCc/gTc	DTX2	0.594595	0.004	0.967
R20	14:104120904	A	M/I	1	atG/atA	ENSG0000(	0.442105	0.347	0.318
R20	5:172362300	T	R/I	251	aGa/aTa	ERGIC1	0.478372	0.112	0.017
R20	6:6152089	C	L/V	668	Ctg/Gtg	F13A1	0.424242	0.299	0.644
R20	11:126126554	T	L/F	263	ttG/ttT	FAM118B	0.522388	0	0.999
R20	2:24384404	A	C/S	239	Tgt/Agt	FAM228B	0.136364	0.916	0.001
R20	15:34823496	T	A/T	181	Gcc/Acc	GOLGA8B	0.4	0.452	0.196
R20	15:34825105	C	A/G	76	gCa/gGa	GOLGA8B	0.302326	0.167	0.933
R20	17:46627965	C	T/A	343	Acg/Gcg	HOXB3	0.465863	0.055	0.982
R20	19:16268238	T	S/L	231	tCg/tTg	HSH2D	0.675926	0.004	0.509
R20	1:63944498	T	R/K	64	aGa/aAa	ITGB3BP	0.112676	0.078	0.747
R20	1:169941697	C	N/S	647	aAt/aGt	KIFAP3	0.369565	0.673	0
R20	16:25151547	T	T/M	128	aCg/aTg	LCMT1	0.431034	0.003	0.996
R20	3:66436625	C	S/R	523	agC/agG	LRIG1	0.486275	0.069	0.965
R20	1:235926145	C	K/R	2043	aAg/aGg	LYST	0.350427	0.056	0.998
R20	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	1	0.748	0
R20	17:4444786	G	N/T	1090	aAc/aCc	MYBBP1A	0.465649	0.175	0.9
R20	6:16130909	A	A/D	70	gCc/gAc	MYLIP	0.777778	0.338	0.505
R20	1:145311114	A	D/N	605	Gat/Aat	NBPF10	0.5	0.051	0.406
R20	1:146054497	A	V/F	24	Gtt/Ttt	NBPF11	0.243243	0.002	0.972
R20	1:147581611	T	D/N	530	Gat/Aat	NBPF24	0.370861	0.086	0.009
R20	1:160313229	T	R/W	15	Cgg/Tgg	NCSTN	0.363636	0.001	0.002
R20	15:75646086	G	K/R	242	aAa/aGa	NEIL1	0.558442	0.089	0.036
R20	5:37049329	T	Q/*	2294	Cag/Tag	NIPBL	0.299065	-	-
R20	16:3592263	C	N/S	1058	aAt/aGt	NLRC3	0.977778	0.142	0.999
R20	10:15177386	A	D/V	93	gAt/gTt	NMT2	0.695364	0.001	0.955
R20	9:139399389	G	L/P	1585	cTg/cCg	NOTCH1	0.542945	0.001	0.999
R20	19:15299866	T	G/R	438	Ggg/Agg	NOTCH3	0.418327	0.031	0.888
R20	16:21422267	C	T/S	178	aCc/aGc	NPIPL3	0.288934	0.008	0.736
R20	5:176636958	A	A/T	520	Gca/Aca	NSD1	0.395062	0.323	0.001
R20	12:58109878	T	S/L	265	tCa/tTa	OS9	0.455172	0.003	0.917
R20	6:108372377	T	T/K	214	aCa/aAa	OSTM1	0.107143	0.56	0.028
R20	1:233397853	A	P/S	140	Cct/Tct	PCNXL2	0.506667	0.004	0.877
R20	1:233398888	C	I/V	59	Att/Gtt	PCNXL2	0.356164	1	0.002
R20	7:99971949	G	Q/R	116	cAg/cGg	PILRA	0.291667	1	0
R20	7:99971954	G	Q/E	118	Cag/Gag	PILRA	0.217391	1	0
R20	1:97235421	A	G/E	93	gGa/gAa	PTBP2	0.194444	0.017	0.098
R20	1:158914735	T	H/L	421	cAt/cTt	PYHIN1	0.882353	1	0
R20	1:158914742	T	K/N	423	aaA/aaT	PYHIN1	0.924528	0.501	0
R20	3:120408675	T	D/N	236	Gac/Aac	RABL3	0.40625	0.008	0.455
R20	12:114374926	A	L/F	652	Ctc/Ttc	RBM19	0.53	0	1
R20	7:92161810	A	R/K	132	aGa/aAa	RBM48	0.15	0.211	0.993
R20	16:74670447	T	S/N	408	aGt/aAt	RFWD3	0.456522	1	0
R20	2:107051195	T	H/Q	652	caC/caA	RGPD3	0.509009	0.237	0.008
R20	7:33148951	T	A/T	12	Gct/Act	RP9	0.684211	0.309	0.025
R20	3:133941335	C	Y/C	91	tAc/tGc	RYK	0.521127	0.002	0.003
R20	3:45751124	T	M/I	156	atG/atT	SACM1L	0.454545	0.183	0.06
R20	4:8230255	C	F/S	945	tTc/tCc	SH3TC1	0.526316	0.103	0.86
R20	22:39137529	T	D/E	372	gaC/gaA	SUN2	0.512195	0.154	0.435
R20	12:106715297	T	R/W	150	Cgg/Tgg	TCP11L2	0.534884	0	0.979
R20	2:43506906	C	T/R	1765	aCa/aGa	THADA	0.521739	0.007	0.988
R20	5:140023548	C	T/P	368	Act/Cct	TMCO6	0.5	0.007	1
R20	8:94776117	T	L/F	152	Ctc/Ttc	TMEM67	0.263158	0.05	0.343
R20	9:32542716	A	R/C	603	Cgt/Tgt	TOPORS	0.417266	0.039	0.009
R20	19:34935965	A	R/H	237	cGt/cAt	UBA2	0.514523	0.002	0.968
R20	10:122626206	A	V/I	374	Gta/Ata	WDR11	0.486486	1	0
R20	X:117582934	A	R/K	909	aGa/aAa	WDR44	0.121951	0.905	0
R20	3:49050669	A	G/R	568	Ggg/Agg	WDR6	0.517928	0	1
R20	8:124453552	G	K/R	172	aAa/aGa	WDYHV1	0.44186	0.108	0.52
R20	12:970351	T	A/V	598	gCt/gTt	WNK1	0.406667	0.488	0.668
R20	20:18287007	A	E/K	63	Gaa/Aaa	ZNF133	0.2	0.025	0.069
R20	19:12243437	C	R/G	522	Cga/Gga	ZNF20	0.25	0.396	0.915
R20	20:52193571	A	E/*	578	Gag/Tag	ZNF217	0.563452	-	-
R21	3:141011964	T	R/C	454	Cgc/Tgc	ACPL2	0.71875	0.002	0.947

R21	12:49168220	T	V/I	750	Gtc/Atc	ADCY6	0.4	1	0.007
R21	2:112621462	G	V/A	281	gTt/gCt	ANAPC1	0.461538	0.469	0
R21	14:24034827	T	D/E	243	gaC/gaA	AP1G2	0.462963	0	0.999
R21	22:39448293	G	D/G	313	gAt/gGt	APOBEC3F	0.2	0.497	0.009
R21	3:48955853	C	R/G	244	Cga/Gga	ARIH2OS	0.380952	NA	0.001
R21	3:35835280	T	L/F	757	Ctc/Ttc	ARPP21	0.492063	0.013	0.999
R21	4:47570987	T	G/V	996	gGa/gTa	ATP10D	0.416667	0.084	0.187
R21	19:49458967	A	R/Q	37	cGa/cAa	BAX	0.42246	0.252	0.38
R21	7:72861707	C	N/S	1244	aAc/aGc	BAZ1B	0.464646	0.023	0.088
R21	11:3050618	T	G/D	286	gGc/gAc	CARS	0.314516	0.003	0.932
R21	11:2398805	T	C/F	9	tGc/tTc	CD81	0.180124	0.001	1
R21	5:133745610	A	S/I	108	aGt/aTt	CDKN2AIP	0.392523	0.002	0.832
R21	3:137880883	T	G/R	495	Ggg/Agg	DBR1	0.408602	0.144	0
R21	4:956595	A	P/L	667	cCg/cTg	DGKQ	0.42	0.294	0.971
R21	20:31368239	A	I/N	37	aTc/aAc	DNMT3B	0.475806	0.001	0.971
R21	16:2285338	T	A/V	707	gCc/gTc	E4F1	0.560606	0.012	0.022
R21	17:78120751	G	T/P	4	Acg/Ccg	EIF4A3	0.478873	0.021	0.056
R21	17:4859264	T	Q/L	298	cAg/cTg	ENO3	0.127273	0	1
R21	17:79410416	T	P/S	681	Ccg/Tcg	ENSG0000(	0.520325	0.198	0.787
R21	10:47909775	T	T/M	291	aCg/aTg	FAM21B	0.257143	0.148	0.05
R21	17:27085722	C	S/A	419	Tcc/Gcc	FAM222B	0.583333	0.15	0.002
R21	13:99947715	T	Q/K	229	Caa/Aaa	GPR183	0.426667	0.506	0.046
R21	19:49490588	A	V/L	119	Gtg/Ttg	GYS1	0.58	0.531	0.046
R21	15:28474849	T	E/K	1652	Gaa/Aaa	HERC2	0.16	0.067	0.629
R21	6:29911916	G	M/V	213	Atg/Gtg	HLA-A	0.989796	0.282	0.064
R21	20:30156976	A	G/E	412	gGa/gAa	HM13	0.474104	0.027	0.092
R21	6:44220795	G	N/S	582	aAt/aGt	HSP90AB1	0.517843	0.058	0.363
R21	3:4726847	T	A/V	1211	gCg/gTg	ITPR1	0.478261	0.603	0.994
R21	11:134018569	C	E/D	280	gaA/gaC	JAM3	0.486486	0.183	0.754
R21	14:104159917	T	R/*	626	Cga/Tga	KLC1	0.36	-	-
R21	19:55107147	G	I/M	235	atA/atG	LILRA1	0.382353	0.042	0.283
R21	5:61876754	A	E/K	497	Gaa/Aaa	LRRC70	0.157895	0.107	0.94
R21	14:24780849	G	L/V	358	Ctc/Gtc	LTB4R2	0.416667	0.524	0.999
R21	15:42114425	G	S/A	1018	Tct/Gct	MAPKBP1	0.590909	0.052	0.891
R21	2:85769449	G	I/V	241	Atc/Gtc	MAT2A	0.459227	0.378	0
R21	8:48882489	A	A/T	436	Gca/Aca	MCM4	0.459902	1	0
R21	8:6296551	T	H/Y	172	Cac/Tac	MCPH1	0.130435	0.298	0.017
R21	2:191302042	G	H/Q	429	caC/caG	MFSD6	0.75	0.792	0
R21	10:129917554	G	R/T	106	aGg/aCg	MKI67	0.52	0.181	0.664
R21	21:42780023	A	E/K	671	Gaa/Aaa	MX2	0.166667	0.01	0.775
R21	3:136664926	A	P/Q	243	cCa/cAa	NCK1	0.111111	0	1
R21	20:46281162	C	Q/P	1320	cAa/cCa	NCOA3	0.37037	0.204	0.102
R21	X:119070392	T	E/K	181	Gaa/Aaa	NKAP	0.111111	0.079	0.155
R21	9:134027279	G	Q/E	812	Cag/Gag	NUP214	0.222222	0.043	0.983
R21	1:228481916	T	T/M	3732	aCg/aTg	OBSCN	0.608696	0.068	0.437
R21	11:65385659	A	A/T	276	Gca/Aca	PCNXL3	0.275862	0.273	0.005
R21	22:21174137	T	F/Y	136	tTt/tAt	PI4KA	0.470968	0.004	0.988
R21	3:130400423	C	N/S	1207	aAc/aGc	PIK3R4	0.6	0.006	1
R21	9:139311520	G	M/V	251	Atg/Gtg	PMPCA	0.441176	0.003	0.151
R21	2:86281387	G	I/T	695	aTa/aCa	POLR1A	0.649123	0.001	0.118
R21	14:77750199	T	D/N	532	Gat/Aat	POMT2	0.333333	0.363	0.078
R21	2:86364592	C	K/N	660	aaG/aaC	PTCD3	0.272727	0.022	0.209
R21	7:77236595	G	T/A	247	Acg/Gcg	PTPN12	0.693878	0.073	1
R21	12:120662138	A	S/F	19	tCc/tTc	PXN	0.428571	0	1
R21	7:92161810	A	R/K	132	aGa/aAa	RBM48	0.125	0.211	0.993
R21	2:227729558	G	Y/C	50	tAt/tGt	RHBDD1	0.457143	0.172	0.699
R21	6:4995431	T	E/K	325	Gaa/Aaa	RPP40	0.173913	1	0
R21	9:19376300	C	S/R	247	agT/agG	RPS6	0.381579	0.002	0.676
R21	14:94847290	T	P/T	279	Cct/Act	SERPINA1	0.582734	0	1
R21	17:2276374	G	Q/R	639	cAg/cGg	SGSM2	0.467391	0.121	0.001
R21	3:160134135	A	E/K	457	Gaa/Aaa	SMC4	0.272727	0.003	0.998
R21	14:35036938	T	R/K	374	aGa/aAa	SNX6	0.138889	0.447	0.92
R21	5:6663036	C	F/L	224	Ttc/Ctc	SRD5A1	0.583333	0.055	0.531
R21	1:26212360	C	M/V	127	Atg/Gtg	STMN1	0.142857	0.31	0
R21	3:176744196	T	G/R	495	Gga/Aga	TBL1XR1	0.470588	0.001	1
R21	3:52258088	A	D/Y	82	Gac/Tac	TLR9	0.714286	0.007	0.998
R21	7:5413842	T	A/T	1025	Gcc/Acc	TNRC18	0.181818	0.052	1
R21	4:184614147	T	T/M	695	aCg/aTg	TRAPPC11	0.458333	0.085	0.209
R21	19:10473029	T	R/Q	527	cGg/cAg	TYK2	0.415385	0.154	0.188
R21	19:59068296	T	G/D	69	gGc/gAc	UBE2M	0.186715	0	1
R21	3:49148241	A	R/C	1098	Cgc/Tgc	USP19	0.477419	0.009	1
R21	8:17104857	T	S/F	35	tCc/tTc	VPS37A	0.380952	0.001	0.999
R21	X:128948661	T	A/T	200	Gcc/Acc	ZDHHC9	0.933333	0.078	0.249
R21	8:123964910	A	T/N	387	aCc/aAc	ZHX2	0.65625	0.036	0.938
R21	1:33741997	A	E/K	51	Gag/Aag	ZNF362	0.630435	0.098	0.999
R21	7:99091624	C	Q/R	405	cAg/cGg	ZNF394	0.576923	0	0.169
R21	19:35451256	A	I/L	56	Ata/Tta	ZNF792	0.631579	0.75	0

R22	15:32929129	G	S/G	719	Agt/Ggt	ARHGAP11	0.5	0.329	0.002
R22	19:7518524	A	R/H	488	cGc/cAc	ARHGEF18	0.241379	0.044	0.602
R22	16:31502184	C	L/R	460	cTt/cGt	C16orf58	0.477273	0.12	0.112
R22	17:3749444	T	S/Y	25	tCc/tAc	C17orf85	0.568182	0.015	0.07
R22	7:92978036	A	E/K	741	Gaa/Aaa	CCDC132	0.75	0.235	0.979
R22	12:120518704	A	S/N	441	aGt/aAt	CCDC64	0.529412	0.089	0.998
R22	11:64112445	A	R/Q	811	cGg/cAg	CCDC88B	0.3	0.112	1
R22	1:180063416	A	E/K	2726	Gaa/Aaa	CEP350	0.2	0.002	0.997
R22	22:51020767	A	L/F	82	Ctc/Ttc	CHKB	0.453125	0.002	1
R22	10:101980346	A	K/M	158	aAg/aTg	CHUK	0.16	0.001	0.982
R22	6:84634230	A	Q/K	245	Caa/Aaa	CYB5R4	0.113636	1	0
R22	15:78562936	T	S/L	106	tCa/tTa	DNAJA4	0.548387	0.122	0.001
R22	15:78562936	T	Q/*	60	Cag/Tag	DNAJA4	0.548387	-	-
R22	1:212274236	T	T/M	635	aCg/aTg	DTL	0.541667	0.015	0.919
R22	16:2294432	A	N/I	139	aAc/aTc	ECI1	0.5	0.017	0.048
R22	19:14883288	G	L/P	74	cTg/cCg	EMR2	0.818182	1	0
R22	18:677360	A	A/V	378	gCa/gTa	ENOSF1	0.125	0.001	0.39
R22	7:92206443	C	M/V	147	Atg/Gtg	FAM133B	0.435484	0.452	0
R22	3:56667269	A	R/W	1184	Cgg/Tgg	FAM208A	0.525641	NA	0.995
R22	10:47909775	T	T/M	291	aCg/aTg	FAM21B	0.535714	0.148	0.05
R22	7:76828908	G	L/P	68	cTc/cCc	FGL2	0.526316	0.001	1
R22	12:49319118	G	E/Q	32	Gaa/Caa	FKBP11	0.263158	0.139	0.746
R22	17:61899420	C	T/A	467	Aca/Gca	FTSJ3	0.527027	0.913	0
R22	1:228645367	C	Y/C	51	tAt/tGt	HIST3H2A	0.490385	0	1
R22	5:176311129	A	L/F	622	Ctc/Ttc	HK3	0.447059	0	1
R22	19:8528509	G	K/R	126	aAa/aGa	HNRNPM	0.495885	0.048	0.81
R22	7:48015239	T	E/K	171	Gaa/Aaa	HUS1	0.137931	0.006	0.97
R22	12:416874	C	I/V	1226	Att/Gtt	KDM5A	0.4	0.091	0.876
R22	8:48508458	A	E/K	395	Gaa/Aaa	KIAA0146	0.181818	0.507	0.001
R22	9:131670996	C	L/P	518	cTg/cCg	LRRC8A	0.125	0	1
R22	6:131931239	T	V/M	342	Gtg/Atg	MED23	0.136364	0.002	0.996
R22	3:158531833	A	T/N	210	aCc/aAc	MFSD1	0.511628	0.416	0.006
R22	1:167742550	G	S/G	184	Agc/Ggc	MPZL1	0.487179	0.012	0.18
R22	17:16021324	A	R/C	645	Cgt/Tgt	NCOR1	0.130435	0	0.988
R22	17:73221261	A	D/N	221	Gat/Aat	NUP85	0.277778	0.159	0.01
R22	16:88786649	T	D/N	1998	Gac/Aac	PIEZO1	0.494253	0.271	0.005
R22	1:77627394	C	Y/C	196	tAc/tGc	PIGK	0.136364	0	1
R22	8:144995351	G	C/R	3017	Tgc/Cgc	PLEC	0.333333	0.507	0
R22	19:15565032	G	I/T	736	aTt/aCt	RASAL3	0.32967	0.001	0.956
R22	2:178990749	A	G/E	424	gGa/gAa	RBM45	0.111111	0.095	1
R22	19:648196	G	F/L	290	Ttc/Ctc	RNF126	0.422535	0.348	0.75
R22	4:8238068	C	K/Q	1157	Aag/Cag	SH3TC1	0.774194	0	0.995
R22	17:79870417	T	L/M	360	Ctg/Atg	SIRT7	0.510638	0.01	0.987
R22	1:183515266	A	E/K	846	Gaa/Aaa	SMG7	0.134615	0.001	0.877
R22	12:123950524	A	G/E	146	gGa/gAa	SNRNP35	0.134328	0	1
R22	14:35036938	T	R/K	374	aGa/aAa	SNX6	0.123288	0.447	0.92
R22	15:51057717	T	R/Q	5	cGg/cAg	SPPL2A	0.809524	0.071	0
R22	1:16717888	A	E/K	24	Gaa/Aaa	SZRD1	0.181818	0.029	0.98
R22	1:43915789	C	K/Q	3311	Aag/Cag	SZT2	0.492754	0.044	1
R22	20:30738656	A	R/Q	408	cGg/cAg	TM9SF4	0.444444	0.148	0.36
R22	14:21961037	A	R/Q	421	cGg/cAg	TOX4	0.505618	0.103	0.055
R22	22:38168672	A	R/Q	2334	cGg/cAg	TRIOBP	0.423529	0.002	1
R22	21:38568077	A	D/E	1773	gaT/gaA	TTC3	0.496454	0.126	0.058
R22	1:19439129	T	R/K	3897	aGg/aAg	UBR4	0.53125	0.211	0.841
R22	12:132404529	T	R/C	937	Cgc/Tgc	ULK1	0.392857	0.004	1
R22	7:102280786	G	Y/S	117	tAt/tCt	UPK3BL	0.28125	0.005	1
R22	21:33687274	C	I/M	2257	atC/atG	URB1	0.454545	0.004	0.943
R22	11:11971487	A	Q/K	1066	Caa/Aaa	USP47	0.435294	0.005	0.341
R22	16:74922194	T	R/Q	740	cGg/cAg	WDR59	0.304348	0.399	0.355
R22	3:14197971	C	P/A	633	Cct/Gct	XPC	0.40625	0	0.997
R23	2:27276020	T	T/M	65	aCg/aTg	AGBL5	0.254545	NA	1
R23	7:91691641	A	E/K	1940	Gaa/Aaa	AKAP9	0.142857	0.121	0.997
R23	4:80952841	C	K/E	268	Aaa/Gaa	ANTXR2	0.130435	0.019	0.587
R23	X:100870716	G	A/P	299	Gcc/Ccc	ARMCX6	0.894737	0.008	0.952
R23	1:203678456	T	R/W	529	Cgg/Tgg	ATP2B4	0.375	0.002	0.453
R23	8:103841636	C	S/G	367	Agc/Ggc	AZIN1	0.174194	0.596	0
R23	5:70858261	A	E/K	2553	Gaa/Aaa	BDP1	0.2	1	0
R23	20:36147563	C	Q/R	5	cAg/cGg	BLCAP	0.156863	0.054	0.997
R23	5:34918530	T	T/I	74	aCa/aTa	BRIX1	0.542857	0.39	0.392
R23	20:60498629	C	M/L	499	Atg/Ctg	CDH4	0.357143	0.372	0
R23	7:39990344	G	Q/R	35	cAg/cGg	CDK13	0.185185	0	0.004
R23	1:243362389	T	E/K	202	Gaa/Aaa	CEP170	0.14	0.148	0.002
R23	1:180022275	A	E/K	1655	Gaa/Aaa	CEP350	0.16	0.009	0.418
R23	15:93540315	A	E/K	1242	Gaa/Aaa	CHD2	0.148936	0.043	0.734
R23	1:111773417	A	E/K	42	Gaa/Aaa	CHI3L2	0.336	0.08	0.967
R23	13:46090371	G	I/V	635	Att/Gtt	COG3	0.6	1	0.493
R23	20:31315760	C	N/D	61	Aat/Gat	COMMD7	0.483871	0.059	0.979

R23	7:99689321	T	T/M	298	aCg/aTg	COPS6	0.485106	0.057	0.985
R23	16:57155027	G	N/S	235	aAt/aGt	CPNE2	0.509804	1	0
R23	22:38690537	T	A/T	297	Gca/Aca	CSNK1E	0.346939	0.06	0.162
R23	17:8138533	T	R/H	426	cGt/cAt	CTC1	0.461538	0.361	0.022
R23	6:43153227	T	Q/L	210	cAg/cTg	CUL9	0.16	0.001	0.991
R23	16:50825518	A	E/K	717	Gaa/Aaa	CYLD	0.166667	0.058	0.493
R23	9:37801311	C	S/R	150	Agc/Cgc	DCAF10	0.238095	0.628	0
R23	1:20982659	G	V/A	113	gTg/gCg	DDOST	0.475325	0.22	0.005
R23	4:169344886	T	M/K	657	aTg/aAg	DDX60L	0.157895	0.001	1
R23	4:960835	T	V/M	410	Gtg/Atg	DGKQ	0.517241	0.248	0.882
R23	5:54586103	T	E/K	284	Gaa/Aaa	DHX29	0.166667	0.53	0.001
R23	6:31864759	T	A/D	17	gCc/gAc	EHMT2	0.25	0.002	0.032
R23	22:37771228	A	S/I	116	aGc/aTc	ELFN2	0.173913	0.016	0.622
R23	16:15457856	A	T/I	238	aCt/aTt	ENSG0000(	0.121212	0.003	0.976
R23	1:207095182	T	W/*	6	tgG/tgA	FAIM3	0.363636	-	-
R23	10:47909775	T	T/M	291	aCg/aTg	FAM21B	0.28	0.148	0.05
R23	6:16254896	G	N/S	132	aAt/aGt	GMPR	0.426667	0.002	0.997
R23	3:121413423	T	E/K	1978	Gaa/Aaa	GOLGB1	0.105263	0.007	0.663
R23	1:110200288	G	N/S	85	aAc/aGc	GSTM4	0.306122	0.017	0.006
R23	2:197634749	A	A/S	759	Gcc/Tcc	GTF3C3	0.212121	0.026	0.998
R23	1:9323738	T	R/W	396	Cgg/Tgg	H6PD	0.606061	0.004	0.993
R23	10:91162324	C	W/R	98	Tgg/Cgg	IFIT1	0.157895	0	1
R23	3:12977765	C	T/A	251	Act/Gct	IQSEC1	0.395349	0.319	0
R23	19:17945918	G	V/A	674	gTc/gCc	JAK3	0.771429	0.001	0.987
R23	19:10600338	T	I/N	506	aTc/aAc	KEAP1	0.883721	0.491	0.86
R23	14:24901677	A	A/T	404	Gcc/Acc	KHNYN	0.53125	1	0.001
R23	10:91511139	T	R/L	1338	cGa/cTa	KIF20B	0.545455	0.031	0.108
R23	13:46725182	C	S/R	257	agC/agG	LCP1	0.5131	0.449	0.263
R23	19:34685391	C	F/L	44	Ttt/Ctt	LSM14A	0.412791	0.038	0.07
R23	1:232941754	T	R/C	187	Cgc/Tgc	MAP10	0.4	0.091	0.008
R23	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	1	0.748	0
R23	14:36783787	T	E/K	168	Gaa/Aaa	MBIP	0.421875	0.064	0.013
R23	7:45011724	A	T/I	240	aCt/aTt	MYO1G	0.539394	0.108	0.019
R23	9:88618502	G	D/E	353	gaT/gaG	NAA35	0.15	0.175	0.604
R23	16:66852492	C	K/R	187	aAg/aGg	NAE1	0.533333	0.507	0
R23	20:23361863	C	E/G	218	gAg/gGg	NAPB	0.5	0.51	0.005
R23	12:97334238	A	G/E	390	gGa/gAa	NEDD1	0.121212	0.007	0.998
R23	15:75646086	G	K/R	242	aAa/aGa	NEIL1	0.8	0.089	0.036
R23	12:54688992	T	I/K	14	aTa/aAa	NFE2	0.47	0.093	0.008
R23	4:47880552	T	G/E	690	gGa/gAa	NFXL1	0.15	0.312	0.007
R23	12:121666608	C	I/T	229	aTa/aCa	P2RX4	0.266667	0.001	1
R23	3:57542161	A	E/K	19	Gag/Aag	PDE12	0.5625	0.24	0.016
R23	X:133547982	T	H/Y	239	Cat/Tat	PHF6	1	0	0.991
R23	16:88783275	A	S/F	2231	tCc/tTc	PIEZO1	0.391667	0.007	0.563
R23	16:88787956	A	S/F	1798	tCc/tTc	PIEZO1	0.526627	0.941	1
R23	16:2153320	T	S/N	2913	aGc/aAc	PKD1	0.363636	1	0.001
R23	1:150131221	A	E/K	245	Gaa/Aaa	PLEKHO1	0.190045	0.014	0.361
R23	22:50725558	T	V/I	582	Gtc/Atc	PLXNB2	0.454545	0.449	0.097
R23	8:42227434	C	N/H	281	Aat/Cat	POLB	0.461538	0.033	0.884
R23	7:72412984	C	V/L	818	Gtg/Ctg	POM121	0.175926	0.013	0.708
R23	12:121017129	C	M/V	162	Atg/Gtg	POP5	0.328947	0.117	0
R23	22:32110509	C	T/A	1106	Aca/Gca	PRR14L	0.44	0.371	0.038
R23	2:120704103	C	D/H	537	Gat/Cat	PTPN4	0.458333	0	0.999
R23	11:64509560	A	P/L	33	cCg/cTg	RASGRP2	0.376404	0.02	0.951
R23	7:92161810	A	R/K	132	aGa/aAa	RBM48	0.190476	0.211	0.993
R23	2:107040630	G	S/R	1265	Agt/Cgt	RGPD3	0.413223	0.058	0.998
R23	2:11351966	T	E/K	682	Gaa/Aaa	ROCK2	0.181818	0.049	0.209
R23	20:34287651	A	A/T	33	Gcc/Acc	ROMO1	0.506003	0.436	0.995
R23	17:78866607	A	R/H	727	cGt/cAt	RPTOR	0.454545	0.017	0.998
R23	4:83602062	G	D/H	123	Gac/Cac	SCD5	0.190476	0.321	0.763
R23	10:13386865	A	T/I	29	aCa/aTa	SEPHS1	0.227273	0.046	0.046
R23	1:150936182	A	A/T	1212	Gcc/Acc	SETDB1	0.466667	0.029	1
R23	3:48929471	T	G/E	47	gGa/gAa	SLC25A20	0.342857	0.001	1
R23	3:48929471	T	W/*	67	tgG/tgA	SLC25A20	0.342857	-	-
R23	3:160134135	A	E/K	457	Gaa/Aaa	SMC4	0.181818	0.003	0.998
R23	2:55831128	T	E/K	95	Gaa/Aaa	SMEK2	0.12963	0.103	0.993
R23	13:24863312	T	Q/L	323	cAa/cTa	SPATA13	0.4	0.029	0
R23	3:140785609	C	E/D	221	gaA/gaC	SPSB4	0.555556	0.003	0.962
R23	17:40459718	G	T/S	628	aCc/aGc	STAT5A	0.527778	0.063	0.291
R23	17:79977209	T	R/H	46	cGt/cAt	STRA13	0.446281	0.306	0.001
R23	6:158449919	T	R/C	116	Cgc/Tgc	SYNJ2	0.333333	0.003	1
R23	8:120744409	T	L/M	1119	Ttg/Atg	TAF2	0.52381	0.098	0.003
R23	16:2821583	C	M/V	126	Atg/Gtg	TCEB2	0.611111	0.334	0.001
R23	12:110344434	A	E/K	172	Gaa/Aaa	TCHP	0.235294	0.03	0.945
R23	12:104378618	G	L/*	291	tTa/tGa	TDG	0.222222	-	-
R23	1:36755176	G	K/R	519	aAg/aGg	THRAP3	0.46	0.008	0.988
R23	3:100091473	T	E/K	477	Gaa/Aaa	TOMM70A	0.533333	0.004	1

R23	22:43557175	C	W/R	7	Tgg/Cgg	TSPO	0.564103	1	0.099
R23	15:43696678	T	S/L	639	tCa/tTa	TUBGCP4	0.4375	0.003	0.034
R23	1:19500009	T	M/K	1030	aTg/aAg	UBR4	0.142857	0.182	0.039
R23	11:67759319	T	A/T	498	Gcg/Acg	UNC93B1	0.35	0.45	0.1
R23	10:12046574	T	E/K	487	Gaa/Aaa	UPF2	0.137931	0.279	0.296
R23	3:51457281	G	I/T	1048	aTa/aCa	VPRBP	0.485714	0.655	0
R23	1:150040779	G	I/M	62	atC/atG	VPS45	0.367347	0.049	0.02
R23	8:87442980	A	E/K	463	Gaa/Aaa	WWP1	0.12	0	0.972
R23	7:138719380	G	M/T	137	aTg/aCg	ZC3HAV1L	0.153846	0.312	0.017
R23	18:32825582	G	R/G	305	Aga/Gga	ZNF397	0.130435	0.044	0.993
R24	2:223789216	G	S/G	399	Agt/Ggt	ACSL3	0.652174	0.202	0
R24	1:36554641	T	V/F	46	Gtc/Ttc	ADPRHL2	0.526316	0.007	0.981
R24	10:51486110	G	I/T	31	aTc/aCc	AGAP7	0.461538	0.096	0.188
R24	12:105589066	T	G/E	405	gGa/gAa	APPL2	0.121951	1	0
R24	2:220092493	T	R/Q	49	cGa/cAa	ATG9A	0.45098	0.036	0.997
R24	3:130716556	G	I/V	784	Ata/Gta	ATP2C1	0.48631	0.773	0.005
R24	7:105254451	T	G/E	777	gGa/gAa	ATXN7L1	0.111111	0.001	1
R24	8:103841636	C	S/G	367	Agc/Ggc	AZIN1	0.164773	0.596	0
R24	16:56535283	A	R/C	403	Cgc/Tgc	BBS2	0.430168	0.256	0
R24	5:70858261	A	E/K	2553	Gaa/Aaa	BDP1	0.136364	1	0
R24	4:113538892	T	G/E	769	gGa/gAa	C4orf21	0.125	0.51	0.197
R24	11:60775067	G	S/G	52	Agc/Ggc	CD6	0.166667	0.1	0.916
R24	11:903030	A	R/C	65	Cgc/Tgc	CHID1	0.352941	0.019	0.998
R24	5:178040549	A	K/*	251	Aaa/Taa	CLK4	0.512563	-	-
R24	9:123907547	T	G/V	1065	gGt/gTt	CNTRL	0.444444	0.013	0.337
R24	13:46090371	G	I/V	635	Att/Gtt	COG3	0.5	1	0.493
R24	21:46900388	C	I/T	884	aTt/aCt	COL18A1	0.5	0.304	0.734
R24	22:37334174	A	R/Q	775	cGg/cAg	CSF2RB	0.48	1	0.001
R24	10:16967714	C	T/A	2111	Act/Gct	CUBN	0.46875	0.806	0.008
R24	12:31255384	C	Q/H	765	caG/caC	DDX11	0.233062	0.137	0.001
R24	5:54586070	T	E/K	295	Gaa/Aaa	DHX29	0.212766	0.013	0.044
R24	7:76109831	T	A/V	2	gCc/gTc	DTX2	0.314815	0.004	0.967
R24	3:121573655	T	T/I	108	aCt/aTt	EAF2	0.142857	0.025	0.695
R24	16:67913017	G	E/G	482	gAg/gGg	EDC4	0.47541	0.008	0.988
R24	20:34142151	A	V/M	232	Gtg/Atg	ERGIC3	0.325581	0.035	0.994
R24	1:43308683	A	G/E	403	gGa/gAa	ERMAP	0.222222	0.003	1
R24	20:13699604	A	A/V	689	gCa/gTa	ESF1	0.105263	0.261	0.002
R24	4:56724578	A	G/E	30	gGa/gAa	EXOC1	0.138889	0.248	0.986
R24	9:133570895	G	M/V	47	Atg/Gtg	EXOSC2	0.436364	1	0
R24	8:119123163	C	S/R	41	agC/agG	EXT1	0.354839	0.226	0.057
R24	9:96261141	G	M/V	335	Atg/Gtg	FAM120A	0.477612	0.322	0
R24	10:47909775	T	T/M	291	aCg/aTg	FAM21B	0.264706	0.148	0.05
R24	8:101153853	A	T/I	210	aCt/aTt	FBXO43	0.153846	0.002	0.993
R24	1:155279696	G	Y/C	39	tAc/tGc	FDPS	0.368421	0.126	0
R24	14:66188666	T	R/C	337	Cgc/Tgc	FUT8	0.511628	0	1
R24	21:34878393	G	L/P	824	cTt/cCt	GART	0.111111	0	1
R24	10:104121635	G	N/S	550	aAc/aGc	GBF1	0.47191	0.032	0.322
R24	16:23500024	G	I/T	161	aTa/aCa	GGA2	0.44186	0.001	0.512
R24	15:34674259	A	R/C	455	Cgc/Tgc	GOLGA8A	0.348315	0.177	0.992
R24	15:34820480	A	R/C	455	Cgc/Tgc	GOLGA8B	0.183357	0.177	0.998
R24	6:43589885	A	P/L	496	cCg/cTg	GTPBP2	0.495238	0.041	0.997
R24	16:50120247	T	L/F	499	Ctt/Ttt	HEATR3	0.166667	0.033	0.437
R24	9:35813465	C	Q/E	102	Cag/Gag	HINT2	0.487603	0.527	0.008
R24	17:46627784	A	P/L	403	cCc/cTc	HOXB3	0.28	0	0.998
R24	X:53570809	T	A/E	3791	gCa/gAa	HUWE1	1	0.022	0.137
R24	19:18288663	G	K/R	232	aAg/aGg	IFI30	0.119403	0.448	0.094
R24	11:319894	A	L/F	116	Ctc/Ttc	IFITM3	0.22	1	0.984
R24	17:26961576	C	Q/R	1010	cAg/cGg	KIAA0100	0.435897	0.036	0.181
R24	3:108273227	T	E/K	774	Gaa/Aaa	KIAA1524	0.117647	0.024	0.911
R24	2:176857119	T	E/K	33	Gaa/Aaa	KIAA1715	0.181818	0.333	0.604
R24	5:61649188	A	E/K	182	Gaa/Aaa	KIF2A	0.135593	0.377	0.036
R24	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	0.944444	0.748	0
R24	8:90993682	T	E/K	81	Gaa/Aaa	NBN	0.15625	0.009	0.996
R24	1:145311114	A	D/N	605	Gat/Aat	NBPF10	0.651163	0.051	0.406
R24	1:147581611	T	D/N	530	Gat/Aat	NBPF24	0.337349	0.086	0.009
R24	18:2589248	A	A/E	270	gCa/gAa	NDC80	0.125	1	0
R24	15:75646086	G	K/R	242	aAa/aGa	NEIL1	0.788732	0.089	0.036
R24	14:50295439	T	G/E	440	gGa/gAa	NEMF	0.16	0.161	1
R24	4:47880552	T	G/E	690	gGa/gAa	NFXL1	0.142857	0.312	0.007
R24	5:43659351	A	A/T	845	Gcc/Acc	NNT	0.55814	0.001	1
R24	2:10784496	C	M/V	326	Atg/Gtg	NOL10	0.136364	0.006	0.485
R24	5:142689721	T	R/K	470	aGa/aAa	NR3C1	0.176471	0	0.998
R24	21:47329290	G	N/D	121	Aac/Gac	PCBP3	0.15	0.132	0.934
R24	17:8052069	C	Q/R	314	cAg/cGg	PER1	0.586538	0.133	0.001
R24	18:39629569	T	G/C	755	Ggc/Tgc	PIK3C3	0.111111	0	1
R24	16:2149662	A	R/W	3345	Cgg/Tgg	PKD1	0.116279	0.001	0.998
R24	8:144995978	A	R/W	2808	Cgg/Tgg	PLEC	0.385714	0.033	0.988

R24	5:140615	G	P/A	65	Ccc/Gcc	PLEKHG4B	0.660714	0.157	0.731
R24	17:43553051	A	T/M	113	aCg/aTg	PLEKHM1	0.235294	0.014	1
R24	16:23700622	G	Y/C	445	tAc/tGc	PLK1	0.6875	0.175	0.002
R24	22:41974855	T	A/T	169	Gcc/Acc	PMM1	0.487654	0.165	1
R24	1:167334710	C	Q/P	22	cAa/cCa	POU2F1	0.181818	0	0.99
R24	2:44445128	T	E/D	329	gaG/gaT	PPM1B	0.512315	0.222	0.011
R24	3:47451438	T	P/L	717	cCg/cTg	PTPN23	0.545455	0.007	1
R24	1:158914735	T	H/L	421	cAt/cTt	PYHIN1	0.272727	1	0
R24	1:158914742	T	K/N	423	aaA/aaT	PYHIN1	0.30303	0.501	0
R24	7:92161810	A	R/K	132	aGa/aAa	RBM48	0.184211	0.211	0.993
R24	2:85577971	C	I/V	177	Att/Gtt	RETSAT	0.285714	0.343	0.001
R24	11:114320643	A	D/E	220	gaT/gaA	REXO2	0.472868	0.275	0
R24	3:196214384	A	R/S	148	agG/agT	RNF168	0.413793	0.005	0.704
R24	17:78269492	A	E/K	631	Gaa/Aaa	RNF213	0.121212	0.115	0.27
R24	X:18283712	T	G/E	314	gGa/gAa	SCML2	0.214286	0.002	1
R24	4:119678889	T	E/K	470	Gaa/Aaa	SEC24D	0.208333	0.34	0.002
R24	1:169676569	T	C/Y	165	tGc/tAc	SELL	0.498282	0	1
R24	12:132210108	A	F/L	255	ttC/ttA	SFSWAP	0.475275	0.267	0.801
R24	17:33591663	A	V/M	534	Gtg/Atg	SLFN5	0.333333	0.001	0.866
R24	4:144442687	G	M/V	120	Atg/Gtg	SMARCA5	0.565574	0.447	0
R24	3:160134135	A	E/K	457	Gaa/Aaa	SMC4	0.172414	0.003	0.998
R24	2:55831128	T	E/K	95	Gaa/Aaa	SMEK2	0.15	0.103	0.993
R24	5:64036890	T	E/K	67	Gaa/Aaa	SREK1IP1	0.138462	0.087	0.083
R24	7:72470312	T	R/H	80	cGc/cAc	STAG3L3	0.40678	0.091	0.084
R24	15:102261437	T	G/E	153	gGa/gAa	TARSL2	0.129032	1	0
R24	8:42694471	T	R/K	42	aGa/aAa	THAP1	0.15	0	0.739
R24	15:50905957	T	E/K	573	Gaa/Aaa	TRPM7	0.142857	0.023	0.988
R24	11:2424738	G	S/C	292	tCt/tGt	TSSC4	0.4	0.012	0.844
R24	8:103323616	A	S/C	843	Agt/Tgt	UBR5	0.511111	0.392	0.001
R24	5:176332462	G	C/R	661	Tgc/Cgc	UIMC1	0.49848	0.002	1
R24	6:33232182	T	R/H	498	cGc/cAc	VPS52	0.581712	0.005	0.991
R24	13:41654782	A	E/K	253	Gaa/Aaa	WBP4	0.152174	0.323	0.001
R24	19:44803809	C	K/R	31	aAg/aGg	ZNF235	0.142857	0.06	0.126
R24	19:57868016	A	F/Y	260	tTc/tAc	ZNF304	0.2	0.095	0.941
R24	19:58320162	A	A/V	157	gCg/gTg	ZNF552	0.166667	1	0
R24	22:20755608	T	R/*	97	Cga/Tga	ZNF74	0.571429	-	-
R24	7:149191365	C	E/G	85	gAg/gGg	ZNF746	0.166667	0.008	0.999
R24	7:99662148	C	Y/H	444	Tac/Cac	ZSCAN21	0.115385	0	0.999
R25	19:8486789	C	F/S	22	tTc/tCc	02-mar	0.608696	0.421	0.335
R25	13:31338136	A	V/I	127	Gtt/Att	ALOX5AP	0.474138	0.62	0
R25	4:36230681	A	D/V	143	gAt/gTt	ARAP2	0.44	0.132	0.001
R25	14:58814450	A	E/K	420	Gaa/Aaa	ARID4A	0.125	0.088	0.583
R25	10:7839061	C	M/T	48	aTg/aCg	ATP5C1	0.452381	0	1
R25	8:103841636	C	S/G	367	Agc/Ggc	AZIN1	0.136364	0.596	0
R25	2:32819127	A	E/K	4501	Gaa/Aaa	BIRC6	0.122807	0.018	0.948
R25	12:30863381	T	V/M	947	Gtg/Atg	CAPRIN2	0.444444	0.167	0.75
R25	5:98192259	G	K/T	1653	aAa/aCa	CHD1	0.476471	0.139	0.981
R25	17:57725614	C	V/A	178	gTg/gCg	CLTC	0.157895	0.919	0.787
R25	10:101474418	A	H/Y	387	Cac/Tac	COX15	0.2	0	1
R25	2:208434967	A	E/K	157	Gaa/Aaa	CREB1	0.111111	0.033	0.998
R25	6:43168452	T	S/F	1176	tCc/tTc	CUL9	0.2	0	1
R25	12:31237922	C	R/T	167	aGa/aCa	DDX11	0.215686	0.645	0
R25	12:31244689	A	A/T	376	Gcc/Acc	DDX11	0.175926	0.367	0.986
R25	17:73601972	T	R/W	329	Cgg/Tgg	ENSG0000(	0.538462		0.83
R25	7:92195371	T	R/Q	205	cGa/cAa	FAM133B	0.130435	1	0.005
R25	14:35522530	A	G/E	71	gGa/gAa	FAM177A1	0.142857	0.063	0.986
R25	17:27209381	T	E/K	185	Gag/Aag	FLOT2	0.549296	0.053	0.966
R25	1:89476672	A	S/L	426	tCg/tTg	GBP3	0.541667	0.177	0.752
R25	14:96001611	T	P/L	62	cCg/cTg	GLRX5	0.487603	0.001	0.998
R25	1:32796400	G	S/R	290	agC/agG	HDAC1	0.423529	0.064	0.011
R25	6:26234768	A	P/S	132	Cct/Tct	HIST1H1D	0.272727	0.342	0.006
R25	1:79116110	C	I/T	77	aTc/aCc	IFI44	0.423077	0.74	0.017
R25	5:55237518	T	E/K	717	Gaa/Aaa	IL6ST	0.214286	0.021	0.862
R25	2:128262409	T	R/K	357	aGa/aAa	IWS1	0.115385	0.139	0
R25	1:65310517	T	R/H	724	cGt/cAt	JAK1	0.508475	0	1
R25	19:17941409	A	S/L	1000	tCg/tTg	JAK3	0.270386	0.193	0.047
R25	19:17945969	T	R/Q	657	cGg/cAg	JAK3	0.566667	0	0.999
R25	11:47599373	T	R/Q	76	cGg/cAg	KBTBD4	0.521739	0	0.998
R25	8:95538916	A	A/V	519	gCt/gTt	KIAA1429	0.125	0.335	0
R25	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	1	0.748	0
R25	20:5966656	A	L/Q	681	cTa/cAa	MCM8	0.380952	0.001	1
R25	3:150840754	A	A/E	130	gCa/gAa	MED12L	0.111111	0.002	0.999
R25	6:131923436	C	K/E	673	Aaa/Gaa	MED23	0.125	0.321	0.999
R25	8:97256232	A	A/V	325	gCa/gTa	MTERFD1	0.428571	0.082	0.05
R25	17:73619928	A	P/H	108	cCc/cAc	MYO15B	0.509658	0.003	1
R25	17:34859791	A	R/W	659	Cgg/Tgg	MYO19	0.730769	0	1
R25	17:46133837	T	E/D	200	gaG/gaT	NFE2L1	0.55	0.044	0.025

R25	9:33366628	A	G/E	1014	gGa/gAa	NFX1	0.545455	0.02	0.947
R25	16:21422267	C	T/S	178	aCc/aGc	NPIPL3	0.365169	0.008	0.736
R25	11:3114861	T	S/R	614	agC/agA	OSBPL5	0.58209	0.128	0.001
R25	21:47850065	T	S/F	2611	tCc/tTc	PCNT	0.410256	0.001	1
R25	7:11101440	A	S/N	835	aGc/aAc	PHF14	0.512195	0.015	0.675
R25	16:88786902	G	H/P	1947	cAc/cCc	PIEZO1	0.505085	0.064	0.013
R25	7:99971949	G	Q/R	116	cAg/cGg	PILRA	0.181818	1	0
R25	7:99971954	G	Q/E	118	Cag/Gag	PILRA	0.133333	1	0
R25	7:99987711	T	R/W	219	Agg/Tgg	PILRA	0.391304	0.122	0.065
R25	7:77256660	T	S/F	555	tCc/tTc	PTPN12	0.653846	0.002	0.913
R25	9:110045917	C	V/L	3	Gtc/Ctc	RAD23B	0.181818	0.035	0.006
R25	17:8193159	A	E/K	156	Gaa/Aaa	RANGRF	0.356223	0.575	0.006
R25	7:92161810	A	R/K	132	aGa/aAa	RBM48	0.177778	0.211	0.993
R25	16:74664782	T	E/K	551	Gag/Aag	RFWD3	0.137931	0.087	0.893
R25	2:88056937	G	E/Q	1741	Gaa/Caa	RGPD2	0.534247	0.024	0.052
R25	7:75511350	A	E/K	128	Gaa/Aaa	RHBDD2	0.518519	0.046	0.379
R25	6:7230407	T	T/M	692	aCg/aTg	RREB1	0.423077	0.002	1
R25	1:151337115	C	N/K	441	aaC/aaG	SELENBP1	0.385965	0.083	0.011
R25	6:166736370	C	S/G	139	Agc/Ggc	SFT2D1	0.469136	0.049	0.787
R25	1:43396304	G	I/T	170	aTc/aCc	SLC2A1	0.704545	0.001	0.566
R25	19:11113756	T	V/L	622	Gtg/Ttg	SMARCA4	0.352941	0.09	0.055
R25	3:160134135	A	E/K	457	Gaa/Aaa	SMC4	0.175	0.003	0.998
R25	12:64882352	A	E/K	476	Gaa/Aaa	TBK1	0.130435	0.39	0.025
R25	7:97847077	T	R/Q	1104	cGg/cAg	TECPR1	0.5	0.275	0.102
R25	12:51501093	T	E/K	252	Gaa/Aaa	TFCP2	0.137931	0.001	0.605
R25	14:75618737	C	K/R	112	aAg/aGg	TMED10	0.526316	0.193	0.099
R25	11:61165447	C	S/T	83	aGt/aCt	TMEM216	0.238095	0.039	0.241
R25	2:234431955	C	I/V	699	Atc/Gtc	USP40	0.608696	0.354	0.002
R25	5:140049036	T	Q/*	156	Cag/Tag	WDR55	0.507463	-	-
R25	5:112915365	C	E/D	1109	gaG/gaC	YTHDC2	0.6	0.912	0
R25	2:98340801	T	P/L	101	cCg/cTg	ZAP70	0.498361	0.001	1
R25	X:119389245	A	D/N	659	Gat/Aat	ZBTB33	0.121212	0.012	0.47
R25	19:47575356	C	P/A	609	Cca/Gca	ZC3H4	0.666667	0.032	0.037
R25	9:88916458	T	E/K	1385	Gaa/Aaa	ZCCHC6	0.192308	0.026	0.361
R25	19:19824960	T	G/E	44	gGa/gAa	ZNF14	0.292683	0.051	0.985
R25	14:21561367	A	S/F	30	tCc/tTc	ZNF219	0.125	0.087	0.972
R25	15:56993373	T	R/Q	80	cGa/cAa	ZNF280D	0.5	0.147	0.803
R25	19:58384612	G	Y/H	716	Tat/Cat	ZNF814	0.128205	0.063	0.999
R25	4:146686719	G	S/T	1011	aGt/aCt	ZNF827	0.48	1	0
R26	14:74766343	A	S/C	65	Agt/Tgt	ABCD4	0.115385	0.001	1
R26	1:1231862	T	R/H	427	cGc/cAc	ACAP3	0.430939	0.048	0.997
R26	10:135085174	G	Q/P	381	cAg/cCg	ADAM8	0.657143	0.094	0.703
R26	3:49756179	T	S/R	240	agC/agA	AMIGO3	0.56	0.037	0.002
R26	16:89347734	T	C/Y	1739	tGc/tAc	ANKRD11	0.396825	0.011	0.995
R26	16:81077422	A	C/Y	440	tGt/tAt	ATMIN	0.544974	0	0.59
R26	12:124197177	T	A/V	22	gCc/gTc	ATP6V0A2	0.233333	0.023	0.995
R26	18:77090063	G	M/V	663	Atg/Gtg	ATP9B	0.342857	0.001	0.999
R26	3:52442539	A	T/M	69	aCg/aTg	BAP1	0.362069	0.07	0.806
R26	4:113538892	T	G/E	769	gGa/gAa	C4orf21	0.148936	0.51	0.197
R26	8:22459270	C	G/R	188	Ggt/Cgt	C8orf58	0.448276	0	1
R26	17:77768651	T	G/E	318	gGg/gAg	CBX8	0.4125	0.005	0.956
R26	11:82976937	C	N/D	227	Aac/Gac	CCDC90B	0.234043	0.099	0.608
R26	7:39990344	G	Q/R	35	cAg/cGg	CDK13	0.137931	0	0.004
R26	7:39990548	G	Q/R	103	cAg/cGg	CDK13	0.473684	0.204	0.003
R26	1:243362389	T	E/K	202	Gaa/Aaa	CEP170	0.125	0.148	0.002
R26	15:68521859	A	A/S	22	Gcc/Tcc	CLN6	0.225806	0.273	0.135
R26	13:46090371	G	I/V	635	Att/Gtt	COG3	0.186441	1	0.493
R26	10:22606906	A	A/D	78	gCt/gAt	COMMD3	0.980088	0.028	0.794
R26	4:84200260	A	W/C	87	tgG/tgT	COQ2	0.613636	0.001	1
R26	19:4171465	T	A/V	354	gCg/gTg	CREB3L3	0.64	0.458	0.017
R26	6:43153227	T	Q/L	210	cAg/cTg	CUL9	0.133333	0.001	0.991
R26	3:49569826	T	A/S	628	Gcc/Tcc	DAG1	0.407407	0.941	0.855
R26	19:14523449	T	V/I	84	Gtc/Atc	DDX39A	0.552268	0.668	0.002
R26	5:54586103	T	E/K	284	Gaa/Aaa	DHX29	0.137255	0.53	0.001
R26	19:10930722	G	M/V	580	Atg/Gtg	DNM2	0.451777	0.04	0.026
R26	19:2194554	A	G/E	210	gGa/gAa	DOT1L	0.15	0.001	1
R26	7:76109831	T	A/V	2	gCc/gTc	DTX2	0.541667	0.004	0.967
R26	17:78113837	T	V/I	159	Gtt/Att	EIF4A3	0.477178	0.66	0
R26	15:91423947	A	F/Y	528	tTt/tAt	FURIN	0.414474	0.173	0.699
R26	2:109089346	A	E/K	951	Gaa/Aaa	GCC2	0.112903	0.006	0.884
R26	16:50120247	T	L/F	499	Ctt/Ttt	HEATR3	0.135802	0.033	0.437
R26	17:58128256	T	S/N	791	aGc/aAc	HEATR6	0.604651	0.132	0.998
R26	19:5684903	A	D/E	20	gaC/gaA	HSD11B1L	0.318182	0.403	0.868
R26	10:64952707	T	E/K	2023	Gaa/Aaa	JMJD1C	0.136905	0.001	0.998
R26	19:8399399	A	A/S	438	Gcc/Tcc	KANK3	0.347826	0.429	0.573
R26	8:48508458	A	E/K	395	Gaa/Aaa	KIAA0146	0.133333	0.507	0.001
R26	2:176857119	T	E/K	33	Gaa/Aaa	KIAA1715	0.16	0.333	0.604

R26	19:55107147	G	I/M	235	atA/atG	LILRA1	0.9	0.042	0.283
R26	4:151412120	T	R/H	2144	cGt/cAt	LRBA	0.612903	0	1
R26	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	0.890625	0.748	0
R26	15:95001429	T	Q/*	772	Caa/Taa	MCTP2	0.321429	-	-
R26	2:191301470	A	D/N	239	Gac/Aac	MFSD6	0.611111	0.354	0
R26	7:104748310	C	T/P	1136	Act/Cct	MLL5	0.492958	0.001	0.003
R26	15:75189490	A	R/Q	328	cGg/cAg	MPI	0.290323	0.729	0.001
R26	1:147581611	T	D/N	530	Gat/Aat	NBPF24	0.285714	0.086	0.009
R26	22:50960808	T	H/Y	424	Cac/Tac	NCAPH2	0.505882	0.082	0.523
R26	6:11213913	G	E/D	20	gaG/gaC	NEDD9	0.36	1	0.737
R26	15:75646086	G	K/R	242	aAa/aGa	NEIL1	0.409091	0.089	0.036
R26	9:139399422	G	L/P	1574	cTg/cCg	NOTCH1	0.391635	0.001	1
R26	16:150390	A	E/D	249	gaA/gaT	NPRL3	0.425373	1	0.992
R26	1:228401216	A	E/K	355	Gag/Aag	OBSCN	0.380952	0.914	0.978
R26	X:133551286	T	Q/*	308	Caa/Taa	PHF6	0.918367	-	-
R26	1:97235421	A	G/E	93	gGa/gAa	PTBP2	0.102941	0.017	0.098
R26	1:214551385	T	A/T	869	Gca/Aca	PTPN14	0.55	0.027	1
R26	1:158914735	T	H/L	421	cAt/cTt	PYHIN1	0.689655	1	0
R26	1:158914742	T	K/N	423	aaA/aaT	PYHIN1	0.76087	0.501	0
R26	19:41292638	T	R/C	167	Cgc/Tgc	RAB4B	0.449198	0.001	0.999
R26	16:67686924	A	A/T	963	Gct/Act	RLTPR	0.449275	0.448	0.079
R26	10:99129276	T	R/H	954	cGc/cAc	RRP12	0.516667	0.084	0.625
R26	2:166198852	G	A/G	812	gCc/gGc	SCN2A	0.409639	0	0.993
R26	9:139301956	T	G/R	154	Ggg/Agg	SDCCAG3	0.604317	0.003	0.324
R26	4:119678889	T	E/K	470	Gaa/Aaa	SEC24D	0.125	0.34	0.002
R26	6:166736370	C	S/G	139	Agc/Ggc	SFT2D1	0.533333	0.049	0.787
R26	2:113404422	T	T/I	6	aCc/aTc	SLC20A1	0.461538	0.23	0.023
R26	10:73121880	A	V/I	315	Gtc/Atc	SLC29A3	0.285714	0.464	0.065
R26	19:2732949	T	G/S	249	Ggc/Agc	SLC39A3	0.438776	0.063	0.987
R26	3:47752274	C	T/A	273	Act/Gct	SMARCC1	0.4689	0.175	0.997
R26	2:55831128	T	E/K	95	Gaa/Aaa	SMEK2	0.145038	0.103	0.993
R26	19:49132826	A	M/I	587	atG/atA	SPHK2	0.4	0.011	0.85
R26	2:219538424	C	I/T	54	aTa/aCa	STK36	0.386364	0	1
R26	1:36807432	T	R/Q	411	cGa/cAa	STK40	0.464286	0.101	0.313
R26	14:64656886	T	A/V	5990	gCt/gTt	SYNE2	0.173913	0.06	0.999
R26	2:200813057	C	K/E	73	Aag/Gag	TYW5	0.821429	0.003	0.995
R26	12:101684587	G	E/G	271	gAa/gGa	UTP20	0.142857	0.09	0.003
R26	3:38048041	G	D/E	769	gaT/gaG	VILL	0.45679	1	0
R26	17:1636083	A	E/K	432	Gag/Aag	WDR81	0.71875	0.035	0.851
R26	X:123034426	A	E/K	395	Gaa/Aaa	XIAP	0.153846	0.348	0.001
R26	1:16269071	A	T/M	664	aCg/aTg	ZBTB17	0.535912	0.081	1
R26	20:18287007	A	E/K	63	Gaa/Aaa	ZNF133	0.130435	0.025	0.069
R26	19:19824960	T	G/E	44	gGa/gAa	ZNF14	0.352941	0.051	0.985
R26	19:37880643	A	H/Q	564	caT/caA	ZNF527	0.136364	0.312	0.586
R27	19:41201940	G	G/A	388	gGt/gCt	ADCK4	0.689655	0	1
R27	7:91632286	G	L/V	1019	Tta/Gta	AKAP9	0.4	0.015	0.874
R27	6:24503641	A	V/M	197	Gtg/Atg	ALDH5A1	0.633333	0	1
R27	1:110169018	A	R/Q	221	cGg/cAg	AMPD2	0.507317	0.017	0.909
R27	19:10204294	C	A/G	318	gCg/gGg	ANGPTL6	0.422222	0.291	0.182
R27	17:42254393	T	T/M	286	aCg/aTg	ASB16	0.611111	0.065	0.999
R27	3:63973848	G	D/E	403	gaC/gaG	ATXN7	0.578947	0.204	0.028
R27	20:36147563	C	Q/R	5	cAg/cGg	BLCAP	0.203704	0.054	0.997
R27	2:202057771	T	C/F	169	tGc/tTc	CASP10	0.55102	0.173	0.001
R27	19:51738930	T	P/L	308	cCg/cTg	CD33	0.344828	0.714	0
R27	17:38447312	A	D/N	61	Gat/Aat	CDC6	0.522523	0.02	0.903
R27	12:122817596	A	K/N	924	aaG/aaT	CLIP1	0.482759	0.014	0.992
R27	13:46090371	G	I/V	635	Att/Gtt	COG3	0.211538	1	0.493
R27	6:43181607	A	A/D	1882	gCc/gAc	CUL9	0.382979	0.006	0.994
R27	5:54586070	T	E/K	295	Gaa/Aaa	DHX29	0.138889	0.013	0.044
R27	16:72132634	T	T/M	236	aCg/aTg	DHX38	0.860465	0.089	0.79
R27	3:132166250	A	G/E	77	gGa/gAa	DNAJC13	0.12	0.131	0.964
R27	6:83847159	T	A/V	1133	gCc/gTc	DOPEY1	0.142857	0.136	0
R27	7:76109831	T	A/V	2	gCc/gTc	DTX2	0.7	0.004	0.967
R27	18:33750158	T	R/*	711	Cga/Tga	ELP2	0.441558	-	-
R27	17:79411537	T	P/S	819	Ccc/Tcc	ENSG0000(	0.714286	0.159	0.1
R27	15:77472026	C	T/S	748	aCt/aGt	ENSG0000(	0.425	0.879	0.001
R27	16:21858847	A	A/S	46	Gct/Tct	ENSG0000(	0.180288	0.045	0.92
R27	17:73598940	T	E/D	194	gaG/gaT	ENSG0000(	0.549858		0.801
R27	1:11151612	C	Q/E	139	Cag/Gag	EXOSC10	0.54321	0.516	0.059
R27	11:6239297	A	R/W	521	Cgg/Tgg	FAM160A2	0.611111	0.001	1
R27	10:47909775	T	T/M	291	aCg/aTg	FAM21B	0.85	0.148	0.05
R27	19:17895550	G	P/R	748	cCc/cGc	FCHO1	0.511905	0.06	0.83
R27	15:91428688	A	L/Q	87	cTg/cAg	FES	0.384615	0.003	0.997
R27	4:159790085	T	S/I	766	aGc/aTc	FNIP2	0.333333	0.122	0.039
R27	12:2981353	T	R/Q	188	cGa/cAa	FOXM1	0.438776	0.013	0.882
R27	20:61574890	T	A/V	120	gCg/gTg	GID8	0.486486	0.03	0.004
R27	12:48181855	C	F/L	776	ttC/ttG	HDAC7	0.407821	0	0.772

R27	19:1073202	C	R/P	159	cGt/cCt	HMHA1	0.453552	0.005	1
R27	21:34635342	T	P/L	362	cCg/cTg	IFNAR2	0.510417	0.645	0.007
R27	16:1570041	G	I/T	1294	aTt/aCt	IFT140	0.52	0.001	0.998
R27	22:23235989	T	T/S	106	Acc/Tcc	IGLL5	0.148148	0.115	0.006
R27	2:234113353	G	T/S	1186	aCt/aGt	INPP5D	0.47549	0.021	0.148
R27	19:17949108	T	M/I	511	atG/atA	JAK3	0.506608	0.11	0.02
R27	15:42120356	C	E/Q	12	Gag/Cag	JMJD7-PLA	0.339286	0.115	0.748
R27	17:39925453	A	V/L	159	Gtg/Ttg	JUP	0.506329	0.003	0.99
R27	17:7750627	C	S/P	372	Tcc/Ccc	KDM6B	0.577778	0	0.994
R27	8:95539153	G	N/T	440	aAt/aCt	KIAA1429	0.524752	0.084	0.003
R27	17:8272930	G	V/A	334	gTt/gCt	KRBA2	0.529412	0.076	0.138
R27	19:55107147	G	I/M	235	atA/atG	LILRA1	0.761905	0.042	0.283
R27	12:66517774	G	I/T	79	aTt/aCt	LLPH	0.18125	0.583	0.837
R27	17:48465438	T	R/Q	162	cGg/cAg	LRRC59	0.521053	0.137	0.897
R27	15:75654288	T	D/N	337	Gat/Aat	MAN2C1	0.336735	0	1
R27	1:232943843	G	L/R	883	cTa/cGa	MAP10	0.792453	0.013	1
R27	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	0.821429	0.748	0
R27	15:94945216	C	E/Q	685	Gaa/Caa	MCTP2	0.575758	0.006	1
R27	11:66204635	T	S/*	138	tCg/tAg	MRPL11	0.243094	-	-
R27	11:60235747	A	E/K	234	Gaa/Aaa	MS4A1	0.166667	0.027	0.989
R27	1:145311114	A	D/N	605	Gat/Aat	NBPF10	0.588235	0.051	0.406
R27	1:147581611	T	D/N	530	Gat/Aat	NBPF24	0.245902	0.086	0.009
R27	14:51190377	C	T/S	2069	aCt/aGt	NIN	0.422819	0.087	0.275
R27	9:139397675	G	L/P	1709	cTg/cCg	NOTCH1	0.471591	0.224	0.931
R27	1:120479928	C	F/V	1167	Ttc/Gtc	NOTCH2	0.484375	0.076	0.08
R27	17:3591969	A	R/C	280	Cgt/Tgt	P2RX5	0.503745	0.001	1
R27	10:74828651	A	D/V	139	gAt/gTt	P4HA1	0.581395	0	1
R27	X:133527979	T	E/*	139	Gaa/Taa	PHF6	0.780488	-	-
R27	16:88805071	T	R/Q	180	cGg/cAg	PIEZO1	0.927536	0.24	0.007
R27	1:43131667	A	S/N	118	aGt/aAt	PPIH	0.451613	1	0
R27	10:124742261	G	K/E	77	Aaa/Gaa	PSTK	0.5	0.004	1
R27	1:97235421	A	G/E	93	gGa/gAa	PTBP2	0.169231	0.017	0.098
R27	16:29706105	T	A/V	45	gCg/gTg	QPRT	0.582278	0.708	0.023
R27	17:58011851	C	L/S	279	tTg/tCg	RPS6KB1	0.15	0.001	1
R27	21:36421184	C	S/G	5	Agc/Ggc	RUNX1	0.469799	0	0.073
R27	21:33104002	A	D/Y	2	Gac/Tac	SCAF4	0.333333	0.001	0.999
R27	2:198265453	T	E/K	902	Gaa/Aaa	SF3B1	0.427297	0.019	0.997
R27	3:150460005	T	D/N	300	Gac/Aac	SIAH2	0.426471	0.341	0.929
R27	3:170102518	T	D/V	465	gAt/gTt	SKIL	0.142857	0.002	1
R27	19:49813317	A	T/M	227	aCg/aTg	SLC6A16	0.689655	0.127	0.456
R27	2:55831128	T	E/K	95	Gaa/Aaa	SMEK2	0.160377	0.103	0.993
R27	17:40457661	A	G/S	472	Ggc/Agc	STAT5A	0.454819	0.005	0.918
R27	14:21820891	A	R/C	1029	Cgt/Tgt	SUPT16H	0.459596	0.04	0.796
R27	2:10016120	G	E/G	227	gAa/gGa	TAF1B	0.545455	0.006	0.997
R27	19:1650219	G	V/A	10	gTg/gCg	TCF3	0.415179	0.058	0.047
R27	16:1545401	C	E/D	130	gaG/gaC	TELO2	0.443038	0.608	0.05
R27	21:32638697	T	E/K	198	Gaa/Aaa	TIAM1	0.591549	0	0.999
R27	4:38798217	C	L/V	746	Ctc/Gtc	TLR1	0.666667	0.001	0.997
R27	19:47549460	T	A/T	118	Gcc/Acc	TMEM160	0.336283	0.258	0.021
R27	8:74893812	G	M/V	247	Atg/Gtg	TMEM70	0.461538	0.692	0.001
R27	8:133740164	C	I/V	167	Atc/Gtc	TMEM71	0.438462	0.464	0.002
R27	7:72734164	T	N/K	159	aaC/aaA	TRIM50	0.212121	0.587	0.816
R27	15:43690373	A	E/K	472	Gaa/Aaa	TUBGCP4	0.157895	0.023	0.86
R27	7:102280786	G	Y/S	117	tAt/tCt	UPK3BL	0.217105	0.005	1
R27	X:129054530	A	E/K	284	Gaa/Aaa	UTP14A	0.125	0.052	0.907
R27	3:51474987	C	K/R	376	aAg/aGg	VPRBP	0.190476	0	0.974
R27	1:16273450	A	A/V	125	gCg/gTg	ZBTB17	0.410072	0.382	0
R27	2:220072049	C	D/A	19	gAt/gCt	ZFAND2B	0.52	0.002	1
R27	19:19824960	T	G/E	44	gGa/gAa	ZNF14	0.439024	0.051	0.985
R27	19:58083501	C	S/A	591	Tct/Gct	ZNF416	0.222222	0.07	0
R28	3:128598578	C	R/P	15	cGt/cCt	ACAD9	0.166667	0.03	0.998
R28	10:51486110	G	I/T	31	aTc/aCc	AGAP7	0.347826	0.096	0.188
R28	9:117108253	A	S/F	1184	tCt/tTt	AKNA	0.407407	0.003	0.998
R28	11:292956	A	R/H	410	cGt/cAt	ATHL1	0.617257	0.002	1
R28	16:1396221	C	Q/H	819	caG/caC	BAIAP3	0.230769	0.174	0.156
R28	7:6647595	G	L/V	385	Ctc/Gtc	C7orf26	0.511628	0.005	0.732
R28	17:37343823	C	N/S	108	aAt/aGt	CACNB1	0.530612	0.001	0.087
R28	12:67698424	A	E/K	445	Gaa/Aaa	CAND1	0.181818	0.013	0.944
R28	13:111294837	C	L/W	483	tTg/tGg	CARS2	0.50289	0.001	0.999
R28	3:56651368	T	T/I	691	aCa/aTa	CCDC66	0.344262	0.572	0.005
R28	4:68384039	C	N/S	222	aAt/aGt	CENPC1	0.28	0.177	0.009
R28	12:6687601	T	F/Y	1698	tTt/tAt	CHD4	0.450644	0	0.981
R28	17:57721712	G	I/V	40	Att/Gtt	CLTC	0.565217	1	0
R28	6:42897387	A	A/T	27	Gcc/Acc	CNPY3	0.5	0.242	0
R28	13:46090371	G	I/V	635	Att/Gtt	COG3	0.16	1	0.493
R28	3:128979230	A	R/H	309	cGt/cAt	COPG1	0.508621	0.029	0.999
R28	8:145619659	T	V/I	1227	Gtc/Atc	CPSF1	0.455882	0.194	0.432

R28	6:43153227	T	Q/L	210	cAg/cTg	CUL9	0.222222	0.001	0.991
R28	10:101503827	A	R/Q	146	cGa/cAa	CUTC	0.514451	0	1
R28	7:76109831	T	A/V	2	gCc/gTc	DTX2	0.285714	0.004	0.967
R28	1:29379640	A	R/Q	519	cGa/cAa	EPB41	0.37931	0.244	0.978
R28	11:61641303	T	A/T	441	Gcc/Acc	FADS3	0.533835	0.042	0.998
R28	10:47909775	T	T/M	291	aCg/aTg	FAM21B	0.365385	0.148	0.05
R28	19:9921688	T	L/M	289	Ctg/Atg	FBXL12	0.489796	0.016	0.241
R28	14:55818675	A	E/K	523	Gaa/Aaa	FBXO34	0.125	0.043	0.053
R28	5:147820707	C	Y/H	1099	Tat/Cat	FBXO38	0.629032	0	1
R28	1:32797781	C	F/S	437	tTc/tCc	HDAC1	0.448352	0.294	0.282
R28	X:48674615	A	G/R	521	Ggg/Agg	HDAC6	0.996403	0.289	0.81
R28	1:149783695	C	I/V	62	Atc/Gtc	HIST2H2BF	0.153846	0.02	0.581
R28	19:36230305	G	M/T	315	aTg/aCg	IGFLR1	0.52	0.408	0.055
R28	5:55237518	T	E/K	717	Gaa/Aaa	IL6ST	0.16	0.021	0.862
R28	1:226923391	T	R/Q	590	cGg/cAg	ITPKB	0.481132	0.042	0.04
R28	15:40698136	G	D/E	36	gaC/gaG	IVD	0.569106	0.029	0.487
R28	6:56917553	C	T/P	86	Aca/Cca	KIAA1586	0.608696	0.014	1
R28	2:11905785	G	N/D	40	Aat/Gat	LPIN1	0.576923	1	0.002
R28	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	0.93617	0.748	0
R28	22:22160228	C	R/G	135	Aga/Gga	MAPK1	0.44	0.001	0.989
R28	6:90421898	G	V/A	2503	gTc/gCc	MDN1	0.136364	0.077	0.293
R28	22:40814439	G	V/A	668	gTc/gCc	MKL1	0.4	0.079	0.469
R28	2:242036766	G	R/S	199	agG/agC	MTERFD2	0.428571	0.4	0.105
R28	1:147581611	T	D/N	530	Gat/Aat	NBPF24	0.506849	0.086	0.009
R28	9:33468362	C	H/R	422	cAt/cGt	NOL6	0.340659	0.45	0
R28	9:139390721	T	Y/*	2490	taC/taA	NOTCH1	0.462	-	-
R28	9:139397640	T	V/M	1721	Gtg/Atg	NOTCH1	0.385382	0.001	1
R28	17:73205954	T	Y/F	55	tAt/tTt	NUP85	0.580247	0.205	0.001
R28	10:51040875	A	A/V	874	gCc/gTc	PARG	0.541667	0.128	0.967
R28	8:144995351	G	C/R	3017	Tgc/Cgc	PLEC	0.191781	0.507	0
R28	19:8563302	T	V/M	512	Gtg/Atg	PRAM1	0.520833	0.214	0.072
R28	2:54122754	T	E/K	1270	Gaa/Aaa	PSME4	0.130435	0.102	0.964
R28	8:142435224	T	D/V	61	gAt/gTt	PTP4A3	0.318182	0.151	0.004
R28	7:100961418	T	G/S	65	Ggt/Agt	RABL5	0.472222	1	0.018
R28	20:20493325	G	V/A	1563	gTc/gCc	RALGAPA2	0.5	1	0
R28	4:57796749	A	M/I	575	atG/atA	REST	0.147059	0.676	0
R28	3:16535343	T	D/N	12	Gat/Aat	RFTN1	0.545455	0.002	0.977
R28	21:30378775	A	D/V	308	gAt/gTt	RWDD2B	0.511628	0.125	0.971
R28	15:77020948	T	R/Q	717	cGg/cAg	SCAPER	0.394737	0.044	1
R28	12:48172924	A	V/I	84	Gtc/Atc	SLC48A1	0.62069	0.489	0.226
R28	3:57882294	A	E/K	439	Gaa/Aaa	SLMAP	0.122449	0.004	0.999
R28	3:160131304	A	E/K	342	Gaa/Aaa	SMC4	0.142857	0.318	0.001
R28	17:36522253	T	R/W	382	Cgg/Tgg	SOCS7	0.45	0.002	1
R28	8:53030998	C	I/R	920	aTa/aGa	ST18	0.47619	0.011	0.668
R28	11:124494858	A	R/H	61	cGt/cAt	TBRG1	0.306931	0.251	0.066
R28	7:45148493	A	P/L	115	cCa/cTa	TBRG4	0.522293	0.057	0.488
R28	11:62557365	T	S/F	169	tCt/tTt	TMEM179E	0.354839	0.062	0.999
R28	15:42556365	T	E/K	110	Gaa/Aaa	TMEM87A	0.135135	0.727	0.026
R28	18:66377296	C	P/R	76	cCa/cGa	TMX3	0.685714	0.002	1
R28	11:57069289	A	A/S	1655	Gcc/Tcc	TNKS1BP1	0.46	0.005	1
R28	21:45504066	A	V/I	768	Gtc/Atc	TRAPPC10	0.547619	0.286	0.088
R28	9:119460858	C	E/D	279	gaG/gaC	TRIM32	0.16	0.057	0.692
R28	6:30692143	G	D/G	435	gAt/gGt	TUBB	0.429321	NA	0.805
R28	17:40765874	T	T/I	234	aCc/aTc	TUBG1	0.417582	0.001	0.954
R28	16:11785862	T	R/Q	395	cGg/cAg	TXNDC11	0.433333	0.247	0.024
R28	13:100037558	G	N/S	335	aAt/aGt	UBAC2	0.540146	0.023	0.711
R28	13:41654782	A	E/K	253	Gaa/Aaa	WBP4	0.2	0.323	0.001
R28	4:10077094	A	H/Y	577	Cac/Tac	WDR1	0.495356	0.093	0.996
R28	17:1637420	T	R/C	646	Cgc/Tgc	WDR81	0.446809	0.001	1
R28	19:12786341	T	A/V	268	gCg/gTg	WDR83	0.587838	0.238	0.018
R28	3:101383533	T	G/E	550	gGa/gAa	ZBTB11	0.12	0.007	0.999
R28	10:46121844	T	R/H	476	cGc/cAc	ZFAND4	0.588235	0.329	0.01
R28	12:133682428	C	Y/H	189	Tat/Cat	ZNF140	0.125	0.031	0.967
R31	7:35840881	C	G/A	21	gGt/gCt	7-Sep	1	1	0
R31	17:35620701	C	N/D	61	Aat/Gat	ACACA	0.166667	0.005	1
R31	10:51226309	C	M/V	225	Atg/Gtg	AGAP8	0.214286	0.162	0
R31	X:1720027	T	P/L	543	cCg/cTg	AKAP17A	0.470588	0.048	0.991
R31	1:165648702	A	A/S	303	Gcc/Tcc	ALDH9A1	0.417722	0.002	0.8
R31	2:112636421	C	Y/C	114	tAt/tGt	ANAPC1	0.47619	0.116	0.987
R31	2:96583647	A	S/L	802	tCg/tTg	ANKRD36C	0.214286	0.538	0.339
R31	2:96587360	T	G/E	747	gGg/gAg	ANKRD36C	0.375	0.109	1
R31	2:96587399	A	S/L	734	tCg/tTg	ANKRD36C	0.178571	0.135	0.777
R31	21:47613571	A	H/Y	35	Cat/Tat	AP001468.	0.266667	0.928	1
R31	16:28508617	A	R/H	752	cGt/cAt	APOBR	0.4	0.231	0.001
R31	8:68137231	A	A/V	210	gCa/gTa	ARFGEF1	0.418919	0.074	0.883
R31	X:135863020	A	V/L	8	Gtg/Ttg	ARHGEF6	1	1	1
R31	X:1531648	T	R/K	465	aGg/aAg	ASMTL	0.481013	1	0.019

R31	X:1531687	C	H/R	452	cAt/cGt	ASMTL	0.448276	1	0.999
R31	X:1537881	T	V/M	382	Gtg/Atg	ASMTL	0.537037	0.002	0.002
R31	3:52442505	A	M/I	80	atG/atT	BAP1	0.545455	0.712	0.021
R31	5:70858261	A	E/K	575	Gaa/Aaa	BDP1	0.142857	1	0.995
R31	12:113629501	T	T/M	254	aCg/aTg	C12orf52	0.65625	0.042	0.794
R31	12:7053319	T	S/I	12	aGc/aTc	C12orf57	0.510917	0.016	0.001
R31	5:179264557	A	T/I	234	aCa/aTa	C5orf45	0.535714	0.205	0.856
R31	8:146278063-1462	T	S/F	33	tCc/tTc	C8orf33	0.508197	0.036	0.997
R31	9:173279-173279	T	C/Y	110	tGt/tAt	CBWD1	0.464789	0	0
R31	3:48474264	C	N/D	155	Aat/Gat	CCDC51	0.421053	1	0.662
R31	17:80071629	C	H/R	217	cAc/cGc	CCDC57	0.190476	0.021	0
R31	7:5963104	T	P/L	398	cCc/cTc	CCZ1	0.352518	0.591	0
R31	13:46090371	G	I/V	411	Att/Gtt	COG3	0.2	1	0
R31	X:1428421	T	R/L	358	cGg/cTg	CSF2RA	0.545455	0.001	0.999
R31	15:100353211	G	S/G	56	Agc/Ggc	CTD-2054N	0.175	1	1
R31	6:43153227	T	Q/L	210	cAg/cTg	CUL9	0.228571	0.001	0
R31	X:148627384	G	T/A	70	Acc/Gcc	CXorf40A	1	0.024	0
R31	X:149101934	C	C/W	53	tgT/tgG	CXorf40B	1	0.199	0.917
R31	5:156721867	C	K/Q	95	Aag/Cag	CYFIP2	0.978632	1	0.614
R31	19:48981323	G	A/G	270	gCa/gGa	CYTH2	0.896825	0.602	0.999
R31	1:200619632	G	L/P	412	cTa/cCa	DDX59	0.333333	0.263	0.408
R31	X:2139186	T	E/K	297	Gag/Aag	DHRSX	0.451807	0.003	0.9
R31	X:2139200	C	H/R	292	cAt/cGt	DHRSX	0.523077	0.528	0.059
R31	X:2161129	G	V/L	224	Gtc/Ctc	DHRSX	0.985507	0.674	0.002
R31	1:94343099	A	T/I	131	aCa/aTa	DNTTIP2	0.48855	0.412	0.005
R31	19:2222047	T	A/V	960	gCc/gTc	DOT1L	0.666667	0.557	1
R31	7:76109831-7610	T	A/V	2	gCc/gTc	DTX2	0.382353	0.004	0
R31	19:14883288	G	L/P	74	cTg/cCg	EMR2	0.221622	1	0.414
R31	6:170159110	C	L/P	59	cTg/cCg	ERMARD	0.539683	0	0.009
R31	10:47909775	T	T/M	186	aCg/aTg	FAM21B	0.357143	0.152	0
R31	9:20948889	G	M/V	1280	Atg/Gtg	FOCAD	0.166667	0.005	0.493
R31	X:153908482	A	T/M	503	aCg/aTg	GAB3	1	0.283	0
R31	4:845660	A	A/V	1050	gCc/gTc	GAK	0.572816	0.414	0.03
R31	15:84907343	T	A/S	67	Gca/Tca	GOLGA6L4	0.545455	0.133	0.003
R31	15:34680063	T	A/T	47	Gct/Act	GOLGA8A	0.194444	1	0.002
R31	X:153220360	G	S/P	1164	Tcc/Ccc	HCFC1	1	0.837	0.98
R31	15:28447277-2844	T	D/E	255	gaT/gaA	HERC2	0.6	0.24	0.059
R31	6:27806590	T	P/S	51	Ccc/Tcc	HIST1H2BN	0.53125	0.027	0
R31	6:32549475	C	M/V	171	Atg/Gtg	HLA-DRB1	1	1	0.003
R31	4:57976210	T	G/D	103	gGc/gAc	IGFBP7	0.733333	0.326	0.076
R31	14:106926223-106	C	T/A	107	Act/Gct	IGHV3-43	0.227273	-	0.991
R31	14:106926388	C	T/A	52	Acc/Gcc	IGHV3-43	0.565217	-	0.9
R31	2:89339952	A	R/S	40	agA/agT	IGKV1-12	0.190476	-	0.008
R31	2:89399628	G	Q/H	25	caG/caC	IGKV1-16	0.2	-	0.967
R31	2:89544283	G	M/T	114	aTg/aCg	IGKV2-30	0.384615	-	0.001
R31	2:89442255	T	S/R	50	agC/agA	IGKV3-20	0.159091	-	0
R31	22:23135262	G	T/A	42	Act/Gct	IGLV2-11	0.208333	-	0.001
R31	22:22385581	G	L/V	24	Ctg/Gtg	IGLV4-69	0.190476	-	0.113
R31	X:155239602	A	R/H	365	cGt/cAt	IL9R	0.588235	1	0.128
R31	X:155239824	G	N/S	439	aAc/aGc	IL9R	0.774194	0.55	0.002
R31	X:155239827	G	N/S	440	aAc/aGc	IL9R	0.674797	0.151	0.879
R31	1:234744991	A	P/S	84	Ccg/Tcg	IRF2BP2	0.552083	0.405	0.991
R31	12:26551884	A	I/F	2541	Atc/Ttc	ITPR2	0.571429	0	0.394
R31	2:24522797	C	K/R	442	aAa/aGa	ITSN2	0.571429	0.195	0.003
R31	7:141386430	G	Q/H	8	caA/caC	KIAA1147	0.531915	0.299	0.615
R31	20:30898505	A	A/T	309	Gcc/Acc	KIF3B	0.111111	0.179	0.616
R31	18:21469994	A	G/R	35	Ggg/Agg	LAMA3	0.15625	0	0.005
R31	19:54744387	T	V/M	341	Gtg/Atg	LILRA6	0.727273	0.036	0.009
R31	19:54744799	C	P/R	288	cCc/cGc	LILRA6	0.666667	0.506	0.002
R31	19:54746051	C	L/W	69	tTg/tGg	LILRA6	0.767442	1	0.691
R31	19:54726628	T	V/M	21	Gtg/Atg	LILRB3	0.589286	0.086	0.002
R31	12:49499707	A	A/V	64	gCg/gTg	LMBR1L	0.459459	0.014	0.883
R31	7:39990527	G	L/P	331	cTt/cCt	LOC101925	0.2	0.077	0
R31	7:39990548	G	L/P	324	cTg/cCg	LOC101925	0.708333	0.204	0.019
R31	17:44373433	G	P/A	312	Cct/Gct	LRRC37A	0.466667	0.292	0.999
R31	17:44373886	T	P/S	463	Cca/Tca	LRRC37A	0.384615	0.5	0.001
R31	17:44408066	A	F/L	280	ttC/ttA	LRRC37A	0.596899	0.113	0
R31	17:44414684	C	W/R	767	Tgg/Cgg	LRRC37A	0.485714	0.489	1
R31	17:44627117	G	K/E	1538	Aag/Gag	LRRC37A2	0.674242	0.019	0.944
R31	17:30351758	A	L/I	570	Ctt/Att	LRRC37B	0.492063	1	0.128
R31	6:161494534	G	L/V	663	Ctg/Gtg	MAP3K4	0.136364	0.279	0
R31	6:161512445	G	N/S	1003	aAt/aGt	MAP3K4	0.515152	0.555	0.461
R31	14:50904729	T	V/E	569	gTa/gAa	MAP4K5	1	0.748	0.999
R31	16:29818387	G	E/G	71	gAg/gGg	MAZ	0.269231	0.01	0.98
R31	7:128142743	G	R/G	141	Agg/Ggg	METTL2B	0.166667	0.004	0.763
R31	1:12090138	A	R/Q	300	cGg/cAg	MIIP	0.528926	0.01	0.095
R31	11:47648670	C	M/V	206	Atg/Gtg	MTCH2	0.462687	0.629	0.615

R31	22:26272163	A	R/Q	1364	cGa/cAa	MYO18B	0.484778	0.558	0.001
R31	10:36812385	C	N/D	260	Aat/Gat	NAMPTL	1	1	0.05
R31	1:145359921	A	Q/K	3048	Caa/Aaa	NBPF10	0.338346	0.143	0.046
R31	1:145368473	A	R/H	602	cGt/cAt	NBPF10	0.257485	0.001	1
R31	1:146400104	A	A/T	266	Gct/Act	NBPF12	0.25	0.154	0.396
R31	1:144193112	A	Q/K	1251	Caa/Aaa	NBPF8	0.26087	0.162	0
R31	13:52715206-5271	T	A/T	293	Gca/Aca	NEK3	0.981132	0.574	0.019
R31	16:69776344	A	D/V	377	gAc/gTc	NOB1	0.547486	0.001	0.938
R31	17:65734433	G	S/R	575	agC/agG	NOL11	0.666667	0.461	0.799
R31	4:2940026	C	I/V	779	Atc/Gtc	NOP14	0.2	0	0
R31	1:120611964	C	C/W	19	tgC/tgG	NOTCH2	0.142857	0.185	0.815
R31	16:21846835	A	R/L	874	cGt/cTt	NPIPB4	0.416667	0.15	0.843
R31	13:25021245-2502	G	V/A	1065	gTg/gCg	PARP4	1	1	0.999
R31	1:144912233	T	R/H	468	cGc/cAc	PDE4DIP	0.304348	0.084	0.033
R31	19:33878978	A	R/C	388	Cgc/Tgc	PEPD	0.466667	0	0.99
R31	12:53690219	G	I/V	57	Att/Gtt	PFDN5	0.526316	-	0.252
R31	16:2159365	A	R/C	1935	Cgt/Tgt	PKD1	0.518519	0.173	0
R31	8:144998831	T	E/K	1894	Gag/Aag	PLEC	0.56	0.004	0.794
R31	9:139316350	A	V/M	152	Gtg/Atg	PMPCA	0.325	0.235	0
R31	X:152226542	C	V/A	377	gTg/gCg	PNMA3	0.174242	1	0.001
R31	16:22337261	A	E/K	510	Gag/Aag	POLR3E	0.722222	0.299	0.917
R31	7:72413443	A	A/T	706	Gca/Aca	POM121	0.313725	0.574	0.05
R31	15:43874771	A	R/W	171	Cgg/Tgg	PPIP5K1	0.5	0.088	1
R31	10:73581770	C	L/V	260	Ctt/Gtt	PSAP	0.368421	0.248	0.763
R31	7:99817556-99817	T	P/L	8	cCg/cTg	PVRIG	0.355932	1	0
R31	X:48435928	T	P/L	164	cCg/cTg	RBM3	1	0	1
R31	3:49398382	C	R/G	176	Agg/Ggg	RHOA	0.15942	0	1
R31	15:41044365	A	R/W	67	Cgg/Tgg	RMDN3	0.458333	0.02	0.84
R31	16:30234381-3023	A	S/L	411	tCa/tTa	RP11-347C	0.3	0.153	0
R31	X:153629155	G	N/S	202	aAt/aGt	RPL10	1	1	0.023
R31	3:23963089	G	M/V	121	Atg/Gtg	RPL15	0.727273	1	1
R31	1:53513547	G	T/A	89	Aca/Gca	SCP2	0.537313	0.011	0.065
R31	X:1508583	C	Q/R	50	cAg/cGg	SLC25A6	0.566667	0	0
R31	18:33706750	G	G/A	74	gGg/gCg	SLC39A6	0.277778	0	0.002
R31	16:30206213	A	W/R	83	Tgg/Agg	SLX1A	0.319149	0	0.023
R31	17:49067841	T	G/S	706	Ggt/Agt	SPAG9	0.28	0.054	0.681
R31	21:47588485	A	A/V	94	gCc/gTc	SPATC1L	1	0.107	0
R31	5:139936798	G	A/P	41	Gcc/Ccc	SRA1	0.39759	0.014	0.973
R31	17:74053576	G	V/L	296	Gtg/Ctg	SRP68	0.296296	0.007	0.83
R31	11:125488310	T	T/I	514	aCa/aTa	STT3A	0.517391	0.879	0.999
R31	7:56146659	G	Q/R	289	cAg/cGg	SUMF2	0.15	0.617	0
R31	7:56146707	G	Q/R	305	cAg/cGg	SUMF2	0.3	0.965	0
R31	1:43893703	T	S/F	379	tCc/tTc	SZT2	0.484848	0.004	0.004
R31	17:34582958	T	P/Q	419	cCa/cAa	TBC1D3C	1	0.037	0.002
R31	17:34747974	T	P/Q	278	cCa/cAa	TBC1D3H	1	0.037	0.879
R31	X:148681299	A	S/C	243	Agc/Tgc	TMEM185A	1	0.812	0.843
R31	4:2746621	C	Y/D	130	Tac/Gac	TNIP2	0.454545	0	1
R31	7:5410285	T	V/M	1314	Gtg/Atg	TNRC18	0.516129	0.049	0
R31	2:202260069	T	Q/K	290	Cag/Aag	TRAK2	0.448819	0.147	0.917
R31	7:142423613	G	K/R	90	aAg/aGg	TRBV27	0.622222	-	0.999
R31	7:142423667	G	Y/C	108	tAc/tGc	TRBV27	0.15	-	0.001
R31	7:142423681	G	S/G	113	Agt/Ggt	TRBV27	0.209677	-	0.394
R31	8:143425434-1434	A	S/F	213	tCc/tTc	TSNARE1	0.571429	-	0.252
R31	6:116574478	C	F/V	232	Ttt/Gtt	TSPYL4	0.506667	0.001	0.96
R31	1:117618158	A	E/K	318	Gag/Aag	TTF2	0.567568	0.164	0.999
R31	20:36640810	A	R/L	470	cGc/cTc	TTI1	0.542857	0.141	0.999
R31	14:76259409-7625	A	S/Y	1061	tCt/tAt	TTLL5	0.371429	0.001	0.002
R31	X:47057647	G	I/V	16	Atc/Gtc	UBA1	0.523077	1	0.84
R31	1:154229547	A	S/R	733	agT/agA	UBAP2L	0.518135	0.001	0
R31	X:154456747	G	M/V	123	Atg/Gtg	VBP1	1	0.068	0.938
R31	12:123351893	T	P/T	210	Cca/Aca	VPS37B	0.576923	0.005	0.997
R31	X:48460314	G	H/R	233	cAt/cGt	WDR13	0.998654	1	0.003
R31	1:203819031	T	R/W	606	Cgg/Tgg	ZC3H11A	0.424561	0.219	0.005
R31	12:133733283	T	T/I	484	aCt/aTt	ZNF10	0.238095	0.001	0
R31	12:133683016	C	Y/H	385	Tat/Cat	ZNF140	0.125	0.009	0
R31	12:133683100	C	Y/H	413	Tat/Cat	ZNF140	0.16	0.035	0.493

Table S8. DAVID: functional annotation

Category	Term	Count	%	PValue	Genes
KEGG_PATHWAY	hsa04144:Endocytosis	14	2.67175573	0.001733767	PARD6A, PARD3, USP8, HLA-A, HSPA1A, CLTC, HLA-G, HSPA1L, RABEP1, VPS28, EPN1, IQSEC1, AP2M1, DNM2
KEGG_PATHWAY	hsa04330:Notch signaling pathway	6	1.14503817	0.009457064	KAT2A, NOTCH1, HDAC1, DTX2, CREBBP, NCOR2
KEGG_PATHWAY	hsa04070:Phosphatidylinositol signaling system	7	1.33587786	0.016657676	DGKQ, PIK3C2B, PI4KA, PIK3CA, PLCD1, ITPR1, ITPR2
KEGG_PATHWAY	hsa04630:Jak-STAT signaling pathway	10	1.90839695	0.028576476	TYK2, IFNAR2, OSMR, IL10RB, IL6ST, STAT5A, CREBBP, JAK1, PIK3CA, JAK3
KEGG_PATHWAY	hsa04120:Ubiquitin mediated proteolysis	9	1.71755725	0.036942745	ANAPC1, SYVN1, XIAP, CUL4A, DDB1, UBE2M, BIRC6, KEAP1, HERC2
KEGG_PATHWAY	hsa03040:Spliceosome	8	1.52671756	0.061582784	HSPA1L, EIF4A3, SF3B1, DDX46, CRNKL1, CDC40, HSPA1A, CDC5L
KEGG_PATHWAY	hsa03410:Base excision repair	4	0.76335878	0.072913739	MUTYH, NEIL1, PARP4, OGG1
KEGG_PATHWAY	hsa03010:Ribosome	6	1.14503817	0.09499093	RPL30, RPS27, RPL9, RPL15, RPS19P3, RPS6

Table S9. ENDEAVOUR gene ranking

Gene symbol	Description	Global prioritization score	Rank
ABL1	Proto-oncogene tyrosine-protein kinase ABL1	1	9.34E-07
JAK1	Tyrosine-protein kinase JAK1	2	2.59E-06
INSL3|JAK3	Tyrosine-protein kinase JAK3	3	9.65E-06
DNM2|QTRT1	Dynamin-2	4	2.23E-05
STAT5A	Signal transducer and activator of transcription 5A. [Source:Uniprot/SWISSPROT;Acc:P42229]	5	5.56E-05
HDAC1	Histone deacetylase 1	6	0.000555
SMARCC1	SWI/SNF-related matrix-associated actin-dependent regulator of chromatin subfamily C member 1	7	0.00188
IFNAR2	Interferon-alpha/beta receptor beta chain precursor	8	0.00543
NCOR1	Nuclear receptor corepressor 1	9	0.00746
MAZ	Myc-associated zinc finger protein	10	0.00941
MAP4K5	Mitogen-activated protein kinase kinase kinase kinase 5	11	0.0171
AKAP8	A-kinase anchor protein 8	12	0.0181
PHF6	PHD finger protein 6	13	0.0227
RPL15	60S ribosomal protein L15. [Source:Uniprot/SWISSPROT;Acc:P61313]	14	0.0235
RBBP8	Retinoblastoma-binding protein 8	15	0.0323
PTPN12	Tyrosine-protein phosphatase non-receptor type 12	16	0.0339
MED12	Mediator of RNA polymerase II transcription subunit 12	17	0.0353
LRPPRC	130 kDa leucine-rich protein	18	0.0377
E4F1	p120E4F [Source:RefSeq_peptide;Acc:NP_004415]	19	0.039
NBN	Nibrin	20	0.043
BLM	Bloom syndrome protein	21	0.0448
BAP1	Ubiquitin carboxyl-terminal hydrolase BAP1	22	0.049
CLTC	Clathrin heavy chain 1	23	0.0499
HOXB3	Homeobox protein Hox-B3	24	0.055
SNX6	Sorting nexin-6	25	0.0622
ARID4A	AT-rich interactive domain-containing protein 4A	26	0.0726
CPSF1	Cleavage and polyadenylation specificity factor subunit 1	27	0.0792
KEAP1	Kelch-like ECH-associated protein 1	28	0.0813
HERC2	HECT domain and RCC1-like domain-containing protein 2. [Source:Uniprot/SWISSPROT;Acc:O95714]	29	0.0817
PARP4	Poly [ADP-ribose] polymerase 4	30	0.0866
CLK4	Dual specificity protein kinase CLK4	31	0.088
KLC1	Kinesin light chain 1	32	0.0896
PKD1	Polycystin-1 precursor	33	0.0943
THRAP3	Thyroid hormone receptor-associated protein 3	34	0.0975
HLA-A|HLA-G	HLA class I histocompatibility antigen, alpha chain G precursor	35	0.0979
WBP4	WW domain-binding protein 4	36	0.0998
ALDH5A1	Succinate semialdehyde dehydrogenase, mitochondrial precursor	37	0.107
ANAPC1	Anaphase-promoting complex subunit 1	38	0.108
SMC4	Structural maintenance of chromosomes protein 4	39	0.11
FAM21B|FAM21C	Protein FAM21C. [Source:Uniprot/SWISSPROT;Acc:Q9Y4E1]	40	0.111
APOBEC3F|APOBEC3G	DNA dC->dU-editing enzyme APOBEC-3G	41	0.121
DCK	Deoxycytidine kinase	42	0.121
IL6ST	Interleukin-6 receptor subunit beta precursor	43	0.122
AKNA	AT-hook transcription factor [Source:RefSeq_peptide;Acc:NP_110394]	44	0.123
POM121	Nuclear envelope pore membrane protein POM 121	45	0.126
EEF1B2	Elongation factor 1-beta	46	0.128
JMJD1C	Probable JmjC domain-containing histone demethylation protein 2C	47	0.136
NUP85	nucleoporin 85 [Source:RefSeq_peptide;Acc:NP_079120]	48	0.137
AP3B1	AP-3 complex subunit beta-1	49	0.146
COPA	Coatomer subunit alpha	50	0.151
MT-ND2	NADH-ubiquinone oxidoreductase chain 2	51	0.16
DOT1L	Histone-lysine N-methyltransferase, H3 lysine-79 specific	52	0.173
AKAP9	A-kinase anchor protein 9	53	0.176
SEPT7	Septin-7	54	0.183
P2RX5|TAX1BP3	Tax1-binding protein 3	55	0.185
ZBTB11	Zinc finger and BTB domain-containing protein 11. [Source:Uniprot/SWISSPROT;Acc:O95625]	56	0.187
OGG1	N-glycosylase/DNA lyase [Includes: 8-oxoguanine DNA glycosylase	57	0.188
DDX11	Probable ATP-dependent RNA helicase DDX11	58	0.194
PSAP	Proactivator polypeptide precursor [Contains: Saposin A	59	0.198
EIF4A3	Probable ATP-dependent RNA helicase DDX48	60	0.199
MS4A1	B-lymphocyte antigen CD20	61	0.209
PLEKHO1	OC120 [Source:RefSeq_peptide;Acc:NP_057358]	62	0.209
DNAJC13	DnaJ homolog subfamily C member 13	63	0.221
FRG1	Protein FRG1	64	0.222
BAZ2B	Bromodomain adjacent to zinc finger domain protein 2B	65	0.236
AP1G2|JPH4	Junctophilin-4	66	0.246
RPL9	60S ribosomal protein L9. [Source:Uniprot/SWISSPROT;Acc:P32969]	67	0.257
TMEM87A	Transmembrane protein 87A precursor. [Source:Uniprot/SWISSPROT;Acc:Q8NBN3]	68	0.262
MT-CO2	Cytochrome c oxidase subunit 2	69	0.291
MFN1	Mitofusin-1	70	0.296
SEC24D	Protein transport protein Sec24D	71	0.307
PILRA	Paired immunoglobulin-like type 2 receptor alpha precursor	72	0.327
EMR2	EGF-like module-containing mucin-like hormone receptor-like 2 precursor	73	0.339
PIK3C2B	Phosphatidylinositol-4-phosphate 3-kinase C2 domain-containing beta polypeptide	74	0.341
ZNF574	Zinc finger protein 574. [Source:Uniprot/SWISSPROT;Acc:Q6ZN55]	75	0.341
TRIM5	Tripartite motif-containing protein 5	76	0.342
ZNRF1	E3 ubiquitin-protein ligase ZNRF1	77	0.347
EDEM3	ER degradation-enhancing alpha-mannosidase-like 3. [Source:Uniprot/SWISSPROT;Acc:Q9BZQ6]	78	0.354
ZNF133	Zinc finger protein 133. [Source:Uniprot/SWISSPROT;Acc:P52736]	79	0.354
OBSCN	Obscurin	80	0.356
ATXN7	Ataxin-7	81	0.361
MT-ND1	NADH-ubiquinone oxidoreductase chain 1	82	0.375
MT-CO1	Cytochrome c oxidase subunit 1	83	0.375
MT-ATP6	ATP synthase a chain	84	0.375
MT-CYB	Cytochrome b. [Source:Uniprot/SWISSPROT;Acc:P00156]	85	0.376
MT-CO3	Cytochrome c oxidase subunit 3	86	0.378
MT-ND6	NADH-ubiquinone oxidoreductase chain 6	87	0.381
EXOSC2	Exosome complex exonuclease RRP4	88	0.381
SCML2	Sex comb on midleg-like protein 2. [Source:Uniprot/SWISSPROT;Acc:Q9UQR0]	89	0.392

KIAA1715	Protein lunapark. [Source:Uniprot/SWISSPROT;Acc:Q9C0E8]	90	0.392
PTPN23	Tyrosine-protein phosphatase non-receptor type 23	91	0.412
PEPD	Xaa-Pro dipeptidase	92	0.416
PTBP2	Polypyrimidine tract-binding protein 2	93	0.428
NEIL1	Endonuclease VIII-like 1	94	0.442
SMEK2	SMEK homolog 2. [Source:Uniprot/SWISSPROT;Acc:Q5MIZ7]	95	0.443
GOLGA8A|GOLGA8B	Golgin subfamily A member 8A/B	96	0.45
MT-ND4	NADH-ubiquinone oxidoreductase chain 4	97	0.455
MT-ND5	NADH-ubiquinone oxidoreductase chain 5	98	0.459
NEK3	Serine/threonine-protein kinase Nek3	99	0.471
C5orf24	CDNA FLJ37562 fis, clone BRCOC2000487. [Source:Uniprot/SPTREMBL;Acc:Q8N1T9]	100	0.482
KIF2A	Kinesin-like protein KIF2A	101	0.483
KIAA2026	KIAA2026	102	0.493
ENO3	Beta-enolase	103	0.499
CBWD5	COBW domain-containing protein 5. [Source:Uniprot/SPTREMBL;Acc:Q5RIA9]	104	0.5
ZSCAN21	Zinc finger and SCAN domain-containing protein 21	105	0.502
CEP350	Centrosome-associated protein 350	106	0.515
HK3	Hexokinase-3	107	0.516
ALMS1	Alstrom syndrome protein 1. [Source:Uniprot/SWISSPROT;Acc:Q8TCU4]	108	0.524
PRF1	Perforin-1 precursor	109	0.529
BDP1	transcription factor-like nuclear regulator [Source:RefSeq_peptide;Acc:NP_060899]	110	0.533
ZNF235	Zinc finger protein 235	111	0.546
AMOTL1	Angiomotin-like protein 1. [Source:Uniprot/SWISSPROT;Acc:Q8IY63]	112	0.552
DDOST	Dolichyl-diphosphooligosaccharide--protein glycosyltransferase 48 kDa subunit precursor	113	0.554
NFXL1	NF-X1-type zinc finger protein NFXL1	114	0.555
CEP170	centrosomal protein 170kDa isoform gamma [Source:RefSeq_peptide;Acc:NP_001035864]	115	0.564
NBPF11|NBPF12|NBPF8	neuroblastoma breakpoint family, member 11	116	0.566
ZNF140	Zinc finger protein 140. [Source:Uniprot/SWISSPROT;Acc:P52738]	117	0.572
MYO15B	myosin XVB pseudogene	118	0.585
ARHGEF18	Rho-specific guanine nucleotide exchange factor p114 [Source:RefSeq_peptide;Acc:NP_056133]	119	0.608
PLEKHM1	pleckstrin homology domain containing, family M	120	0.613
GOLGB1	Golgin subfamily B member 1	121	0.626
C14orf159	UPF0317 protein C14orf159, mitochondrial precursor. [Source:Uniprot/SWISSPROT;Acc:Q7Z3D6]	122	0.628
GSTM2|GSTM4	Glutathione S-transferase Mu 4	123	0.633
KIAA1429	KIAA1429	124	0.652
BAHCC1	CDNA: FLJ23058 fis, clone LNG03818. [Source:Uniprot/SPTREMBL;Acc:Q9H5T5]	125	0.659
CCDC66	coiled-coil domain containing 66 [Source:RefSeq_peptide;Acc:NP_001012524]	126	0.665
COG3	Conserved oligomeric Golgi complex component 3	127	0.676
C7orf26	Uncharacterized protein C7orf26. [Source:Uniprot/SWISSPROT;Acc:Q96N11]	128	0.68
RFWD3	RING finger and WD repeat domain-containing protein 3	129	0.686
MT-ND3	NADH-ubiquinone oxidoreductase chain 3	130	0.701
DGKQ	Diacylglycerol kinase theta	131	0.703
MARCH2	E3 ubiquitin-protein ligase MARCH2	132	0.708
PMPCA	Mitochondrial-processing peptidase alpha subunit, mitochondrial precursor	133	0.712
ZNF20|ZNF625	Zinc finger protein 625. [Source:Uniprot/SWISSPROT;Acc:Q96I27]	134	0.713
DHX29	Putative ATP-dependent RNA helicase DHX29	135	0.719
NOB1	RNA-binding protein NOB1	136	0.727
ODF2L	outer dense fiber of sperm tails 2-like isoform a [Source:RefSeq_peptide;Acc:NP_065780]	137	0.74
SERPINA1	Alpha-1-antitrypsin precursor	138	0.755
HUS1|HUS1B	Checkpoint protein HUS1B	139	0.765
C9orf72	Uncharacterized protein C9orf72. [Source:Uniprot/SWISSPROT;Acc:Q96LT7]	140	0.773
ZNF14	Zinc finger protein 14	141	0.778
IGLV4-69	Immunoglobulin Lambda light chain V gene segment [Source:IMGT/GENE_DB;Acc:IGLV4-69]	142	0.78
IGLV1-47	Immunoglobulin Lambda light chain V gene segment [Source:IMGT/GENE_DB;Acc:IGLV1-47]	143	0.78
TCHP	trichoplein [Source:RefSeq_peptide;Acc:NP_115676]	144	0.788
AZIN1	Antizyme inhibitor 1	145	0.803
ACAD9	Acyl-CoA dehydrogenase family member 9, mitochondrial precursor	146	0.806
VPS52	Vacuolar protein sorting-associated protein 52 homolog	147	0.817
KIAA1245|NBPF10|NOTCH2NL	Notch homolog 2 N-terminal like protein [Source:RefSeq_peptide;Acc:NP_982283]	148	0.838
IGHA2	Immunoglobulin heavy chain C gene segment [Source:IMGT/GENE_DB;Acc:IGHA2]	149	0.865
IGLV3-25	Immunoglobulin Lambda light chain V gene segment [Source:IMGT/GENE_DB;Acc:IGLV3-25]	150	0.868
MCPH1	Microcephalin. [Source:Uniprot/SWISSPROT;Acc:Q8NEM0]	151	0.881
PYHIN1	pyrin and HIN domain family, member 1 alpha 1 isoform [Source:RefSeq_peptide;Acc:NP_689714]	152	0.886
LILRA1	Leukocyte immunoglobulin-like receptor subfamily A member 1 precursor	153	0.896
SH3TC1	SH3 domain and tetratricopeptide repeats-containing protein 1. [Source:Uniprot/SWISSPROT;Acc:Q8TE82]	154	0.91
HEATR3	HEAT repeat-containing protein 3. [Source:Uniprot/SWISSPROT;Acc:Q7Z4Q2]	155	0.921
WDR81	WD repeat protein 81. [Source:Uniprot/SWISSPROT;Acc:Q562E7]	156	0.924
IGLV2-23	Immunoglobulin Lambda light chain V gene segment [Source:IMGT/GENE_DB;Acc:IGLV2-23]	157	0.925
ATXN7L1|ATXN7L4	Ataxin-7-like protein 4. [Source:Uniprot/SWISSPROT;Acc:Q8N2T0]	158	0.932
CDH4	Cadherin-4 precursor	159	0.932
MCTP2	multiple C2-domains with two transmembrane regions 2 [Source:RefSeq_peptide;Acc:NP_060819]	160	0.933
IGLV2-11	Immunoglobulin Lambda light chain V gene segment [Source:IMGT/GENE_DB;Acc:IGLV2-11]	161	0.936
TNRC18	Trinucleotide repeat-containing protein 18	162	0.944
C4orf21	Uncharacterized protein C4orf21. [Source:Uniprot/SPTREMBL;Acc:Q86YA3]	163	0.947
IGHG2	Immunoglobulin heavy chain C gene segment [Source:IMGT/GENE_DB;Acc:IGHG2]	164	0.958
IGKV1-5	Immunoglobulin Kappa light chain V gene segment [Source:IMGT/GENE_DB;Acc:IGKV1-5]	165	0.958
SFT2D1	Vesicle transport protein SFT2A	166	0.962
BLCAP	Bladder cancer-associated protein	167	0.972
ZNF714	zinc finger protein 714 [Source:RefSeq_peptide;Acc:NP_872321]	168	0.982
CCDC57	coiled-coil domain containing 57 [Source:RefSeq_peptide;Acc:NP_932348]	169	0.983
ARMCX4	Armadillo repeat-containing X-linked protein 4. [Source:Uniprot/SWISSPROT;Acc:Q5H9R4]	170	0.985

Table S10. Results (validation cohort)

ID	JAK1	JAK3	STAT5B	IL7R	NOTCH1	FBXW7	KRAS	NRAS	PTEN	FLT3
G40	WT	P151R	WT	WT	WT	WT	WT	WT	**R233fsX25**	WT
G75	**S703I**	WT	WT	WT	**I1718IinsGD+Q2394X**	WT	WT	WT	WT	WT
G28	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G26	WT	WT	WT	WT	**L1593P+P2514RfsX3**	WT	WT	WT	WT	WT
G39	WT	WT	WT	WT	**L1678P**	WT	WT	**E63insQTP**	WT	WT
G79	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G53	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G80	WT	**R657Q**	WT	WT	WT	**R505H**	WT	WT	WT	WT
G60	WT	WT	WT	WT	WT	WT	WT	WT	**E242fsX18**	WT
G52	WT	WT	WT	WT	WT	**R465H**	WT	WT	WT	WT
G5	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G58	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G7	WT	WT	WT	WT	**L1593P+L1706F+Q2391X**	WT	WT	WT	WT	WT
G47	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
R5	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G74	WT	WT	WT	WT	WT	WT	WT	WT	WT	**D835Y**
G56	WT	WT	WT	WT	**P1630S**	WT	WT	WT	WT	WT
G38	WT	WT	WT	**244_245delTIinsCSKTL**	**V1676D**	**G477S**	WT	WT	WT	WT
G48	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G61	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G36	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G64	WT	WT	WT	WT	**V1578E**	WT	WT	WT	WT	WT
G59	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G21	WT	WT	WT	WT	**1578delV+Q2409X**	WT	WT	WT	WT	WT
G76	WT	WT	WT	**245_246delISinsTPRRC**	**I2456fsX23**	WT	WT	WT	WT	WT
G54	WT	WT	WT	WT	**L1593P**	**R465C**	WT	WT	WT	WT
G71	WT	WT	WT	WT	WT	WT	WT	WT	**R233fsX3**	WT
G51	WT	WT	WT	WT	**L1593P**	WT	WT	WT	WT	WT
G27	WT	WT	WT	WT	**F1592S+A2425X**	WT	WT	WT	WT	WT
G41	WT	WT	WT	**242_243insCPD**	**F1606LinsG**	WT	WT	WT	WT	WT
G49	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G55	WT	WT	WT	WT	WT	**R465H**	WT	**G12D**	WT	WT
G50	WT	WT	WT	WT	**L1593P**	WT	WT	WT	WT	WT
G66	WT	WT	WT	WT	WT	WT	WT	WT	**R233fsX10**	WT
G12	WT	WT	WT	WT	**L1593fs**	WT	**G12V**	WT	WT	WT
G65	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G68	WT	WT	WT	WT	WT	**R505C**	WT	WT	WT	WT
G46	WT	WT	WT	WT	**L1593P**	WT	WT	WT	WT	WT
R7	**E897K**	**A572V**	**S434L**	WT	**L1585P**	WT	WT	WT	WT	WT
G44	WT	WT	WT	WT	**L1593P+R1608H+T2511fsx5**	WT	WT	WT	WT	WT
G45	WT	V722I	WT	WT	WT	WT	WT	WT	WT	WT
G63	WT	WT	WT	WT	**1584_1585insQG**	WT	WT	WT	WT	WT
G25	WT	WT	WT	WT	**L1596H+Q2406X**	WT	**K117N**	WT	WT	WT
G6	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
G89	WT	**Q988P**	**Y665F**	WT	**V1676F+V2443fs**	WT	WT	WT	WT	WT
G42	WT	WT	WT	WT	**A1696D**	**R465H+G477S**	WT	WT	WT	WT
G16	WT	WT	WT	WT	WT	WT	WT	WT	**E235fsX23**	WT
G18	WT	V722I	WT	WT	**L1678P**	**R505C**	WT	WT	WT	WT
G97	**L783F**	WT	WT	WT	**L1593P**	WT	WT	WT	WT	WT

Table S11. Probes used for FISH validation

Gene	Chromosome	Cytogenetic band	Centromeric	Spanning	Telomeric
MIR181A1HG	1	q32		RP11-455F11	
HOXA	7	p15	RP5-1103I5		RP1-167F23
TRB	7	q34	RP11-1220K2		RP11-556I13
TRA/D	14	q11	RP11-242H9		RP11-447G18
SOX8	16	p13	RP11-656J16		RP11-252I11
C19orf10	19	p13	RP11-125C3		RP11-615O9
NOTCH3	19	p13		RP11-937H1	
JAK3	19	p13		RP11-124K10	
MAST3	19	p13	RP11-282P1		RP11-769G24

Figure S1: RNAseq data analysis

a)

Mapping: TopHat2
Expression quantification: htseq

- Within-line normalization: EDASeq (GC content)
- Between-line normalization: EDASeq (full quantile)
- Bench -effect removal: edgeR

b)

Fusion detection: deFuse

Filtering:
- At least 8 reads spanning fusion breakpoints and 5 reads split by fusion breakpoint were required
- Removal of predictions observed in normal Thymus
- Removal of predictions between adjacent genes unless implied in genomic inversion or eversion
- Removal of predictions involving ribosome or mithocondrial genes

Candidate Fusions:
- In-frame fusions
- Fusion driving over-expression
- Fusion inducing inactivation of tumor-suppressor

c)

Mapping: TopHat2
Initial calling: SAMtolls

Variant filtering:
- Filtering for Thymus call
- Filtering for polymorphisms: dbSNP137 (excluding COSMIC v66), 1000 Genome, HapMap, Complete genome
- Filtering for repeat regions
- Filtering for the first/last position in the read
- VAF≥20

Non Synonymous
Characterization:
- DAVID for functional annotation
- ENDEAVOUR for gene prioritization

Candidate genes:
- SNVs detected in at least 2 samples
- SNVs in targeted pathways

Figure S2. Experimental strategy.

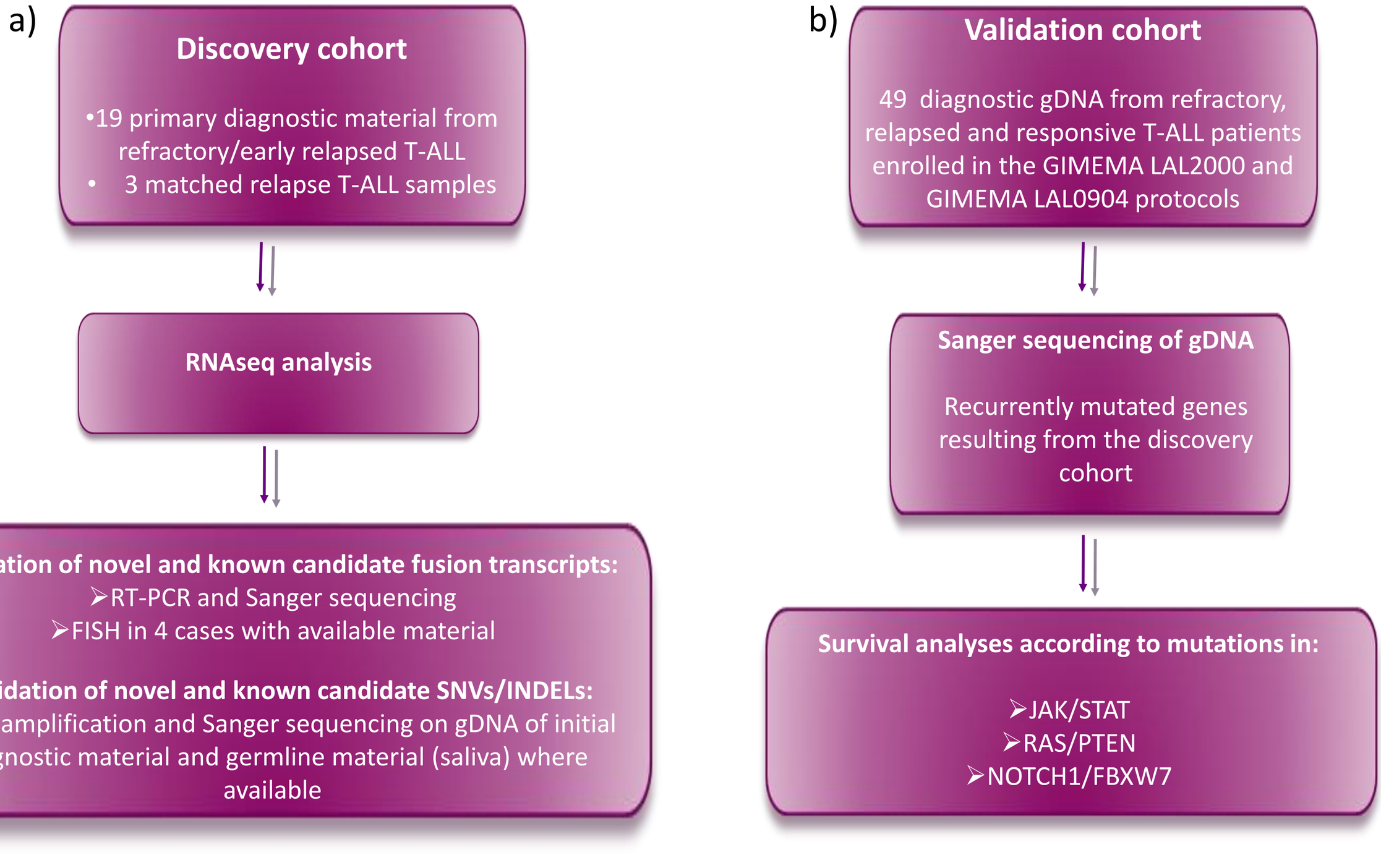
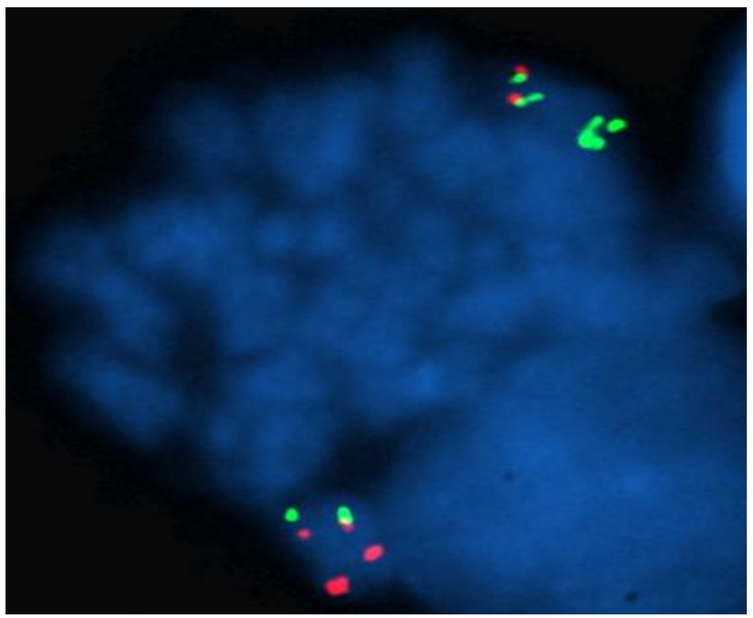
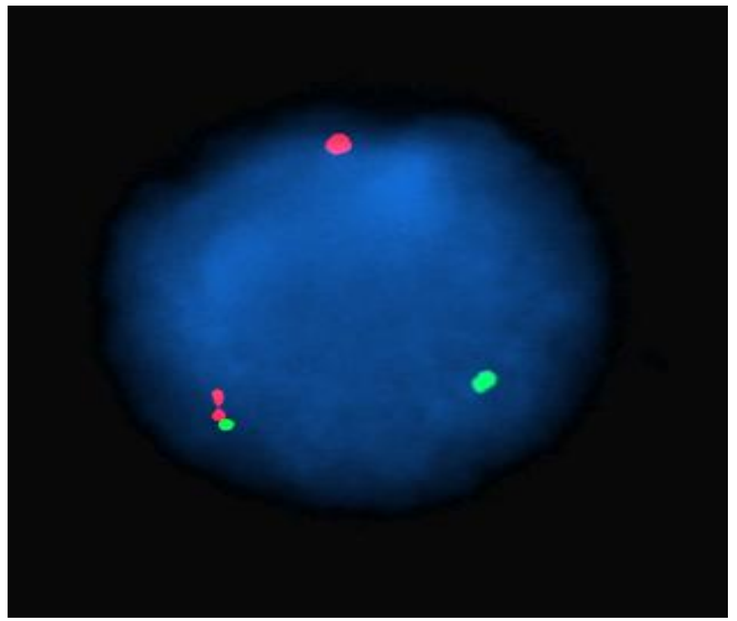


Figure S3: FISH validation

A



B



C

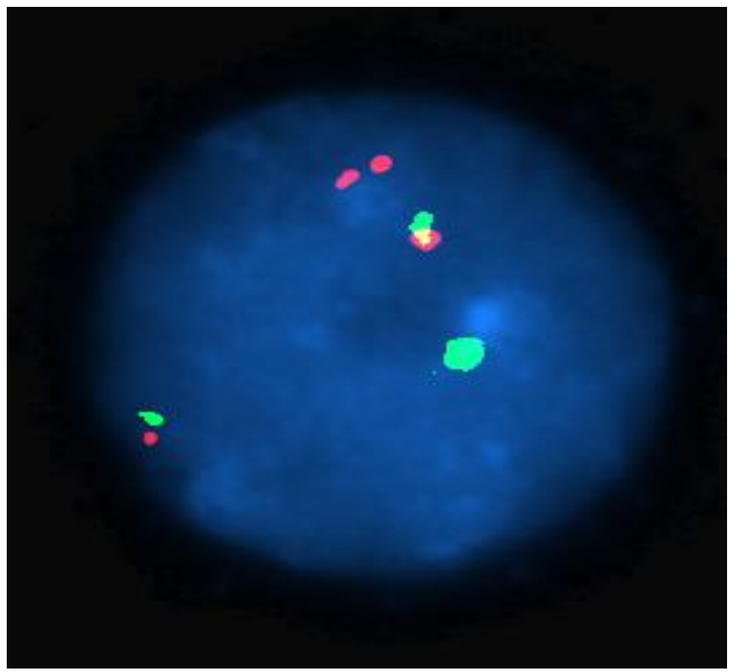
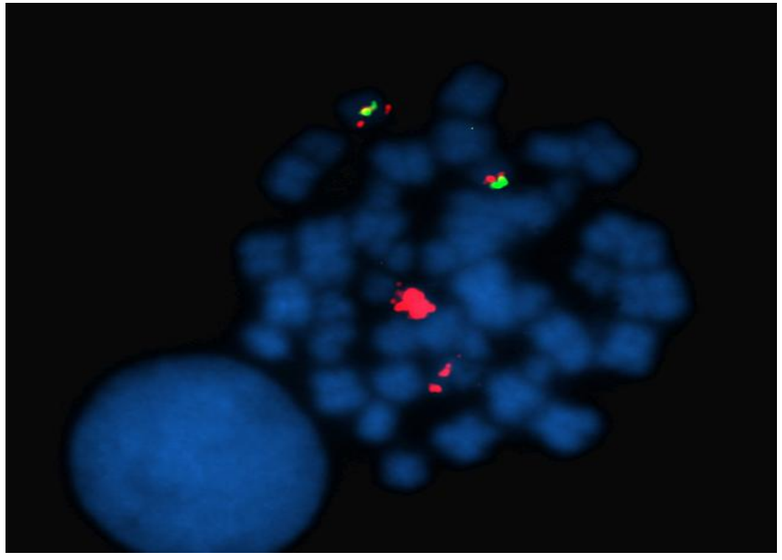
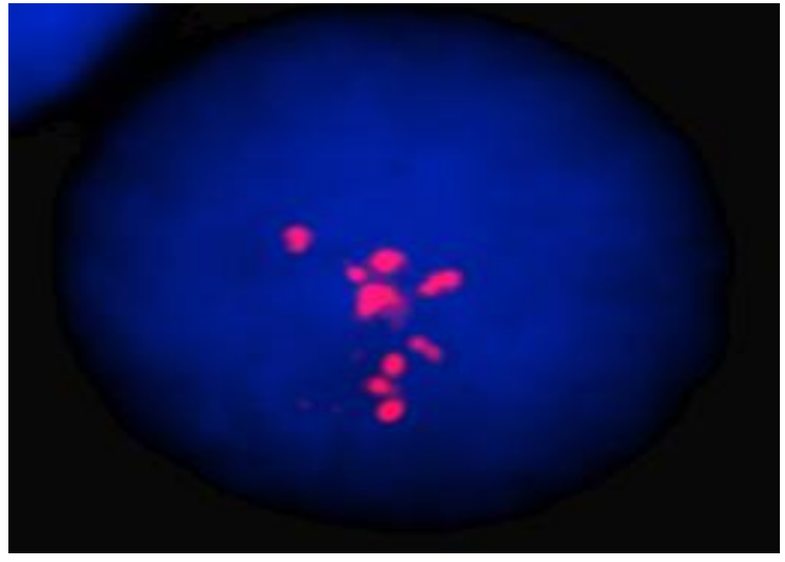


Figure S4: FISH validation of R15 case

A



B



C

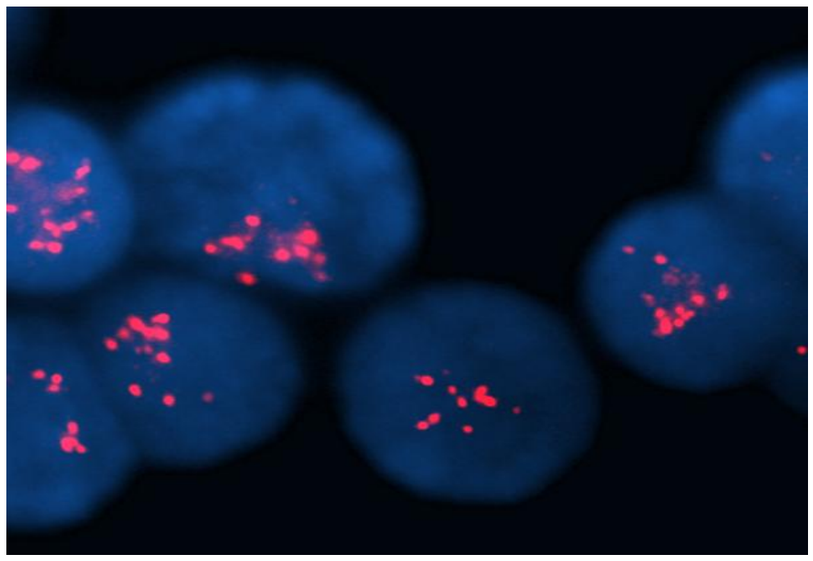


Figure S5: Comparison span reads paired diagnosis relapse samples

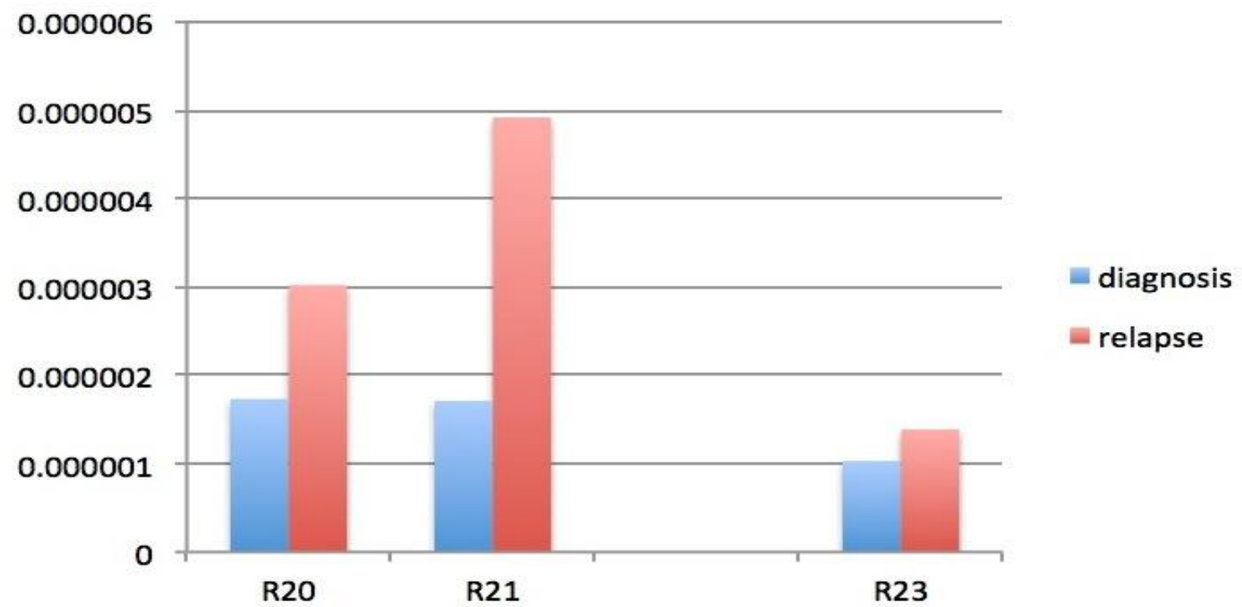
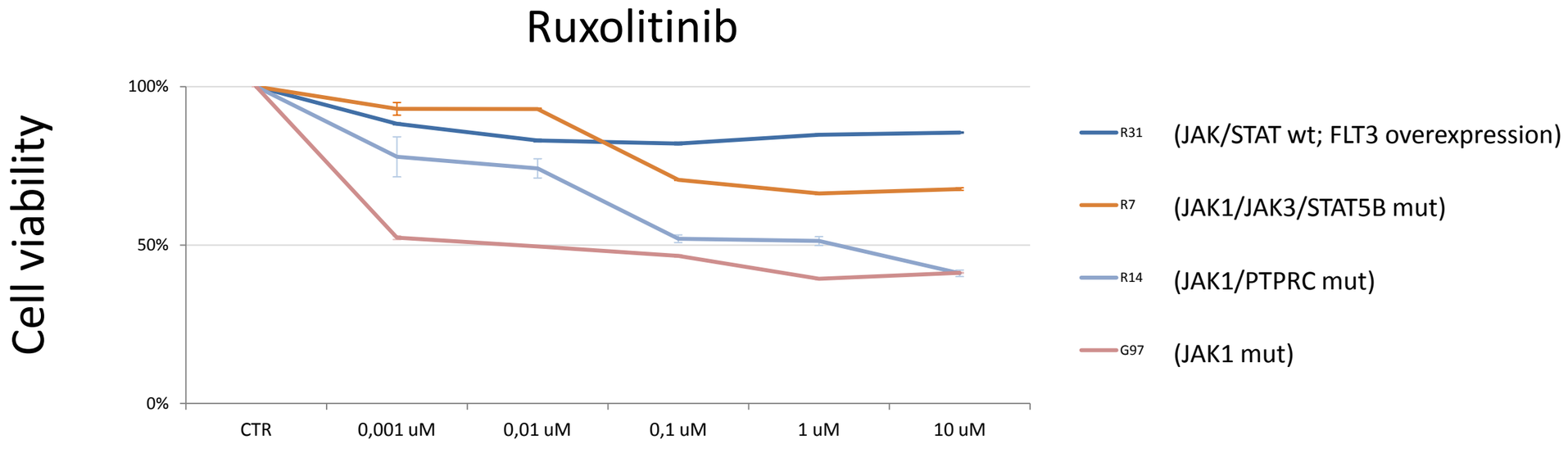


Figure S6. In vitro assays.

a)



b)

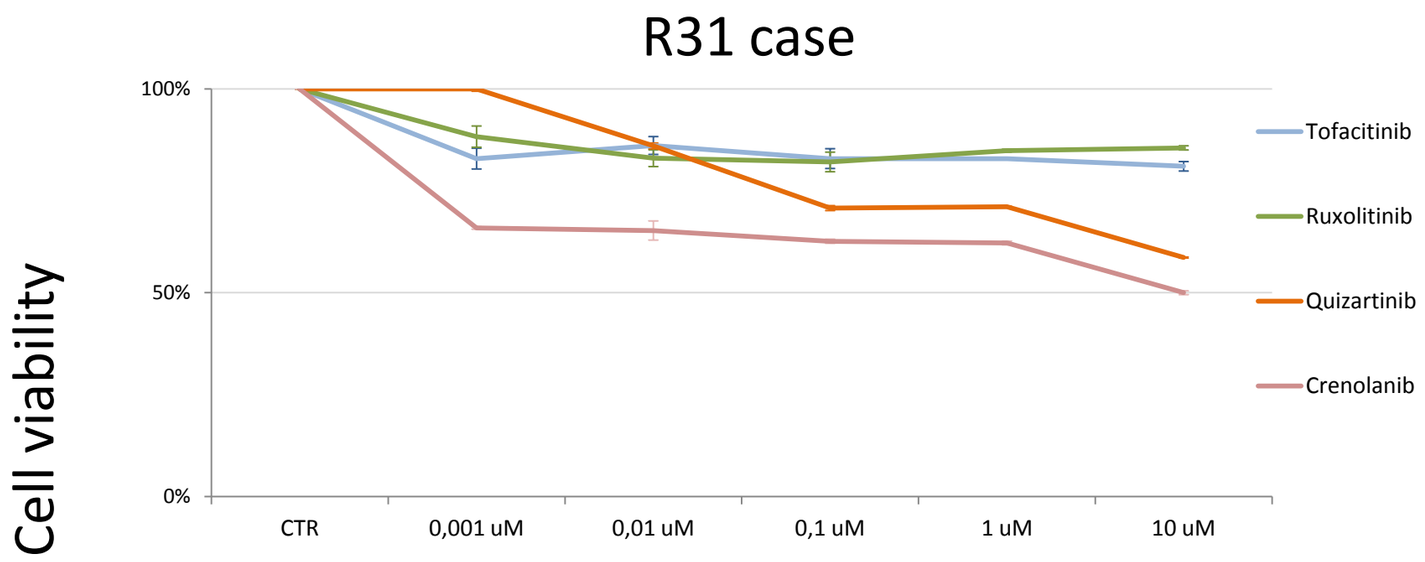
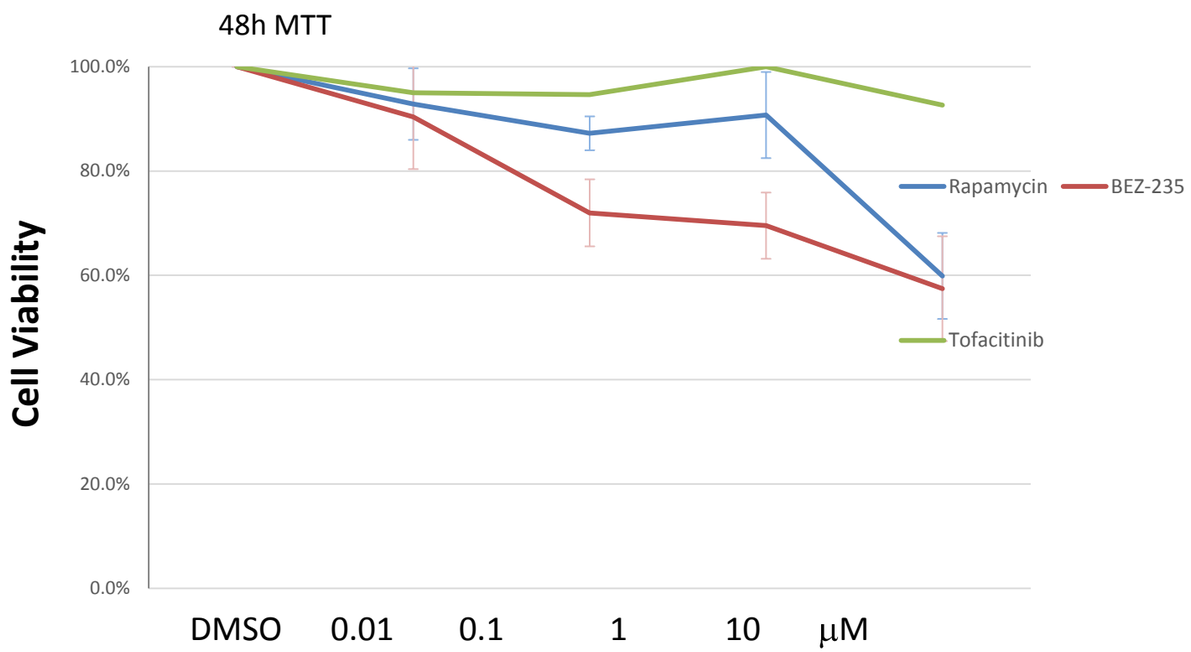


Figure S7. In vitro assays on primary T-ALL cells carrying PTEN mutation.

a)



b)