DOI: 10.7759/cureus.

Identification Of Novel Homozygous Deletion Of The Plakophilin-1 Gene Through Illumina Next Generation Sequencing In An Indian Patient With EDSF Syndrome

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Abstract

A rare autosomal recessive disorder ectodermal dysplasia-skin fragility (EDSF) syndrome causes skin fragility, persistent chellitis, palmoplantar keratoderma, aberrant hair growth, and nail dystrophy. Plakophilin-1 gene mutations, which induce desmosomal abnormalities and poor intercellular cohesion between epidermal cells, are the root cause of EDSF syndrome. Here, we present information on a 7-year-old Indian girl with EDSF syndrome who has a new homozygous deletion of the PKP1 gene. Our research adds to the body of knowledge on PKP mutations and highlights the use of crucial part that PKP1 plays in the development and maintenance of the epidermal desmosomes. In addition, for the first time, we describe the change in gene and protein sequences of PKP1 at c. 1333delC (p. Arg445Alafs*66) with ultrastructural alterations of the skin and curly hair in patients with EDSF syndrome.

Categories: Dermatology, Genetics, Pediatrics
Keywords: desmosomes, skin fragility, autosomal recessive, pkp1, ectodermal dysplasia

Introduction

An autosomal recessive illness known as ectodermal dysplasia-skin fragility (EDSF) syndrome (OMIM #604556) causes skin fragility, persistent cheilitis, palmoplantar keratoderma, aberrant hair growth, and nail dystrophy. Plakophilin-1 is a protein that is encoded by the FRPI gene, and it has been discovered that these mutations account for EDSF syndrome. There have been a total of 21 people with EDSF syndrome recorded till date around the world in various groups since McGrath's initial case report in 1971. Plakophilins (PRP) are essential structural elements of desmosomal adhesion and are critical for controlling desmosomal signalling and turnover [1]. The suprabasal epidermis is the primary site of expression for the three known isoforms (PRP1, PRP2, and PRP3), with PRP1 playing a critical role in controlling cell migration, desmosome assembly, and desmosomal protein content.

Case Presentation

A couple from Indian family from Telangana state have a history of multiple abortions. After 11 miscarriages a baby was born in 2015 and the wife was pregnant with 14 weeks foetus in her womb. Their daughter, who is 7-year-old is presenting with dermatological problems including bleeding lesions, delicate nails with hard and fissured skin of the palms and soles, justenless and pulkable thin hair and lack of sweating. Perioral fissuring and chelilitis were prominent. Scaly hyperkeratotic plaques were symmetrically distributed over the extensor surface of his elbows and knees. Yellowish, thickened fingernails and toenails were evident. Diffuse hyperkeratosis with deep fissures was present on his palms and soles (Fig-1). The oral mucosa was normal, but irregular teeth arrangement was noticed. WES trio has been recommended rule out recurrence in subsequent pregnancies and they been evaluated for the gene variations related to the reported phenotype.

Methodology

Targeted sequencing and mutation analysis was performed by Polymerase Chain Reaction (PCR) followed by automated DNA sequencing of the amplicon using BigDye ABI Genetic Analyzer 5500DX platform [2]. The raw data obtained is subsequently analyzed for the nucleotide variants. Sanger sequencing of genomic DNA for PKPI mutations were used to examine novel, unrelated instances of EDSF syndrome [3].

Electrophoretogram analysis for chromosome specific markers through Quantitative fluorescence PCR (QF-PCR)

Quantitative fluorescence PCR (QF-PCR) is a reliable molecular method for rapid aneuploidy diagnosis [4]. May as isolated from the given sample using a commercial kit according to manufacturer's instructions. Multiplex PCR amplification of short tandem repeat (STR) markers using fluorescent tagged primer was carried out using a commercial kit according to manufacturer's instructions. The resulting fragments were analysed on the genetic analyser for visualization and quantification. The copy number of respective chromosome is quantified by calculating the relative allele ratio. Analysed region includes: D13S742, D13S628, D13S628, D13S305, D1SS305, D1SS305, D1SS305, D1SS306, D18S976, D18S976,

Diagnostic findings not related to phenotype

To find the variants of other genes that are unrelated to the detected abnormality, sequencing of the protein coding regions approximately 50Mb of the human exome (targeting approximately 99% of regions in CCDS and Ref Seq) and complete mitochondrial genome sequencing was performed using Illumina next generation sequencing (NGS) systems at a mean depth of 80-100X with percentage of bases covered at 20X depth >90% in the target region and the depth for mitochondrial genome at 1000-2000X.

Sequencing of the protein coding regions approximately 30Mb of the human exome (targeting approximately 99% of regions in CCDS and Ref Seq) and complete mitochondrial genome sequencing was performed using Illumina next generation sequencing (NGS) systems at a mean depth of 80-100X with percentage of bases covered at 20X depth >90% in the target region and the depth for mitochondrial genome at 1000-2000X. In some cases, due to the complexity of the sequence, not all variants in the flanking regions are able to be analysed. A base is considered to have sufficient coverage at 20X and an exon is considered fully covered if all coding bases plus three nucleotides of flanking sequence on either side are covered at 20X or more. GATK best practice framework was followed for variant identification. Duplicate reads identification and removal, Base quality recalibration and re-alignment of reads based on indels were done using DRAGEN BIO IT platform [2]. Quality checks (QC) will be performed on all VCF files to exclude variants where sequencing is of poor quality. Additional QC metrics includes total homozygous and heterozygous calls (SNVs and indels), proportion of variant calls that were common, number of variants falling into different annotated consequence categories, number of extreme heterozygots (alternate allele proportion 0.8). Variant annotations will be done using published databases like OMIM, GWAS, GNOMAD, 1000 Genome etc [5-7]. Non-synonymous and splice site variants will be used for clinical interpretation. Silent variations that do not result in any change in amino acid in the coding region are not reported. Golden helix Varseq 2.2.4 was used for variant annotation, analysis and reporting (8).

Discussion

 $Ectodermal\ dysplasia/skin\ fragility\ syndrome\ is\ caused\ by\ homozygous\ or\ compound\ heterozygous\ mutation\ in\ the\ plakophilin-1\ gene\ (PKP1)\ on\ chromosome\ 1q32.\ Ectodermal\ dysplasia/skin\ fragility\ syndrome$

(EDSFS) is an autosomal recessive genodermatosis characterized by widespread skin fragility, alopecia, nail dystrophy, and focal keratoderma with painful fissures. Hyohidrosis and chelilitis are sometimes present [5, 4, 9].

Skin biopsies were taken from the scalp and the hyperkeratotic plaque on the right ankle. The histological changes were similar, revealing hyperkeratosis, focal thickening of the granular layer, widened intercellular spaces, isolated dyskeratotic cells and striking paranuclear eosinophilic masses within the upper epidermal layers. The formation of suprabasal splits within the follicles were evident. (Fig. 2).

Cortical cells that were fragmented, abnormally curling hair, and morphogenic abnormalities were all found. An analysis of the scalp's histopathology revealed hyperkerate

PKP1 chr1:201289495delC - Likely Pathogenic

The frameshift deletion NM_001005337.5(PKP1):c.1333delC (p.Arg445Alafs*56) has not been reported previously as a pathogenic variant nor as a benign variant, to our knowledge. The p.Arg445Alafs*56 variant is novel (not in any individuals) in gnomAD. The p.Arg445Alafs*56 variant is novel (not in any individuals) in 1kG. This variant is predicted to cause loss of normal protein function through protein truncation caused a frameshift mutation. The frame shifted sequence continues 56 residues until a stop codon is reached. This variant is a frameshift variant which occurs in an exon of PKP1 upstream of where nonsense mediated decay is predicted to occur. There is another pathogenic loss of function variant 169 residues downstream of this variant, indicating that the region is critical to protein function. The p.Arg445Alafs*56 variant is a loss of function variant in the gene PKP1, which is intolerant of Loss of Function variants, as indicated by the presence of existing pathogenic loss of function variant NP_001005337.1:p.Q614*. For these reasons, this variant has been classified as Likely Pathogenic. The same variant in heterozygous state was detected in father (KT41398134-FB) and mother (KT41398134-MB) (Table-1).

 $Sanger\ sequencing\ data\ (electropherogram)\ for\ the\ provided\ prenatal\ sample\ showing\ nucleotide\ change\ at\ chr1:\ c.1333delC,\ (p.Arg445Alafs°56)\ in\ PKP1gene\ (Figure-3).$

OF-PCR reveals that no other chromosomal abberations

Electrophoretogram analysis for chromosome specific markers indicates a normal complement of 13, 18, 21 and sex chromosomes (Figure-4). No pathogenic variants in genes that are unrelated to the patient's phenotype were detected in this individual (Table-2)

Sample	Gene & Transcript	Variant	Location	Zygosity	Inheritance
Daughter (7 yys)	PKP1 NM_001005337.3	c.1333delC (p.Arg445Alafs*56)	Exon 7	Homozygous	Autosomal Recessive
Foetus (14 weeks 2 days)	PKP1	c.1333delC (p.Arg445Alafs*56)	Not yet known	Present (Heterozygous)	Autosomal Recessive

TABLE 1: PKP1 chr1:201289495delC - Likely Pathogenic

Figure-1



FIGURE 1: clinical presentation of the patient with ED. The index patient is indicated by an arrow

Figure-2





FIGURE 2: Histology of skin biopsies of the patient with ED

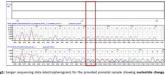


FIGURE 3: Sanger sequence data of nucleotide change at chromosome-1 PKP-1 gene at c1333delc



FIGURE 4: QT-PCR analysis for chromosomal abberations

Further, the chorionic villus sample of 14 weeks foetus was evaluated for the gene variations related to the reported phenotype. The results of laboratory tests, electrocardiography, chest computed tomography, abdominal and urinary ultrasonography, and ultrasonic cardiogram were normal (Table-5)

ist of Syndromes	Aneuploidy
Pataus syndrome (Trisomy 13)	Not Detected
Edward syndrome (Trisomy 18)	Not Detected
Downs syndrome (Trisomy 21)	Not Detected
Gonosomal Aneuploidy	Not Detected
Maternal Cell Contamination	No significant MCC Detected

TABLE 2: Chromosome specific marker analysis

Conclusions

To summarize, ED is an uncommon genetic skin condition. We present the case of the second known Indian individuals affected by ED, which can be attributed to a deletion and frame shift mutation in the PKP1 gene. This finding strengthens the existing understanding of the role of PKP1 mutations in the development of ED and contributes to the growing collection of PKP1 mutation data.

Appendices

Gene	Percentage of Coding Region Covered	Gene	Percentage of Coding Region Covered	Gene	Percentage of Coding Region Covered
AAAS	100	AAGAB	100	ABAT	100
ABCA1	100	ABCA12	100	ABCA3	100
ABCA5	100	ABCB11	100	ABCB4	100
ABCB6	100	ABCC6	100	ABCC8	100
ABCC9	100	ABCD1	100	ABCG5	100
ABCG8	100	ABHD5	100	ABL1	100
ACAD9	100	ACADVL	100	ACAN	96.85
ACAT1	100	ACD	100	ACO2	100
ACP2	100	ACP5	100	ACTA2	100

ACTB	100	ACTC1	100	ACTG1	100
ACTG2	100	ACTL6A	100	ACTL6B	100
ACTN1	100	ACVR1	100	ACVRL1	100
ADA	100	ADA2	100	ADAM10	100
ADAM17	100	ADAMTS10	100	ADAMTS13	100
ADAMTS2	100	ADAMTS3	100	ADAMTSL1	100
ADAMTSL2	100	ADARB1	100	ADAT3	100
ADCY5	100	ADGRE2	100	ADH5	100
ADNP	100	AEBP1	100	AFF3	100
AFF4	100	AGA	100	AGBL5	100
AGGF1	100	AGO2	99.34	AGPAT2	100
AGXT	100	AHI1	100	AHSG	100
AIFM1	100	AIMP1	100	AIMP2	100
AIP	100	AIRE	100	AK9	98
AKR1D1	100	AKT1	100	AKT2	100
ALAS2	100	ALDH2	100	ALDH3A2	100
ALDOA	100	ALDOB	100	ALG11	100
ALG12	100	ALG3	100	ALG8	100
ALG9	100	ALKBH8	100	ALMS1	100
ALOX12B	100	ALOXE3	100	ALPK1	100
ALS2	100	ALX1	100	ALX4	100
AMACR	100	AMMECR1	100	AMN	100
ANAPC1	100	ANGPT1	100	ANGPTL6	100
ANK1	100	ANKRD11	100	ANKRD17	100
ANO6	100	ANOS1	100	ANTXR1	100
ANTXR2	100	AP1B1	100	AP1G1	100
AP1S1	100	AP1S2	100	AP1S3	100
AP2M1	100	AP3B1	100	AP3B2	100
AP3D1	100	APC	100	APC2	100
APCDD1	100	APOA1	100	APOA5	100
APOB	100	APOC2	100	APOE	100
APP	100	AQP5	100	AR	100
ARFGEF2	100	ARHGAP31	100	ARID1B	100
ARID2	100	ARL13B	100	ARL2BP	100
ARL3	100	ARL6	100	ARL6IP6	100
ARMC5	100	ARMC9	100	ARNT2	100
ARSB	100	ARSG	100	ARVCF	100
ARX	100	ASAH1	100	ASL	100
ASPRV1	100	ASXL1	100	ASXL3	100
ATG7	100	ATIC	100	ATL1	100
ATL3	100	ATM	100	ATP10A	100
ATP11C	100	ATP1A3	100	ATP2A2	100
ATP2C1	100	ATP6AP1	100	ATP6AP2	100
ATP6V0A2	100	ATP6V1A	100	ATP6V1B2	100
ATP6V1E1	100	ATP7A	100	ATP7B	100
ATP8B1	100	ATR	100	ATRIP	100
ATRX	100	ATXN10	100	ATXN7	100
AUTS2	100	AXIN2	100	AXL	100
B2M	100	B3GALNT2	100	B3GAT3	100
B3GLCT	100	B4GALNT1	100	B4GALT1	100
B4GALT7	98.58	B4GAT1	100	B9D1	100
B9D2	100	BAAT	100		100
				BANF1	
BAP1	100	BAZ1B	100	BBS10	100
BBS12	100	BBS2	100	BBS4	100
BBS7	100	BBS9	100	BCAS3	100
BCL11B	100	BCL2	100	BCL6	100
BCL7B	100	BCO1	100	BCOR	100
BCORL1	100	BCR	100	BCS1L	100
BEST1	100	BHLHA9	100	BICRA	100
BIRC3	100	BLM	100	BLOC1S6	100
BMP15	100	BMP2	100	BMP4	100
BMPER	100	BMPR1B	100	BMPR2	100
		BPGM	100	BPTF	100

BRAF	100	BRCA1	100	BRCA2	100
BRCC3	100	BRD4	100	BRF1	100
BRIP1	100	BRSK2	100	BSCL2	100
BTD	100	BTK	100	BTNL2	100
BUB1	100	BUB1B	100	BUD23	100
C12ORF4	100	C1QTNF5	100	C1R	100
C1S	100	C2	100	C2CD3	100
C4A	100	C5	100	C9ORF72	100
CA4	100	CACNA1A	100	CACNA1B	100
CACNA1D	100	CACNA1F	100	CACNA1G	100
CACNA1H	100	CACNA1I	100	CACNG2	100
CALR	100	CAMK2A	100	CAMK2B	100
CANT1	100	CAP2	100	CAPN15	100
CAPN5	100	CARD11	100	CARD14	100
CARD9	100	CARMIL2	100	CASK	100
CASP10	100	CASP14	100	CASP8	100
CASR	100	CAST	100	CASZ1	100
CAT	100	CAV1	100	CAVIN1	100
CBL	100	CC2D1A	100	CC2D2A	100
CCBE1	100	CCDC103	100	CCDC115	100
CCDC141	100	CCDC22	100	CCDC32	73
CCDC39	100	CCDC40	100	CCDC47	100
CCL2	100	CCM2	100	CCNK	100
CCNO	100	CCR1	100	CCR6	100
CCT5	100	CD109	100	CD19	100
CD28	100	CD36	100	CD3D	100
CD3E	100	CD3G	100	CD4	100
CD79A	100	CD79B	100	CD81	100
CD96	100	CDAN1	100	CDH1	100
CDH11	100	CDH15	100	CDH2	100
CDH3	100	CDK10	100	CDK13	100
CDK19	100	CDK4	100	CDK5	100
CDKL5	100	CDKN1A	100	CDKN1B	100
CDKN1C	100	CDKN2C	100	CDON	100
CDSN	100	CENPE	100	CENPJ	100
CENPT	100	CEP120	100	CEP152	100
CEP19	100	CEP290	100	CEP55	100
CEP57	100	CERKL	100	CERS3	100
CFI	100	CFTR	100	CHAMP1	100
CHD1	100	CHD2	100	CHD7	100
CHKB	100	CHMP1A	100	CHMP2B	100
CHN1	100	CHRNA1	100	CHRNA7	100
CHRNB1	100	CHRND	100	CHRNE	100
CHRNG	100	CHST14	100	CHST8	100
CHSY1	100	CIB1	100	CIC	100
CIDEC	100	CIITA	100	CISD2	100
CITED2	100	CKAP2L	100	CLCN2	100
CLCN3	100	CLCN7	100	CLDN1	100
CLDN10	100	CLEC7A	100	CLIP1	100
CLIP2	100	CLMP	100	CLPX	100
CLRN1	100	CLTC	100	CNBP	100
CNGA1	100	CNGB1	100	CNGB3	100
CNKSR2	100	CNOT2	100	CNOT3	100
CNP	100	CNPY3	100	COG4	100
COG5	100	COG6	100	COG7	100
COG8	100	COL11A2	100	COL12A1	100
COL14A1	100	COL18A1	100	COL1A1	100
COL1A2	100	COL25A1	100	COL2A1	100
COL3A1	100	COL4A1	100	COL4A2	100
COL4A5	100	COL5A1	100	COL5A2	100
COL6A1	100	COL6A2	100	COL6A3	100
COL7A1	100	COLEC10	100	COLGALT1	95.08
COMT	100	COPB1	100	COQ2	100
COX10	100	COX14	100	COX4I2	100
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COX5A	100	COX7B	100	CPA1	100
CPLX1	100	CPOX	100	CRADD	100
CRBN	100	CREBBP	100	CRIPT	100
CRKL	100	CRLF1	98.27	CRX	100
CRYAB	100	CSGALNACT1	100	CSNK2A1	100
CSPP1	100	CSRP3	100	CST3	100
CST6	100	CSTA	100	CSTB	100
CTBP1	100	CTC1	100	CTCF	100
CTLA4	100	CTNNA1	100	CTNNB1	100
CTNND1	100	CTNND2	100	CTNS	100
CTSA	100	CTSB	100	CTSC	100
CUBN	100	CUL4B	100	CUX1	100
CUX2	100	CWC27	100	CXCR4	100
CYB5A	100	CYB5R3	100	CYBA	100
CYFIP2	100	CYLD	100	CYP11A1	100
CYP11B1	100	CYP11B2	100	CYP19A1	100
CYP1B1	100	CYP27A1	100	CYP4F22	100
CYP7A1	100	CYP7B1	100	CYSLTR2	100
D2HGDH	100	DACT1	100	DAG1	100
DALRD3	100	DAXX	100	DCAF17	100
DCC	100	DCDC2	100	DCHS1	100
DCPS	100	DCT	100	DDB1	100
DDB2	100	DDC	100	DDIT3	100
DDX11	100	DDX3X	100	DDX41	100
DDX11	100	DDX3X	100	DEF6	100
DENND5A	100	DEPDC5	100	DES	100
DENNUSA	100	DEPDCS	100	DES	100
DGUOK	100	DHCR24	100	DHCR7	100
DHFR	100	DHODH	100	DHPS	100
DHX30	100	DHX37	100	DHX38	100
DIAPH1	97.93	DICER1	100	DIP2B	100
DIS3L2	100	DKC1	100	DLG4	100
DLK1	100	DLL1	100	DLL4	100
DLST	100	DLX3	100	DLX4	100
DLX5	100	DMD	100	DMPK	100
DMRT3	100	DMXL2	100	DNAAF1	100
DNAAF2	100	DNAAF3	100	DNAAF4	100
DNAAF5	100	DNAH11	100	DNAH5	100
DNAI1	100	DNAI2	100	DNAJC13	100
DNAJC19	100	DNAJC21	100	DNAJC30	100
DNAL1	100	DNASE1	100	DNASE1L3	100
DNM1	100	DNM2	100	DNMT3A	100
DOCK3	99.74	DOCK6	100	DOCK8	100
DOK7	100	DPAGT1	100	DPF2	100
DPH1	100	DPM1	100	DPM2	100
DPYS	100	DPYSL5	100	DRC1	100
DSC2	100	DSC3	100	DSE	100
DSG1	100	DSG2	100	DSG3	100
DSG4	100	DSP	100	DST	100
DTNBP1	100	DUOX2	100	DUOXA2	100
DUSP6	100	DVL3	100	DYNC1H1	100
DYNC2H1	100	DYNC2LI1	100	DYRK1A	100
DZIP1L	100	EBP	100		100
	100			ECHS1	
EDA EDC3		EDA2R	100	EDAR	100
EDC3	100	EDNID EDNID	100	EDN3	100
EDNRA	100	EDNRB	100	EED	100
EEF1A2	100	EFEMP1	100	EFEMP2	100
EFL1	100	EFNB1	100	EFTUD2	100
EGFR	100	EHMT1	100	EIF2AK3	100
	400	EIF4G1	100	EIF4H	100
EIF2AK4	100				
EIF5A	100	ELANE	100	ELMO2	100
EIF5A ELN	100	ELANE ELOVL4	100	ELMO2 ELP1	100
EIF5A ELN EMC10	100 100 100	ELOVL4 EMD	100		100
EIF5A ELN	100	ELOVL4	100	ELP1	100

EPAS1 100 EPB41L1 100 EPB42 100 EPCAM 100 EPG5 100 EPHB4 100 EPHX2 100 EPM2A 100 EPOR 100 ERAP1 100 ERBB4 100 ERCC1 100 ERCC2 100 ERCC3 100 ERCC4 100 ERCC8 100 ERGIC1 100 ERLIN2 100 ERMARD 100 ESC02 100 ESR1 100 ETFA 100 ETFDH 100 EVC 100 EVC2 100 EXOC2 100 EVC 100 EVC2 100 EXOC6B 100 EXPH5 100 EXT1 100 EXT2 100 EXTL3 100 EYA1 100 EYS 100 EZH2 100 EZR 100 F10 100 F11 100 F7 100 F8 100	
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EYA1 100 EYS 100 EZH2 100 EZR 100 F10 100 F11 100 F12 100 F13A1 100 F2 100 F7 100 F8 100 F9 100	
EZR 100 F10 100 F11 100 F12 100 F13A1 100 F2 100 F7 100 F8 100 F9 100	
F12 100 F13A1 100 F2 100 F7 100 F8 100 F9 100	
F7 100 F8 100 F9 100	
FAH 100 FAM111A 100 FAM111B 100	
FAM161A 100 FAN1 100 FANCA 100	
FANCB 100 FANCC 100 FANCD2 100	
FANCE 100 FANCG 100 FANCI 100	
FANCL 100 FANCM 100 FAR1 100	
FARSA 100 FAS 100 FASTKD2 100	
FAT4 100 FBLN1 100 FBLN5 100	
FBN1 100 FBP1 100 FBXO31 100	
FBXW11 100 FCGR2B 100 FDFT1 100	
FDPS 100 FDXR 100 FECH 100	
FERMT1 100 FERMT3 100 FEZF1 100	
FGA 100 FGB 100 FGD1 100	
FGF10 100 FGF12 100 FGF13 100	
FGF14 100 FGF17 100 FGF20 100	
FGF23 100 FGF3 100 FGF9 100	
FGFR1 100 FGFR3 100 FGFRL1 100	
FGG 100 FHL1 100 FHL2 100	
FIG4 100 FITM2 100 FKBP10 100	
FKBP14 100 FKBP6 100 FKRP 100	
FKTN 100 FLCN 100 FLI1 100	
FLII 100 FLNA 100 FLNB 100	
FLRT1 100 FLRT3 100 FLT4 100	
FLVCR2 100 FMR1 100 FN1 100	
FOS 100 FOXC1 100 FOXC2 100	
FOXE1 100 FOXF1 100 FOXG1 100	
FOXL2 100 FOXN1 100 FOXP1 100	
FOXP3 100 FOXRED1 100 FRAS1 100	
FREM1 100 FREM2 100 FRG1 100	
FRMPD4 100 FRRS1L 100 FSCN2 100	
FSHB 100 FSHR 100 FTL 100	
FTO 100 FUS 100 FUT8 100	
FUZ 100 FYB1 100 FZD2 100	
FZD4 100 FZD6 100 G6PC3 100	
G6PD 100 GABRA1 100 GABRA2 100	
GABRA3 100 GABRA5 100 GABRB2 100	
GABRB3 100 GABRG2 100 GALC 100	
GALK1 100 GALM 100 GALNT3 100	
GAN 100 GAS8 100 GATA1 100	
GATA2 100 GATA3 100 GATA4 100	
GATA5 100 GATA6 100 GATAD1 100	
GBE1 100 GCDH 100 GCLC 100	
GDF11 100 GDF3 100 GDF5 100	
GDF6 100 GFI1B 100 GFM1 100	
GGCX 100 GHR 100 GIGYF2 100	
GINS1 100 GJA1 100 GJB2 100	
GJB6 100 GLA 100 GLB1 100	
GLE1 100 GLI1 100 GLI2 100	

GLI3	100	GLRX5	100	GLS	100
GMPPA	100	GMPPB	100	GNA11	100
GNA14	100	GNAO1	100	GNAQ	100
GNAS	100	GNB2	100	GNE	100
GNPTAB	100	GNRH1	100	GNRHR	100
GNS	100	GP1BA	100	GP1BB	100
GP6	93.51	GP9	100	GPC3	100
GPC4	100	GPC6	100	GPI	100
GPKOW	100	GPNMB	100	GPR101	100
GPR143	100	GPR35	100	GPX4	100
GREM1	100	GRHL2	100	GRIA3	100
GRIA4	100	GRIK2	100	GRIN1	100
GRIN2B	100	GRIN2D	100	GRIP1	100
GRM1	100	GRM7	100	GSC	100
GSN	100	GTF2E2	100	GTF2H5	100
GTF2I	100	GTF2IRD1	100	GTF2IRD2	100
GTPBP2	100	GTPBP3	100	GUCA1A	100
GUCA1B	100	GUCY2D	100	GUF1	100
GUSB	100	GYPC	100	HAMP	100
HAND2	100	HAVCR2	100	HBA1	100
HBA2	100	HBB	100	HBG1	100
HBG2	100	HCCS	100	HCN1	100
HDAC4	100	HDAC6	100	HDAC8	100
HEPHL1	100	HERC2	100	HESX1	100
HEXB	100	HEY2	100	HFE	100
HGD	100	HGSNAT	95.65	HHAT	100
HIC1	100	HINT1	100	HIRA	100
HIVEP2	100	HLA-B	100	HLA-C	100
HLA-DPA1	100	HLA-DPB1	100	HLA-DQA1	100
HLA-DQB1	100	HLA-DRA	100	HLA-DRB1	100
HLCS	100	HMBS	100	HMGA2	100
HMOX1	100	HNF1A	100	HNF1B	100
HNF4A	100	HNMT	100	HNRNPH2	100
HNRNPK	100	HOXA11	100	HOXA13	100
HOXC13					
	100	HPD	100	HPDL	100
HPGD	100	HPS3	100	HPS4	100
HPGD HPS5	100	HPS3 HR	100	HPS4 HS3ST6	100
HPGD HPS5 HS6ST1	100 100 100	HPS3 HR HSD17B10	100 100 100	HPS4 HS3ST6 HSD3B7	100 100 100
HPGD HPS5	100	HPS3 HR	100	HPS4 HS3ST6	100
HPGD HPS5 HS6ST1	100 100 100	HPS3 HR HSD17B10	100 100 100	HPS4 HS3ST6 HSD3B7	100 100 100
HPGD HPS5 HS6ST1 HSPA9	100 100 100 100	HPS3 HR HSD17B10 HSPG2	100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2	100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT	100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1	100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1	100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN	100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1	100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1	100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A	100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B	100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS	100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA	100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1	100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG	100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1	100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122	100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140	100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27	100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT143	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27	100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT143	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT68 IGF2	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGL11	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2 IKBKB	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH IKZF1 IL10RB	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL10RA IL12A	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH IL10RB IL12B	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL10RA IL12A IL17F	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH IL10RB IL12B IL17RA	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1 IL17RC	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL10RA IL17F IL17RD	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH IKZF1 IL10RB IL12R	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1 IL17RC IL1RAPL1	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTR42 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL10RA IL12A IL17F IL17RD	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH IL10RB IL12B IL17RA	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1 IL17RC	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL10RA IL17F IL17RD	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH IKZF1 IL10RB IL12R	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1 IL17RC IL1RAPL1	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTR42 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL10RA IL12A IL17F IL17RD	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH IKZF1 IL10RB IL17RA IL18BP IL2RB	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT57 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1 IL17RC IL1RAPL1 IL2RG	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTR42 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL10RA IL12A IL17F IL17RD IL1RN IL31RA	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH IKZF1 IL10RB IL12RB IL17RA IL18BP IL2RB IL36RN	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1 IL17RC IL1RAPL1 IL2RG IL4R	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTR42 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL10RA IL12A IL17F IL17RD IL1RN IL31RA IL6	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH IKZF1 IL10RB IL12B IL17RA IL18BP IL2RB IL36RN IL6ST IMPDH1	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1 IL17RC IL1RAPL1 IL2RG IL4R IL7 IMPG1	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL10RA IL12A IL17F IL17RD IL1RN IL31RA IL6 IL7R	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH IKZF1 IL10RB IL12B IL17RA IL18BP IL2RB IL36RN IL6ST IMPDH1 ING1	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1 IL17RC IL1RAPL1 IL2RG IL4R IL7 IMPG1 INPP5K	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL10RA IL12A IL17F IL17RD IL1RN IL31RA IL6 IL7R IMPG2	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT52 IFT88 IGF2 IHH IKZF1 IL10RB IL12B IL17RA IL18BP IL2RB IL36RN IL6ST IMPDH1 INSR	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1 IL17RC IL1RAPL1 IL2RG IL4R IL7 IMPG1 INPP5K INTU	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL-10RA IL-12A IL-17F IL-17RD IL-1RN IL-31RA IL-6 IL-7R IMPG2 INPPL1 IPO8	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH IKZF1 IL10RB IL12B IL17RA IL18BP IL2RB IL36RN IL6ST IMPDH1 ING1	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1 IL17RC IL1RAPL1 IL2RG IL4R IL7 IMPG1 INPP5K	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL10RA IL12A IL17F IL17RD IL1RN IL31RA IL6 IL7R IMPG2	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT52 IFT88 IGF2 IHH IKZF1 IL10RB IL12B IL17RA IL18BP IL2RB IL36RN IL6ST IMPDH1 INSR	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1 IL17RC IL1RAPL1 IL2RG IL4R IL7 IMPG1 INPP5K INTU	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL-10RA IL-12A IL-17F IL-17RD IL-1RN IL-31RA IL-6 IL-7R IMPG2 INPPL1 IPO8	100 100 100 100 100 100 100 100 100 100
HPGD HPS5 HS6ST1 HSPA9 HTT HYDIN ICOS IDH3A IDUA IFNGR1 IFT172 IFT52 IFT88 IGF2 IHH IKZF1 IL10RB IL12B IL17RA IL18BP IL2RB IL36RN IL6ST IMPDH1 ING1 INSR	100 100 100 100 100 100 100 100 100 100	HPS3 HR HSD17B10 HSPG2 HUWE1 HYLS1 IDH1 IDH3B IFIH1 IFT122 IFT27 IFT57 IGF1 IGHMBP2 IKBKB IKZF3 IL11RA IL12RB1 IL17RC IL1RAPL1 IL2RG IL4R IL7 IMPG1 INPP5K INTU IQSEC2	100 100 100 100 100 100 100 100 100 100	HPS4 HS3ST6 HSD3B7 HTRA2 HYAL1 HYOU1 IDH2 IDS IFNG IFT140 IFT43 IFT74 IGF1R IGLL1 IKBKG IL10RA IL12A IL17F IL17RD IL1RN IL31RA IL6 IL7R IMPG2 INPPL1 IPO8 IRAK1	100 100 100 100 100 100 100 100 100 100

ITGA2B	100	ITGA3	100	ITGA6	100
ITGB2	100	ITGB4	100	ITGB6	100
ITPR2	100	IVD	100	IYD	100
JAG1	100	JAK2	100	JAK3	100
JAM2	100	JARID2	100	JRK	100
JUP	100	KANK2	100	KANSL1	100
KAT6A	100	KAT8	100	KATNB1	100
KCNA1	100	KCNA2	100	KCNB1	100
KCNJ11	100	KCNJ2	100	KCNJ5	100
KCNJ6	100	KCNJ8	100	KCNK4	100
KCNK9	100	KCNN4	100	KCNQ1	100
KCNQ2	100	KCNQ3	100	KCNQ5	100
KCTD1	100	KDM4B	100	KDM5C	100
KDM6A	100	KDM6B	100	KDR	100
KDSR	100	KEAP1	100	KIAA0586	100
KIAA0753	100	KIAA1549	100	KIF12	100
KIF15	100	KIF1A	100	KIF22	100
KIF23	100	KIF3B	100	KIF5A	100
KIF7	100	KIRREL3	100	KISS1	100
KISS1R	100	KIT	100	KITLG	100
KIZ	100	KLC2	100	KLF1	100
KLF13	100	KLHL24	100	KLHL7	100
KMT2A	100	KMT2C	100	KMT2D	100
KMT2E	100	KNG1	100	KNL1	99.51
KNSTRN	100	KPNA3	100	KRAS	100
KREMEN1	100	KRIT1	100	KRT1	100
KRT10	100	KRT13	100	KRT14	100
KRT16	100	KRT17	100	KRT18	100
KRT2	100	KRT25	100	KRT4	100
KRT5	100	KRT6A	100	KRT6B	100
KRT6C	100	KRT71	100	KRT74	100
KRT8	100	KRT81	100	KRT83	100
KRT85	100	KRT86	100	KRT9	100
KYNU	100	LACC1	100	LAMA1	100
LAMA3	100	LAMA4	100	LARGE1	100
LARP7	100	LCA5	100	LCP2	100
LDHA	100	LDLR	100	LEMD2	100
LEMD3	100	LETM1	100	LHB	100
LHCGR	100	LHX3	100	LIFR	100
LIG4	100	LIMK1	100	LINS1	100
LIPC	100	LIPE	100	LIPH	100
LIPT2	100	LMAN1	100	LMAN2L	100
LMBRD1	100	LMBRD2	100	LMF1	100
LMNB1	100	LMNB2	100	LMX1B	100
LONP1	100	LOX	100	LPAR6	100
LPIN2	100	LPL	100	LRAT	100
LRBA	100	LRP1	100	LRP2	100
LRP4	100	LRP5	100	LRPPRC	100
LRRC32	100	LRRC8A	100	LRRK2	100
LSS	100	LTBP1	100	LTBP2	100
LTBP3	100	LTBP4	100	LYZ	100
LZTFL1	100	LZTR1	100	MAB21L1	100
MADD	100	MAF	97.12	MAFB	100
MAGEL2	100	MALT1	100	MAN1B1	100
MAN2B1	100	MANBA	100	MAOA	100
	100	MAP2K1	100	MAP2K2	100
MAP1R					
MAP1B	06.26		100	MAPK1	100
MAP3K1	96.36	MAP3K7	100		100
MAP3K1 MAPK8IP3	100	MAPRE2	100	MASP1	100
MAP3K1 MAPK8IP3 MAT2A	100	MAPRE2	100	MBD5	100
MAP3K1 MAPK8IP3	100 100 100	MAPRE2	100		100
MAP3K1 MAPK8IP3 MAT2A	100	MAPRE2	100	MBD5	100
MAP3K1 MAPK8IP3 MAT2A MBOAT7	100 100 100	MAPRE2 MAX MBTPS2	100	MBD5 MC2R	100
MAP3K1 MAPK8IP3 MAT2A MBOAT7 MC4R	100 100 100	MAPRE2 MAX MBTPS2 MCCC2	100 100 100	MBD5 MC2R MCFD2	100 100 100

MEDIST 100	MED12	100	MED12L	100	MED13	100
MESIZ 100 METIZ 100 MECNY 100 MERTY 100 METIZ 100 METIZ 100 METIZ 100 MCART 100 MAPR 100 MACT 100 MCAT 100 MAPR 100 MAPR 100 MUPH 100 MALH 100 MALH 100 MLDH 100 MAPR 100 MACH 100 MADEL 100 MAPR 100 MAPR 100 MOGS 100 MAPR 100 MAPR 100 MOGS 100 MAPR 100 MAPR 100 MOGS 100 MAPR 100 MAPR 100 MERC 100 MAPR 100 MAPR 100 MERC 100 MAPR 100 MAPR 100 MESA 100 MAPR 100 MAPR 100 MESA 100 MAPR	MED13L	100	MED23	100	MED25	100
METRIX	MED27	100	MEFV	100	MEGF8	100
MGAPS 100 MGPP 100 MGAT2 100 MGAT1 100 MGPP 100 MID 1 100 MGAT2 100 MGPP 100 MID 1 100 MGRS 100 MGRS 100 MGPN 100 MGRS 100 MGRS 100 MGRN 100 MGPS 100 MGRS 100 MGPN 100 MGPS 100 MGPS 100 MGPN 100 MGPN 100 MGPS 100 MGPS 100 MGN 100 MGPS 100 MGPN 100 MGN 100 MGPN 100 MG	MEIS2	100	MEN1	100	MEOX1	100
MGMT 100 MIGP 100 MIGS 100 MIGS 100 MIGS 100 MIGS 100 MICH 100 MI	MERTK	100	METTL23	100	METTL27	100
MITE 100 MASS 100 MICHA 10	MFAP5	100	MFRP	100	MGAT2	100
MCS1 100 MLH 100 MLS 1	MGMT	100	MGP	100	MID1	100
MALPH	MITF	100	MKKS	100	MKRN3	100
MAMCHIC 100 MMP1 100 MMP2 100 MMP3 100	MKS1	100	MLH1	100	MLH3	100
MMP2	MLPH	100	MLX	100	MLXIPL	100
MOGGS 100 MORC2 100 MPDUT 100 MREGT 100 MPI 100 MPLOP 100 MPV17 100 MRPAZ 100 MRAS 100 MB42 100 MSAI 100 MSAI 100 MS46 100 MSI3 100 MSAI 100 MSH6 100 MSI3 100 MSTOI 100 MSN 100 MSI3 100 MSTOI 100 MSK1 100 MSC2 100 MTPAT 100 MUSK 100 MYD 100 MYC2 100 MUSEC3 100 MYC 100 MYC8 100 MYP10 100 MYC8 100 MYUK 100 MYO18 100 MYC9 100 MYUK 100 MYO18 100 MYO5 100 MYUK 100 MYO18 100 MYO5 100 M	MMADHC	100	MMP1	100	MMP14	100
MPEGT	MMP2	100	MMP23B	100	MNX1	100
MPV17 100 MRAP 100 MRAP 100 MRAS 100 MRAS 100 MRAP 100 MSA1 100 MSA2 100 MSH2 100 MSH3 100 MST0 100 MSH3 100 MST1 100 MST0 100 MSH3 100 MST1 100 MST0 100 MST1 100 MTTP 100 MTTP 100 MTHPT 100 MTTP 100 MTV2 100 MYBPC3 100 MYC 100 MYC 100 MYC 100 MYHH 100 MYC 100 MYC 100 MYC 100 MYHH 100 MYH 100 MYC 100 MYC 100 MYHH 100 MYC 100 MYC 100 MYC 100 MYORA 100 MYC 100 MYC 100 MYC 100 MYCH 100 MCC 100 MYC 100 MCC 100 MCC 100 MYCH 100 MCC 100 MCC 100 MCC 100 MCC 100 MYCH 100 MCC 100 M	MOGS	100	MORC2	100	MPDU1	100
MRM2 100 MRPS22 100 MS4A1 100 MS4A2 100 MSH2 100 MSH3 100 MSH6 100 MSL2 100 MSM1 100 MSH1 100 MST1 100 MST0 100 MSX1 100 MST2 100 MTFMT 100 MSK1 100 MTPD 100 MTVB 100 MUSK 100 MVD 100 MVR 100 MUSK 100 MVD 100 MVRS 100 MVFPS 100 MVB 100 MVRB 100 MVH11 100 MYHB 100 MYKK 100 MYOBA 100 MYGBA 100 MYKK 100 MYOBA 100 MYAGA 100 MARL 100 NALCN 100 NAGA 100 NAGA 100 NALCN 100 NAGA 100 NAGA	MPEG1	100	MPI	100	MPLKIP	100
MSHA2 100 MSH2 100 MSH3 100 MSH6 100 MSL3 100 MSNO1 100 MSN 100 MST1 100 MST01 100 MSX1 100 MSY2 100 MTFMT 100 MSK1 100 MTP 100 MTX2 100 MUSK 100 MYD 100 MYXE 100 MUSK 100 MYC 100 MYXE 100 MYSC3 100 MYC 100 MYXE 100 MYH11 100 MYH3 100 MYYH5 100 MY11 100 MYOBA 100 MYYH6 100 MY018 100 MYOBA 100 MY0BB 100 MY018 100 MYOBA 100 MY0BB 100 MY018 100 MYOBA 100 MARDI 100 MADSA 100 MARDI 100 <t< td=""><td>MPV17</td><td>100</td><td>MRAP</td><td>100</td><td>MRAS</td><td>100</td></t<>	MPV17	100	MRAP	100	MRAS	100
MSH6 100 MSL3 100 MSMT1 100 MSTO1 100 MSN 100 MST 1 100 MS 1 100 M	MRM2	100	MRPS22	100	MS4A1	100
MSN 100 MST1 100 MSTO1 100 MSX1 100 MSX2 100 MTFMT 100 MSK1 100 MYD 100 MTX2 100 MUSE 100 MYD 100 MYM 100 MVBPC3 100 MYC 100 MYMB 100 MYP11 100 MYGB 100 MYH6 100 MYY11 100 MYGBA 100 MYGBA 100 MYOBB 100 MYGBA 100 MYTGB 100 MYOBA 100 MYOBA 100 MYTGB 100 NAA00 100 MAGLU 100 MAGLU 100 NAA10 100 NAA20 100 NABP1 100 NALCA 100 NAA30 100 NABCLU 100 NALCA 100 NAA30 100 NACAPIL 100 NACAPIL 100 NACAPIL 100 NA	MS4A2	100	MSH2	100	MSH3	100
MSX1	MSH6	100	MSL3	100	MSMO1	100
MTHEDI	MSN	100	MST1	100	MSTO1	100
MUSK 100 MYD 100 MVK 100 MYPEC3 100 MYC 100 MYDB8 100 MYH11 100 MYH8 100 MYH8 100 MYO18B 100 MYO8A 100 MYOSB 100 MYO18B 100 MYOSD 100 MYOSB 100 MYO2A 100 MYOSB 100 MABP1 100 NAALO 100 NAABP1 100 NABP1 100 NALCN 100 NAAGA 100 NAGLU 100 NALCN 100 NABAS 100 NABAS 100 NACCU NBAS 100 NCAPG2 100 NOP1 100 NDWB 100 NDEAL2 100 NDEAL2 100 NDWF1 100 NDEAL2 100 NDUFA1 100 NDWF1 100 NDUFA1 100 NDUFA1 100 NDWF1 100	MSX1	100	MSX2	100	MTFMT	100
MYBPC3 100 MYC 100 MYHB8 100 MYH11 100 MYHB 100 MYHB 100 MY17 100 MYHB 100 MYCBA 100 MYO18B 100 MYO5A 100 MYCBB 100 MYO8A 100 MYOBA 100 MYTIL 100 NAA10 100 NAABP1 100 MABP1 100 NALCN 100 NAAB 100 NAAGLU 100 NALCN 100 NABB 100 NACHU 100 NBAS 100 NBEA 100 NEEAL2 100 NBN 100 NCF4 100 NDE1 100 NDVF4 100 NDF1 100 NDUFA1 100 NDVF41 100 NDUFA1 100 NDUFA2 100 NDUFA2 100 NDUFA3 100 NDUFA4 100 NDUFA2 100 NDUFA3	MTHFD1	100	MTTP	100	MTX2	100
MYH11 100 MYH8 100 MYH6 100 MY157 100 MYH9 100 MYUK 100 MYOBA 100 MYOBA 100 MYOBA 100 MYOBA 100 MYOBA 100 MYTH 100 MACOA 100 NABP1 100 NABP1 100 NAAD 100 NAAGA 100 NAGLU 100 NALCN 100 NARS 100 NARD 100 NBAS 100 NBEA 100 NEBAL2 100 NBN 100 NCAPG2 100 NCF1 100 NDN 100 NDDFA1 100 NDEP1 100 NDWAD 100 NDUFA1 100 NDUFA1 100 NDUFA2 100 NDUFA3 100 NDUFA4 100 NDUFA3 100 NDUFA3 100 NDUFA4 100 NDUFA5 100 NDUFA5	MUSK	100	MVD	100	MVK	100
MYH7 100 MYH9 100 MYCSB 100 MYOSA 100 MYOSB 100 MYOSB 100 MYOSA 100 MYOSB 100 MYOSB 100 MYOSA 100 NABBH 100 NABBH 100 NAADYNI 100 NAAS 100 NAKZD 100 NALCN 100 NANS 100 NAXD 100 NBAS 100 NBEA 100 NAKZD 100 NBN 100 NCAPG2 100 NCF1 100 NDH 100 NDF1 100 NDF1 100 NDH 100 NDF1 100 NDF1 100 NDH 100 NDF1 100 NDF1 100 NDH 100 NDHA1 100 NDHA1 100 NDHA1 100 NDHA1 100 NDHA1 100 NDHA1 100 NDHA1 100	MYBPC3	100	MYC	100	MYD88	100
MYO18B 100 MYO6A 100 MYO6B 100 MYO9A 100 MYOD1 100 MYTIL 100 NAA10 100 NAA20 100 NABP1 100 NADSYN1 100 NAACA 100 NACHU 100 NALCN 100 NANB 100 NABAL 100 NBAS 100 NBEA 100 NBEAL 100 NBN 100 NCAPG2 100 NCF1 100 NDN 100 NDMFA 100 NDP 100 NDN 100 NDMFA 100 NDMFA1 100 NDUFA1 100 NDMFA1 100 NDMFA1 100 NDUFA2 100 NDMFA2 100 NDMFA4 100 NDUFA2 100 NDMFA3 100 NDMFA4 100 NDUFA2 100 NDMFA3 100 NDMFA4 100 NDUFA3 100 NDMFA4 <td>MYH11</td> <td>100</td> <td>MYH3</td> <td>100</td> <td>MYH6</td> <td>100</td>	MYH11	100	MYH3	100	MYH6	100
MYOGA 100 MYOD1 100 MYT1L 100 NAA10 100 NAA20 100 NABP1 100 NADSYN1 100 NAAS 100 NAACD 100 NALCN 100 NANS 100 NAXD 100 NBAS 100 NBEAL 100 NCF1 100 NBN 100 NCAPG2 100 NCF1 100 NBN 100 NCKAP1L 100 NDE1 100 NDW 100 NDWFA1 100 NDUFA1 100 NDWFA1 100 NDWFA1 100 NDUFA1 100 NDWFA1 100 NDWFA1 100 NDWFA1 100 NDWFA1 100 NDWFA1 100 NDWFA1 100 NDWFA2 100 NDWFA2 100 NDWFA2 100 NDWFA2 100 NDWFA3 100 NDWFA4 100 NDWFA5 100 NDWFA5	MYH7	100	MYH9	100	MYLK	100
NAA10	MYO18B	100	MYO5A	100	MYO5B	100
NADSYN1 100	MYO9A	100	MYOD1	100	MYT1L	100
NALCN 100 NANS 100 NAXD 100 NBAS 100 NBEA 100 NBEAL2 100 NBN 100 NCAPG2 100 NCF1 100 NDF 100 NDE1 100 NDE1 100 NDN 100 NDF1 100 NDF1 100 NDST1 100 NDUFA1 100 NDUFA10 100 NDUFA2 100 NDUFA2 100 NDUFA41 100 NDUFA5 100 NDUFA42 100 NDUFA41 100 NDUFA5 100 NDUFA5 100 NDUFA54 100 NDUFA5 100 NDUFA56 100 NDUFA58 100 NDUFA5 100 NDUFA51 100 NDUFA53 100 NDUFA5 100 NDUFA51 100 NDUFA53 100 NDUFA5 100 NDUFA53 100 NDUFA53 100 NDUFA5 100	NAA10	100	NAA20	100	NABP1	100
NBAS 100 NBEA 100 NBEALZ 100 NBN 100 NCAPGZ 100 NCF1 100 NCF4 100 NCAPIL 100 NDE1 100 NDN 100 NDMF 100 NDP 100 NDST1 100 NDUFA1 100 NDUFA10 100 NDUFA12 100 NDUFA2 100 NDUFA41 100 NDUFA6 100 NDUFA9 100 NDUFAF1 100 NDUFA6 100 NDUFAF3 100 NDUFAF4 100 NDUFAF5 100 NDUFAF6 100 NDUFAF8 100 NDUFAF5 100 NDUFAF6 100 NDUFAF8 100 NDUFAF5 100 NDUFS3 100 NDUFS3 100 NDUFS4 100 NDUFS6 100 NDUFS7 100 NDUFS8 100 NDUFS6 100 NDUFS2 100 NDUFS8 100 <td>NADSYN1</td> <td>100</td> <td>NAGA</td> <td>100</td> <td>NAGLU</td> <td>100</td>	NADSYN1	100	NAGA	100	NAGLU	100
NBN 100 NCAPG2 100 NCF1 100 NCF4 100 NCKAP1L 100 NDE1 100 NDN 100 NDNF 100 NDP 100 NDUFA1 100 NDUFA10 100 NDUFA10 100 NDUFA12 100 NDUFA2 100 NDUFA4 100 NDUFA6 100 NDUFA6 100 NDUFAF1 100 NDUFAF2 100 NDUFAF3 100 NDUFAF4 100 NDUFAF2 100 NDUFAF6 100 NDUFAFA 100 NDUFAF5 100 NDUFAFA 100 NDUFAFA 100 NDUFB1 100 NDUFS3 100 NDUFS3 100 NDUFS4 100 NDUFS6 100 NDUFS7 100 NDUFS8 100 NDUFS6 100 NDUFS7 100 NECAP1 100 NECTIN1 100 NEDAL 100 NEW 100	NALCN	100	NANS	100	NAXD	100
NCF4	NBAS	100	NBEA	100	NBEAL2	100
NDN	NBN	100	NCAPG2	100	NCF1	100
NDST1 100	NCF4	100	NCKAP1L	100	NDE1	100
NDUFA12 100	NDN	100	NDNF	100	NDP	100
NDUFA6 100	NDST1	100	NDUFA1	100	NDUFA10	100
NDUFAF2 100 NDUFAF3 100 NDUFAF4 100 NDUFAF5 100 NDUFAF6 100 NDUFAF6 100 NDUFAF6 100 NDUFAF6 100 NDUFAF8 100 NDUFB1 100 NDUFB3 100 NDUFB9 100 NDUFS1 100 NDUFS3 100 NDUFS4 100 NDUFS6 100 NDUFS7 100 NDUFS8 100 NDUFV1 100 NDUFV2 100 NECAP1 100 NECTIN1 100 NEDD4L 100 NECAP1 100 NEFRO 100 NEUF A 100 NEUF A 100 NEW MED A 100 NEUF A 100 NEW A 100 NFIX 100 NIFAL4	NDUFA12	100	NDUFA2	100	NDUFA4	100
NDUFAF5 100	NDUFA6	100	NDUFA9	100	NDUFAF1	100
NDUFB10	NDUFAF2	100	NDUFAF3	100	NDUFAF4	100
NDUFB9 100 NDUFS1 100 NDUFS3 100 NDUFS4 100 NDUFS6 100 NDUFS7 100 NDUFS8 100 NDUFV1 100 NDUFV2 100 NECAP1 100 NECTIN1 100 NEDD4L 100 NEK1 100 NEK9 100 NELFA 100 NEMF 100 NEPRO 100 NEU1 100 NEUROD2 100 NEXN 100 NFIX 100 NF2 100 NFEBLA 100 NGLY1 100 NFKB1 100 NFKBIA 100 NIPAL4 100 NIPRE1 100 NKX2-5 100 NIPAL4 100 NIPRE1 100 NIPRE2 100 NIPRE3 100 NIPRE1 100 NOG 100 NOG 100 NIPRE2 100 NOTCH1 100 NOTCH1 100 NOTCH2 100 <td< td=""><td>NDUFAF5</td><td>100</td><td>NDUFAF6</td><td>100</td><td>NDUFAF8</td><td>100</td></td<>	NDUFAF5	100	NDUFAF6	100	NDUFAF8	100
NDUFS4 100 NDUFS6 100 NDUFS7 100 NDUFS8 100 NDUFV1 100 NDUFV2 100 NECAP1 100 NECTIN1 100 NEDD4L 100 NEK1 100 NEK9 100 NELFA 100 NEMF 100 NEPRO 100 NEU1 100 NEUROD2 100 NEXN 100 NFIX 100 NF2 100 NFKBIA 100 NGLY1 100 NFKB1 100 NFKBIA 100 NIPAL4 100 NIPRE 100 NHP2 100 NIPAL4 100 NIPBL 100 NKX2-5 100 NIRC4 100 NIPBL 100 NIRC4 100 NIRC4 100 NIPBL 100 NOG 100 NOTCH1 100 NOTCH2 100 NOTCH3 100 NOTCH1 100 NOTCH2 100 NPC2<	NDUFB10	100	NDUFB11	100	NDUFB3	100
NDUFS8 100 NDUFV1 100 NDUFV2 100 NECAP1 100 NECTIN1 100 NED4L 100 NEK1 100 NEK9 100 NELFA 100 NEMF 100 NEPRO 100 NEU1 100 NEUROD2 100 NEXN 100 NFIX 100 NF2 100 NFBIA 100 NGLY1 100 NFKB1 100 NHP2 100 NIPAL4 100 NHRC1 100 NKX2-5 100 NIRC4 100 NLRP1 100 NLRP12 100 NMEB 100 NLRP1 100 NOG 100 NOG 100 NOTO 100 NOP10 100 NOTCH1 100 NOTO 100 NOTCH3 100 NOVA2 100 NPAP1 100 NPC1 100 NPC2 100 NPR2 100 NPR13 <td< td=""><td>NDUFB9</td><td>100</td><td>NDUFS1</td><td>100</td><td>NDUFS3</td><td>100</td></td<>	NDUFB9	100	NDUFS1	100	NDUFS3	100
NECAP1 100 NECTIN1 100 NED04L 100 NEK1 100 NEK9 100 NELFA 100 NEMF 100 NEPRO 100 NEU1 100 NEUROD2 100 NEXN 100 NFIX 100 NF2 100 NFBLX 100 NFIX 100 NFKB1 100 NFBLA 100 NGLY1 100 NHPC1 100 NHP2 100 NIRC4 100 NLRP1 100 NIRC4 100 NIRC4 100 NLRP1 100 NIRC4 100 NIRC4 100 NNT 100 NOTC 100 NOG 100 NOTO 100 NOTCH1 100 NOTCH1 100 NOTCH2 100 NOTCH3 100 NOVA2 100 NPAP1 100 NPC1 100 NPC2 100 NPR2 100 NPR13 10	NDUFS4	100	NDUFS6	100	NDUFS7	100
NEK1 100 NEK9 100 NELFA 100 NEMF 100 NEPRO 100 NEU1 100 NEUROD2 100 NEXN 100 NF1 100 NF2 100 NFBIX 100 NGLY1 100 NFKB1 100 NFBIA 100 NIPAL4 100 NHRC1 100 NHP2 100 NIPAL4 100 NIFBL 100 NIRC4 100 NIRC4 100 NLRP1 100 NIRC4 100 NIRC4 100 NNT 100 NOD2 100 NOG 100 NONO 100 NOP10 100 NOTCH1 100 NOTCH2 100 NOTCH3 100 NOVA2 100 NPAP1 100 NPC1 100 NPC2 100 NPHP1 100 NPHP3 100 NPRL3 100 NR0E1 100 NR144 100<	NDUFS8	100	NDUFV1	100	NDUFV2	100
NEMF 100 NEPRO 100 NEU1 100 NEUROD2 100 NEXN 100 NF1 100 NF2 100 NFE2L2 100 NFIX 100 NFKB1 100 NFKBIA 100 NGLY1 100 NHRC1 100 NHP2 100 NIPAL4 100 NIFBL 100 NKX2-5 100 NIRC4 100 NLRP1 100 NLRP12 100 NME8 100 NNT 100 NOTC 100 NOTCH1 100 NONO 100 NOP10 100 NOTCH1 100 NOTCH2 100 NOTCH3 100 NOVA2 100 NPAP1 100 NPC1 100 NPC2 100 NPHP1 100 NPHP3 100 NPM1 100 NPR2 100 NPRL3 100 NRE3 100 NR01 100 NR5A1 10	NECAP1	100	NECTIN1	100	NEDD4L	100
NEUROD2 100 NEXN 100 NF1 100 NF2 100 NFEZL2 100 NFIX 100 NFKB1 100 NFKBIA 100 NGLY1 100 NHRC1 100 NHP2 100 NIPAL4 100 NIPBL 100 NKX2-5 100 NME8 100 NLRP1 100 NME8 100 NME8 100 NNT 100 NOG 100 NOTCH1 100 NONO 100 NOP10 100 NOTCH1 100 NOTCH2 100 NOVA2 100 NOVA2 100 NPAP1 100 NPC1 100 NPC2 100 NPH1 100 NPH3 100 NPM1 100 NPR2 100 NPRL2 100 NPRL3 100 NR0B1 100 NR5A1 100 NRL 100 NSMCE2 100 NSMF 100 <td>NEK1</td> <td>100</td> <td>NEK9</td> <td>100</td> <td>NELFA</td> <td>100</td>	NEK1	100	NEK9	100	NELFA	100
NF2 100 NFE2L2 100 NFIX 100 NFKB1 100 NFKBIA 100 NGLY1 100 NHRC1 100 NHP2 100 NIPAL4 100 NIPBL 100 NKX2-5 100 NLRC4 100 NLRP1 100 NLRP12 100 NME8 100 NNT 100 NOD2 100 NOG 100 NONO 100 NOP10 100 NOTCH1 100 NOTCH2 100 NOVA2 100 NPAP1 100 NPC2 100 NPHP1 100 NPHP3 100 NPM1 100 NPR2 100 NPRL2 100 NPRL3 100 NR0B1 100 NR1H4 100 NR2E3 100 NR3C1 100 NR5A1 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NEMF	100	NEPRO	100	NEU1	100
NFKB1 100 NFKBIA 100 NGLY1 100 NHRC1 100 NHP2 100 NIPAL4 100 NIPBL 100 NKX2-5 100 NLRC4 100 NLRP1 100 NLRP12 100 NME8 100 NNT 100 NOD2 100 NOG 100 NONO 100 NOP10 100 NOTCH1 100 NOTCH2 100 NOTCH3 100 NOVA2 100 NPAP1 100 NPC2 100 NPC2 100 NPHP1 100 NPHP3 100 NPM1 100 NPR2 100 NPRL2 100 NPRL3 100 NR0B1 100 NR5A1 100 NRL 100 NSD1 100 NSD2 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NEUROD2	100	NEXN	100	NF1	100
NHLRC1 100 NHP2 100 NIPAL4 100 NIPBL 100 NKX2-5 100 NLRC4 100 NLRP1 100 NLRP12 100 NME8 100 NNT 100 NOD2 100 NOG 100 NONO 100 NOP10 100 NOTCH1 100 NOTCH2 100 NOTCH3 100 NOVA2 100 NPAP1 100 NPC2 100 NPC2 100 NPHP1 100 NPHP3 100 NPM1 100 NPR2 100 NPRL2 100 NPRL3 100 NR0B1 100 NR5A1 100 NRL 100 NSD1 100 NSD2 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NF2	100	NFE2L2	100	NFIX	100
NIPBL 100 NKX2-5 100 NLRC4 100 NLRP1 100 NLRP12 100 NME8 100 NNT 100 NOD2 100 NOG 100 NONO 100 NOP10 100 NOTCH1 100 NOTCH2 100 NOTCH3 100 NOVA2 100 NPAP1 100 NPC1 100 NPC2 100 NPHP1 100 NPHP3 100 NPM1 100 NPR2 100 NPRL2 100 NPRL3 100 NR0B1 100 NR1H4 100 NR2E3 100 NR3C1 100 NR5A1 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NFKB1	100	NFKBIA	100	NGLY1	100
NLRP1 100 NLRP12 100 NME8 100 NNT 100 NOD2 100 NOG 100 NONO 100 NOP10 100 NOTCH1 100 NOTCH2 100 NOTCH3 100 NOVA2 100 NPAP1 100 NPC1 100 NPC2 100 NPHP1 100 NPHP3 100 NPM1 100 NPR2 100 NPRL3 100 NPRL3 100 NR0B1 100 NR1H4 100 NR2E3 100 NR3C1 100 NR5A1 100 NRL 100 NSD1 100 NSD2 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NHLRC1	100	NHP2	100	NIPAL4	100
NNT 100 NOD2 100 NOG 100 NONO 100 NOP10 100 NOTCH1 100 NOTCH2 100 NOTCH3 100 NOVA2 100 NPAP1 100 NPC1 100 NPC2 100 NPHP1 100 NPHP3 100 NPM1 100 NPR2 100 NPRL2 100 NPRL3 100 NR0B1 100 NR1H4 100 NR2E3 100 NR3C1 100 NR5A1 100 NRL 100 NSD1 100 NSD2 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NIPBL	100	NKX2-5	100	NLRC4	100
NONO 100 NOP10 100 NOTCH1 100 NOTCH2 100 NOTCH3 100 NOVA2 100 NPAP1 100 NPC1 100 NPC2 100 NPHP1 100 NPHP3 100 NPM1 100 NPR2 100 NPRL2 100 NPRL3 100 NR0B1 100 NR1H4 100 NR2E3 100 NR3C1 100 NR5A1 100 NRL 100 NSD1 100 NSD2 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NLRP1	100	NLRP12	100	NME8	100
NOTCH2 100 NOTCH3 100 NOVA2 100 NPAP1 100 NPC1 100 NPC2 100 NPHP1 100 NPHP3 100 NPM1 100 NPR2 100 NPRL2 100 NPRL3 100 NR0B1 100 NR1H4 100 NR2E3 100 NR3C1 100 NR5A1 100 NRL 100 NSD1 100 NSD2 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NNT	100	NOD2	100	NOG	100
NPAP1 100 NPC1 100 NPC2 100 NPHP1 100 NPHP3 100 NPM1 100 NPR2 100 NPRL2 100 NPRL3 100 NR0B1 100 NR1H4 100 NR2E3 100 NR3C1 100 NR5A1 100 NRL 100 NSD1 100 NSD2 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NONO	100	NOP10	100	NOTCH1	100
NPHP1 100 NPHP3 100 NPM1 100 NPR2 100 NPRL2 100 NPRL3 100 NR0B1 100 NR1H4 100 NR2E3 100 NR3C1 100 NR5A1 100 NRL 100 NSD1 100 NSD2 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NOTCH2	100	NОТСН3	100	NOVA2	100
NPR2 100 NPRL2 100 NPRL3 100 NR0B1 100 NR1H4 100 NR2E3 100 NR3C1 100 NR5A1 100 NRL 100 NSD1 100 NSD2 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NPAP1	100	NPC1	100	NPC2	100
NR0B1 100 NR1H4 100 NR2E3 100 NR3C1 100 NR5A1 100 NRL 100 NSD1 100 NSD2 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NPHP1	100	NPHP3	100	NPM1	100
NR3C1 100 NR5A1 100 NRL 100 NSD1 100 NSD2 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NPR2	100	NPRL2	100	NPRL3	100
NSD1 100 NSD2 100 NSDHL 100 NSMCE2 100 NSMF 100 NSUN2 100	NR0B1	100	NR1H4	100	NR2E3	100
NSMCE2 100 NSMF 100 NSUN2 100	NR3C1	100	NR5A1	100	NRL	100
	NSD1	100	NSD2	100	NSDHL	100
NTHL1 100 NTNG2 100 NTRK2 100	NSMCE2	100	NSMF	100	NSUN2	100
	NTHL1	100	NTNG2	100	NTRK2	100

NUBPL	100	NUMA1	100	NUP107	100
NUP188	100	NUP62	100	NUP85	100
NUP88	100	NUS1	100	NUTM1	100
NXN	100	OCA2	100	OCLN	100
OCRL	100	ODC1	100	OFD1	100
OGT	100	OPA1	100	OPHN1	100
ORC6	100	OSMR	100	OTUD5	100
OTUD6B	100	OTULIN	100	OTX2	100
P4HA2	100	PACS1	100	PACS2	100
PAFAH1B1	100	PAH	100	PAK3	100
PALB2	100	PALLD	100	PANK2	100
PARK7	100	PARN	100	PAX1	100
PAX3	100	PAX6	100	PAX8	100
PCCA	100	PCCB	100	PCDH19	100
PCGF2	100	PCK1	100	PCNA	100
PCNT	100	PCSK1	100	PDCD10	100
PDE10A	100	PDE11A	100	PDE4D	100
PDE6A	100	PDE6B	100	PDE6G	100
PDE8B	100	PDGFB	100	PDGFRB	100
PDHA1	100	PDHB	100	PDHX	100
PDP1	100	PDSS2	100	PEPD	100
PERP	100	PEX1	100	PEX12	100
PEX13	100	PEX16	100	PEX2	100
PEX26	100	PEX3	100	PEX5	100
PEX6	100	PEX7	100	PFKM	100
PGAP1	100	PGAP2	100	PGAP3	100
PGM3	100	PHACTR1	99.71	PHF6	100
PHF8	100	PHIP	100	PHOX2B	100
PIEZO1	100	PIEZO2	100	PIGA	100
PIGB	100	PIGF	100	PIGG	100
PIGL	100	PIGN	100	PIGO	100
PIGP	100	PIGQ	100	PIGS	100
PIGT	100	PIGU	100	PIGW	100
PIGY	100	PIK3C2A	100	PIK3CA	100
PIK3R1	100	PITX1	100	PITX2	100
PKDCC	100	PKHD1	100	PKP1	100
PLA2G7	100	PLAA	100	PLAG1	100
PLAGL1	100	PLCB1	100	PLCB4	100
PLCD1	100	PLCG2	100	PLEC	100
PLG	100	PLIN1	100	PLK4	100
PLOD2	100	PLOD3	100	PLP1	100
PLVAP	100	PLXND1	100	PML	100
PMM2	100	PMS1	100	PMS2	100
PNKD	100	PNKP	100	PNPLA1	100
PNPLA6	100	PNPT1	100	POC1A	100
PODXL	100	POFUT1	100	POGLUT1	100
POLA1	100	POLD1	100	POLE	100
POLG	100	POLG2	100	POLH	100
POLR1B	100	POLR1C	100	POLR1D	100
POLR3H	100	POLR3K	100	POMC	100
POMGNT2	100	POMK	100	POMP	100
POMT1	100	POMT2	100	POP1	100
POR	100	PORCN	100	POT1	100
POU1F1	100	POU2AF1	100	PPARG	100
PPM1D		PPP1CB	100	PPP1R17	100
	100	FFFICE			
PPPTR21			100	PPP2R3C	100
PPP1R21 PPP2R5D	100	PPP2R1A	100	PPP2R3C PQBP1	100
PPP2R5D	100	PPP2R1A PPP3CA	100	PQBP1	100
PPP2R5D PRCD	100 100 100	PPP2R1A PPP3CA PRDM12	100	PQBP1 PRDM5	100
PPP2R5D PRCD PRICKLE1	100 100 100 100	PPP2R1A PPP3CA PRDM12 PRICKLE2	100 100 100	PQBP1 PRDM5 PRKACA	100 100 100
PPP2R5D PRCD PRICKLE1 PRKACG	100 100 100 100 100	PPP2R1A PPP3CA PRDM12 PRICKLE2 PRKAG2	100 100 100 100	PQBP1 PRDM5 PRKACA PRKAR1A	100 100 100 100
PPP2R5D PRCD PRICKLE1 PRKACG PRKCD	100 100 100 100 100 100	PPP2R1A PPP3CA PRDM12 PRICKLE2 PRKAG2 PRKCSH	100 100 100 100 100	PQBP1 PRDM5 PRKACA PRKAR1A PRKD1	100 100 100 100
PPP2R5D PRCD PRICKLE1 PRKACG PRKCD PRKG2	100 100 100 100 100 100	PPP2R1A PPP3CA PRDM12 PRICKLE2 PRKAG2 PRKCSH PRKRA	100 100 100 100 100	POBP1 PRDM5 PRKACA PRKAR1A PRKD1 PRLR	100 100 100 100 100
PPP2R5D PRCD PRICKLE1 PRKACG PRKCD	100 100 100 100 100 100	PPP2R1A PPP3CA PRDM12 PRICKLE2 PRKAG2 PRKCSH	100 100 100 100 100	PQBP1 PRDM5 PRKACA PRKAR1A PRKD1	100 100 100 100

	100	PROS1	100	PRPF31	100
PRPF4	100	PRPF6	100	PRPF8	100
PRPH2	100	PRPS1	100	PRR12	100
PRSS1	100	PRSS12	100	PRTN3	100
PSAT1	100	PSEN1	100	PSMB10	100
PSMB8	100	PSMB9	100	PSMC3	100
PSMC3IP	100	PSMD12	100	PSMG2	100
PSTPIP1	100	PTCD3	100	PTCH1	100
	100	PTH1R	100	PTPN11	100
	100	PTPN3	100	PTS	100
	100	PURA	97.83	PUS1	100
	100	PUS7	100	PYCR1	100
	100	RAB11B	100	RAB23	100
	100	RAB39B	100	RAB3GAP1	100
RAB7A	100	RABL3	100	RAC1	100
RAC2	100	RAD21	100	RAD51	100
RAD51C	100	RAF1	100	RAG1	100
RAG2	100	RAI1	100	RALGAPA1	100
RANBP2	100	RAPSN	100	RARA	100
RASA1	100	RASA2	100	RASGRP1	100
RASGRP2	100	RAX2	100	RB1	100
	100	RBCK1	100	RBM10	100
	100	RBPJ	100	RDH11	100
	100	RDH5	100	RECQL4	100
	100	REV3L	100	RFC2	100
		RFWD3		RFXANK	
	100	RHAG	100	RHBDF2	100
RHO	100	RHOA	100	RHOH	100
RIN2	100	RINT1	100	RIPK1	100
RIPK4	100	RLBP1	100	RLIM	100
RNASEH2A	100	RNASEH2B	100	RNASEH2C	100
RNF113A	100	RNF125	100	RNF13	100
RNF168	100	RNF213	100	ROGDI	100
ROM1	100	ROR2	100	RORB	100
RP1	100	RP1L1	100	RP2	100
RP9	100	RPGRIP1	100	RPGRIP1L	100
RPL10	100	RPL15	100	RPL18	100
	100	RPL27	100	RPL31	100
RPL35	100	RPL35A	100	RPS14	100
	100	RPS17	100	RPS19	100
	100	RPS23	100	RPS26	100
	100	RPS29	100	RPS6KA3	100
RPS7	100	RRAS	100	RRAS2	100
RREB1	100	RRM2B	100	RS1	100
RSPH1	100	RSPH3	100	RSPH4A	100
RSPH9	100	RSPO4	100	RSRC1	100
RTL1	100	RTN2	100	RTTN	100
	100	RUNX2	100	RUSC2	100
	100	SAG	100	SALL1	100
	100	SAMD9	100	SAMHD1	100
	100	SATB1	100	SATB2	100
	100	SBF2	100	SCAPER	100
	100	SCN10A	100	SCN11A	100
	100	SCN1B	100	SCN2A	100
SCN3A	100	SCN4A	100	SCN5A	100
SCN8A	100	SCN9A	100	SCNN1A	100
SCNN1B	100	SCNN1G	100	SCO2	100
SDCCAG8	100	SDHA	100	SDHAF2	100
SDHD	100	SDR9C7	100	SEC23A	100
		SEC63	100	SEMA3A	100
SEC23B	100				
	100	SEMA4D	100	SEMA5A	100
SEMA3E			100		100
SEMA3E SEPSECS	100	SEMA4D			

SERPINF2	100	SERPING1	100	SET	100
SETBP1	100	SETD1A	100	SETD1B	100
SETD2	100	SETD5	100	SETX	100
SF3B1	100	SFTPB	100	SFTPC	100
SGCD	100	SGSH	100	SH2B1	100
SH2B3	100	SH3PXD2B	100	SHOX	100
SHROOM4	100	SIAH1	100	SIK3	100
SIL1	100	SIM1	100	SIN3A	100
SIN3B	100	SIX1	100	SIX5	100
SKIV2L	100	SLC10A1	100	SLC12A2	100
SLC12A3	100	SLC12A6	100	SLC13A5	100
SLC16A2	100	SLC17A5	100	SLC17A9	100
SLC19A3	100	SLC1A2	100	SLC1A3	100
SLC1A4	100	SLC20A2	100	SLC24A5	100
SLC25A1	100	SLC25A11	100	SLC25A13	100
SLC25A20	100	SLC25A3	100	SLC25A4	100
SLC26A2	100	SLC26A4	100	SLC27A4	100
SLC2A10	100	SLC2A2	100	SLC30A9	100
SLC33A1	100	SLC34A2	100	SLC35A1	100
SLC35A2	100	SLC35C1	100	SLC39A13	100
SLC39A14	100	SLC39A4	100	SLC46A1	100
SLC44A1	100	SLC45A2 SLC51A	100	SLC46A1 SLC51B	99.15
SLC4A1 SLC5A5	100	SLC51A SLC5A7	100	SLC51B SLC6A1	100
SLC6A19	100	SLC6A3	100	SLC6A8	100
SLC7A7	100	SLC9A7	100	SLC01B1	100
SLCO2A1	100	SLFN14	100	SLITRK1	100
SLURP1	100	SLX4	100	SMAD2	100
SMAD3	100	SMAD4	100	SMARCA2	100
SMARCA4	100	SMARCAD1	100	SMARCAL1	100
SMARCB1	100	SMARCC2	100	SMARCD1	100
SMARCD2	100	SMARCE1	100	SMC1A	100
SMCHD1	100	SMG9	100	SMO	100
SMOC1	100	SMPD1	100	SMPD4	100
SMOC1 SMS	100	SMPD1 SNAI2	100	SMPD4 SNAP25	100
SMS	100	SNAI2	100	SNAP25	100
SMS SNAP29	100	SNAI2 SNCA	100	SNAP25 SNRNP200	100
SMS SNAP29 SNRPN	100 100 100	SNAI2 SNCA SNX10	100 100 100	SNAP25 SNRNP200 SNX14	100 100 100
SMS SNAP29 SNRPN SON	100 100 100 100	SNAI2 SNCA SNX10 SOS1	100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2	100 100 100 100
SMS SNAP29 SNRPN SON SOST	100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11	100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18	100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2	100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3	100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4	100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6	100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9	100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110	100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1	100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC	100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5	100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1	100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7	100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L	100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11	100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7 SPIDR	100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1	100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7 SPIDR SPINT2	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7 SPIDR SPINT2 SPR	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7 SPIDR SPINT2 SPR SPRY4	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7 SPIDR SPINT2 SPR SPRY4 SPTBN1	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTLC1	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7 SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTAN1 SPTLC1 SRC	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2 SRCAP SRP54 ST3GAL5	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7 SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1 SRA1 SRD5A3 ST14 STAG1	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTLC1 SRC SREBF1 ST3GAL3 STAG2	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2 SRCAP SRCAP SRP54 ST3GAL5 STAMBP	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7 SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1 SRD5A3 ST14 STAG1 STAR	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTLC1 SRC SREBF1 ST3GAL3 STAG2 STAT1	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2 SRCAP	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7 SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1 SRD5A3 ST14 STAG1 STAR STAT3	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTLC1 SRC SREBF1 ST3GAL3 STAG2 STAT1 STAT4	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2 SRCAP SRCAP SRCAP SRP54 ST3GAL5 STAMBP STAT2 STAT5B	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7 SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1 SRD5A3 ST14 STAG1 STAR STAT3 STEAP3	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTLC1 SRC SREBF1 ST3GAL3 STAG2 STAT1 STAT4 STIM1	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2 SRCAP SRCAP SRP54 ST3GAL5 STAMBP STAT2 STAT5B STK11	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7 SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1 SRD5A3 ST14 STAG1 STAG1 STAG1 STAG1 STAGS STAGS STIAGS	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTLC1 SRC SREBF1 ST3GAL3 STAG2 STAT1 STAT4 STIM1 STK4	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2 SRCAP SRP54 ST3GAL5 STAMBP STAT2 STAT5B STK11 STS	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPATA7 SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1 SRD5A3 ST14 STAG1 STAG1 STAR STAG1 STEAP3 STK36 STUB1	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTLC1 SRC SREBF1 ST3GAL3 STAG2 STAT1 STAT4 STIM1 STK4 STIK4 STX11	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2 SRCAP SRCAP SRP54 ST3GAL5 STAMBP STAT2 STAT5B STK11 STS STX1A	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPARTA7 SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1 SRD5A3 ST14 STAG1 STAG1 STAG1 STEAP3 STEAP3 STK36 STUB1 STX3	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SFTAN1 SFTAN1 STAGAL3 STAG2 STAT1 STAT4 STIM1 STK4 STX11 STXBP1	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2 SRCAP SRCAP SRCAP SRCAP ST3GAL5 STAMBP STAT2 STAT5B STK11 STS STX1A	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPARTA7 SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1 SRD5A3 ST14 STAG1 STAG1 STAG1 STAG1 STAGS STUB1 STX3 SUCLA2	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTAN1 STAG2 STAT1 STAT4 STIM1 STXBP1 SUCLG1	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2 SRCAP SRP54 ST3GAL5 STAMBP STAT2 STAT5B STK11 STS STX1A STX8P2 SUFU	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPARTAT SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1 SRD5A3 ST14 STAG1 STAR STAT3 STEAP3 STEAP3 STUB1 STX3 SUCLA2 SUGCT	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTLC1 SRC SREBF1 ST3GAL3 STAG2 STAT1 STAT4 STIM1 STK4 STX11 STX41	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2 SRCAP SRCAP SRP54 ST3GAL5 STAMBP STAT2 STAT5B STK11 STS STX1A STXBP2 SUFU SUMF1	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPARTAT SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1 SRD5A3 ST14 STAG1 STAR STAT3 STEAP3 STEAP3 STK36 STUB1 STX3 SUCLA2 SUGCT SUOX	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTLC1 SRC SREBF1 ST3GAL3 STAG2 STAT1 STAT4 STIM1 STK4 STX11 STXBP1 SUCLG1 SULT2B1 SUNT16H	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2 SRCAP SRP54 ST3GAL5 STAMBP STAT2 STAT5B STK11 STS STX1A STXBP2 SUFU SUMF1 SURF1	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPARC SPATA7 SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1 SRD5A3 ST14 STAG1 STAR STAT3 STEAP3 STEAP3 STIK36 STUB1 STX3 SUCLA2 SUGCT SUOX SUZ12	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTLC1 STAGAL3 STAG2 STAT1 STAT4 STIM1 STK4 STX11 STXBP1 SUCLG1 SULT2B1 SULT2B1 SYK	100 100 100 100 100 100 100 100 100 100
SMS SNAP29 SNRPN SON SOST SOX2 SOX6 SPAG1 SPATA5L1 SPG11 SPINK5 SPP1 SPRED2 SPTB SPTLC2 SRCAP SRCAP SRP54 ST3GAL5 STAMBP STAT2 STAT5B STK11 STS STX1A STXBP2 SUFU SUMF1	100 100 100 100 100 100 100 100 100 100	SNAI2 SNCA SNX10 SOS1 SOX11 SOX3 SOX9 SPARC SPARTAT SPIDR SPINT2 SPR SPRY4 SPTBN1 SRA1 SRD5A3 ST14 STAG1 STAR STAT3 STEAP3 STEAP3 STK36 STUB1 STX3 SUCLA2 SUGCT SUOX	100 100 100 100 100 100 100 100 100 100	SNAP25 SNRNP200 SNX14 SOS2 SOX18 SOX4 SP110 SPATA5 SPECC1L SPINK1 SPOP SPRED1 SPTAN1 SPTLC1 SRC SREBF1 ST3GAL3 STAG2 STAT1 STAT4 STIM1 STK4 STX11 STXBP1 SUCLG1 SULT2B1 SUNT16H	100 100 100 100 100 100 100 100 100 100

TABZ 100 TAC3 100 TAC01 100 TACR3 100 TAF1 100 TAF6 100 TALDO1 100 TANC2 100 TACK1 100 TAP1 100 TASP1 100 TASP1 100 TAT 100 TBCD 100 TBCD 100 TBX4 100 TBL2 100 TBL2 100 TBX1 100 TBX3 100 TBX4 100 TBX6 100 TBX3 100 TBX4 100 TBX6 100 TBX32 100 TCF3 100 TCF12 100 TCF20 100 TCF3 100 TCF4 100 TCTN2 100 TCCF3 100 TCF4 100 TCKRG1 100 TCCP1 100 TECR 100 TECR 100 TECPR2 100 TERF2IP 100 TERT 100	
TALDO1 100 TANC2 100 TAOK1 100 TAP1 100 TASP1 100 TASP1 100 TAT 100 TBCD20 100 TBCD 100 TBCK 100 TBL1XR1 100 TBL2 100 TBX1 100 TBX15 100 TBX2 100 TBX6 100 TBX3 100 TBX4 100 TBX6 100 TBXA2R 98.66 TCAP 100 TCF12 100 TCF20 100 TCF3 100 TCF4 100 TCTN2 100 TCCF1 100 TCTN1 100 TCCF2 100 TECP2 100 TECR 100 TEK 100 TELO2 100 TERF2IP 100 TERT 100 TFR2 100 TFRC 100 TGB3 100 TGB81 100 TGB81 100 TGFB1 100 </td <td></td>	
TAP1 100 TAPBP 100 TASP1 100 TAT 100 TBC1D20 100 TBCD 100 TBCK 100 TBL1XR1 100 TBL2 100 TBX1 100 TBX15 100 TBX2 100 TBX20 100 TBX3 100 TBX4 100 TBX6 100 TBXA2R 98.66 TGAP 100 TGF12 100 TGF20 100 TGF3 100 TGF4 100 TGF1 100 TGCF1 100 TGCF4 100 TGTN2 100 TECP2 100 TGCR1 100 TGTN2 100 TECP2 100 TECR 100 TEK 100 TELO2 100 TERF2IP 100 TERT 100 TET2 100 TFRP2A 100 TFR3 100 TGF2 100 TFRP2A 100 TGF3 100 TGF3 100 TGF81 100 TGF3 100 TGF1 100 TGF81 100 TGF3 100 TGF1 100 TGF81 100 TGF3 100 TGF1 100 TGF81 100 TGF1 100 TGR1 100 TGR1 100 TGF81 100 TGR1 100 TGR1 100 TGR1 100 TGF81 100 TGR1 100 TGR1 100 TGR1 100 TGF81 100 TGR1 100 TGR3 100 TGF81 100 TGR1 100 TGR3 100 TGR5 100 TGR6 100 TGR5 100 TGR5 100 TGR6 100 TGR6 100 TGR5 100 TGR6 100 TGR6 100 TGR5 100 TGR6 100 TGC6 100 TGC6 100 TGC6 100 TGC6 100 TGC6 100 TGC6 100 TG	
TAT 100 TBC1D20 100 TBCD 100 TBCK 100 TBL1XR1 100 TBL2 100 TBX1 100 TBX15 100 TBX2 100 TBX20 100 TBX3 100 TBX4 100 TBX6 100 TBXA2R 98.66 TCAP 100 TCF12 100 TCF20 100 TCF3 100 TCF14 100 TCRG1 100 TCCF1 100 TCTN1 100 TCTN2 100 TECPR2 100 TECR 100 TEK 100 TELO2 100 TERF2IP 100 TERT 100 TET2 100 TFRC 100 TG 100 TG 100 TGF3 100 TGF81 100 TGF3 100 TGF3 100 TGF81 100 TGF3 100 TGF2 100 TGF81 100 TGF3 100 TGF2 100 TGF81 100 TGF3 100 TGF3 100 TGF81 100 TGF3 100 TGF81 100 TGFB1 100 TGF81 100 TGF81 100 TGFB1 100 TGM1 100 TGM3 100 TGFB1 100 TGM1 100 TGM3 100 TGFB1 100 TGM2 100 THC6 100 THC 100 TGM3 100 TGM5 100 THC2 100 TGM3 100 TGM5 100 TGM6 100 TGM6 100 THC8 100 TGM6 100 TGM8 100 TMMDC1 100 TMC6 100 TMC8 10	
TBCK 100 TBL1XR1 100 TBL2 100 TBX1 100 TBX15 100 TBX2 100 TBX20 100 TBX3 100 TBX4 100 TBX6 100 TBXA2R 98.66 TCAP 100 TCF12 100 TCF20 100 TCF3 100 TCF4 100 TCIN2 100 TCOF1 100 TCTN1 100 TCTN2 100 TECPR2 100 TCTN1 100 TEK 100 TELO2 100 TECR 100 TEK 100 TECPR2 100 TERP2IP 100 TERT 100 TET2 100 TFRA2A 100 TFE3 100 TFR2 100 TGFB1 100 TGB3 100 TGBS 100 TGFB1 100 TGB3 100 TGFB1 100 TMP0 100 THRA 100 <td></td>	
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TNFRSF13B 100 TNFRSF13C 100 TNFRSF1A 100	
INFSF4 100 INFSF11 100 INFSF15 100	
TNIK 100 TNNC1 100 TNNI2 100	
TNNI3 100 TNNT3 100 TNPO3 100	
TNRC6B 100 TNXB 100 TOM1 100	
TOP3A 100 TOPORS 100 TOR1A 100	
TP53 100 TP63 100 TPI1 100	
TPM1 100 TPM2 100 TPO 100	
TPP2 100 TRAF3IP2 100 TRAF6 100	
TRAF7 100 TRAIP 100 TRAK1 100	
TRAPPC11 100 TRAPPC4 100 TRAPPC9 100	
TREX1 100 TRH 100 TRHR 100	
TRIM37 100 TRIO 99.72 TRIP12 100	
TRIP13 100 TRIP4 100 TRMT1 100	
TRMT10A 100 TRMU 100 TRNT1 100	
TRPM1 100 TRPM3 100 TRPM4 100	
TRPS1 100 TRPV3 100 TRRAP 100	
TSC1 100 TSC2 100 TSEN2 100	
TSEN34 100 TSEN54 100 TSHB 100	
TSHR 100 TSPAN12 100 TSPEAR 100	
TSR2 100 TTC26 100 TTC37 100	
TTC5 100 TTC7A 100 TTC8 100	
TTI2 100 TTN 100 TTPA 100	
TUB 100 TUBB 100 TUBGCP6 100	
TULP1 100 TUSC3 100 TWIST1 100	
TWIST2 100 TXN2 100 TXNDC15 100	
TXNL4A 100 TXNRD2 100 TYR 100	
TYRP1 100 UBA1 100 UBA5 100	
UBAC2 100 UBAP1 100 UBE2A 100	
UBE3A 100 UBE3B 100 UBE4A 100	
UBR1 100 UBR7 100 UCHL1 100	
UCP2 100 UFSP2 100 UGDH 100	
UGP2 100 UMPS 100 UNC13D 100	

UNC45A	100	UNC80	100	UQCC2	100
UQCRFS1	100	USB1	100	USF3	100
USP18	100	USP53	100	USP8	100
USP9X	100	UVSSA	100	VAC14	100
VAMP1	100	VAMP7	100	VDR	100
VEGFC	100	VHL	100	VIPAS39	100
VPS13A	100	VPS13B	100	VPS13C	100
VPS33B	100	VPS35	100	VPS37A	100
VPS37D	100	VPS51	100	VPS53	100
VSX1	100	VWF	100	WAS	100
WASF1	100	WBP11	100	WDFY3	100
WDPCP	100	WDR1	100	WDR19	100
WDR35	100	WDR45	100	WDR73	100
WDR81	100	WFS1	100	WIPF1	100
WIPI2	100	WNK1	100	WNT10A	100
WNT10B	100	WNT5A	100	WNT7A	100
WRAP53	100	WRN	100	WT1	100
WWOX	100	XIAP	100	XPA	100
XPC	100	XPNPEP2	100	XRCC2	100
XRCC4	100	XYLT1	100	XYLT2	100
YIF1B	100	YWHAE	100	YWHAG	100
YY1	100	ZAP70	100	ZBTB16	100
ZBTB20	100	ZC3H14	100	ZC4H2	100
ZEB2	100	ZFHX2	100	ZFHX4	100
ZFPM2	100	ZFYVE26	100	ZIC1	100
ZIC2	100	ZIC3	100	ZMPSTE24	100
ZMYM2	100	ZMYND10	100	ZNF292	100
ZNF341	100	ZNF407	100	ZNF408	100
ZNF462	100	ZNF469	100	ZNF513	100
ZNF592	100	ZNF699	100	ZNF711	100
ZNFX1	100	ZPR1	100	ZSWIM6	98.88

TABLE 3: Expression analysis of other genes in ED

Additional Information

Disclosures

Human subjects: Consent was obtained or waived by all participants in this study. Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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