

## Supplementary Online Content

Morton SU, Norris-Brilliant A, Cunningham S, et al. Association of potentially damaging de novo gene variants with neurologic outcomes in congenital heart disease. *JAMA Netw Open*. 2023;6(1):e2253191. doi:10.1001/jamanetworkopen.2022.53191

**eTable 1.** Ad Hoc Gene Lists

**eTable 2.** Gene Variants

**eTable 3.** Neurodevelopmental Tests

**eTable 4.** Full Results for Neurodevelopmental Outcomes by Case-Control Status

**eTable 5.** Brain MRI Findings by Case-Control Status

**eTable 6.** MRI Differences by Case-Control Status and Post Hoc Analysis

**eTable 7.** Neurodevelopmental Outcomes in Post Hoc Analysis

**eFigure 1.** Patient Enrollment Flow Diagram

**eFigure 2.** Venn Diagram of Shared Genes Between the 4 Gene Lists Used in the Ad Hoc Analysis

**eMethods.**

eTable 1: ad hoc gene lists			
Chromatin Modifying Genes	HBE Genes	High pLI Genes	NDD Genes
ACTB	AAAS	MARCH5	ABCB7
ACTL6A	AACS	MARCH6	ABCD1
ACTL6B	AAGAB	MARCH7	ACSL4
ACTR6	AAMP	MARCH9	ACTB
ACTR8	AAR2	SEPT5	ACTG1
AEBP2	AARS	SEPT6	ACTL6B
AICDA	AARSD1	SEPT7	ADAR
ANP32E	ABCA2	SEPT9	ADNP
AOF1	ABCD3	SEPT11	AFF2
APBB1	ABCE1	AAK1	AFF3
APITD1	ABCF1	AAMP	AFF4
APOBEC1	ABCF2	ABCA2	AFG3L2
ARID1A	ABCG2	ABCB7	AGTR2
ARID1B	ABHD12	ABCD1	AHDC1
ARID2	ABHD17A	ABCE1	AIFM1
ARID4A	ABHD17B	ABHD13	ALDH18A1
ARID4B	ABHD17C	ABHD17C	ALG13
ARID5A	ABHD4	ABHD2	ANK2
ARRB1	ABI1	ABHD8	ANKH
ASF1A	ABI2	ABI1	ANKRD11
ASF1B	ABL1	ABL1	AP1S2
ASH1L	ABLIM1	ABLIM1	AP2S1
ASH2L	ACACA	ABR	AR
ASXL1	ACAD9	AC005358.1	ARCN1
ASXL2	ACAP3	AC006486.9	ARHGEF6
ATF2	ACAT2	AC007952.5	ARHGEF9
ATM	ACBD3	AC073610.5	ARID1A
ATRX	ACIN1	AC104534.3	ARID1B
ATXN7	ACLY	AC117834.1	ARID2
ATXN7L3	ACO1	ACACA	ARSE
AURKA	ACO2	ACAN	ARX
AURKB	ACOT7	ACAP2	ASH1L
AURKC	ACP1	ACE2	ASXL1
BABAM1	ACSL3	ACER3	ASXL2
BAG6	ACSL4	ACHE	ASXL3
BAHCC1	ACTB	ACIN1	ATAD3A
BAHD1	ACTG1	ACOT7	ATP1A3
BANP	ACTL6A	ACRC	ATP6AP2
BAP1	ACTN1	ACSL4	ATP6V1B2
BAP18	ACTN4	ACTA2	ATP7A
BAZ1A	ACTR1A	ACTB	ATRX
BAZ1B	ACTR1B	ACTC1	AUTS2
BAZ2A	ACTR2	ACTL6A	BAZ2B
BCOR	ACTR3	ACTN1	BCAP31
BCORL1	ACTR8	ACTN2	BCKDK
BHMG1	ACVR1B	ACTN4	BCL11A
BM1	ACVR2B	ACTR1A	BHLHA9
BPTF	ADAM10	ACTR2	BMP2

BRCA1	ADAM17	ACTR3	BPIFB6
BRCA2	ADAMTS9	ACTR3B	BPTF
BRCC3	ADAR	ACVR1B	BRAF
BRD1	ADCY6	ACVR2A	BRPF1
BRD2	ADD1	ACVR2B	BRWD3
BRD3	ADD3	ADAM10	CACNA1A
BRD4	ADH5	ADAM17	CACNA1D
BRD7	ADI1	ADAM23	CACNA1E
BRD8	ADIPOR1	ADAMTS1	CACNA1H
BRD9	ADIPOR2	ADAMTS10	CACNA2D3
BRDT	ADNP	ADAMTS2	CACNB4
BRE	ADNP2	ADAMTS6	CAD
BRMS1	ADO	ADAP1	CAMK2A
BRMS1L	ADPRH	ADARB1	CAMK2B
BRPF1	ADPRHL2	ADARB2	CAMTA1
BRPF3	ADRBK1	ADCY1	CAPRIN1
C11orf30	ADRM1	ADCY2	CASK
C14orf169	ADSL	ADCY5	CBL
C17orf49	ADSS	ADCY9	CCDC22
CABIN1	AEBP2	ADCYAP1	CCDC88A
CAMK2D	AEN	ADD1	CCND2
CARM1	AES	ADD2	CD96
CASC5	AFF4	ADD3	CDH15
CBX2	AGAP1	ADIPOR1	CDK13
CBX3	AGAP3	ADNP	CDK16
CBX4	AGAP4	ADNP2	CDKL5
CBX6	AGAP5	ADORA2A	CDON
CBX7	AGAP6	ADRA2C	CELF4
CBX8	AGAP7	ADRB2	CHAMP1
CCDC101	AGAP8	ADRBK1	CHD2
CCNB1	AGFG1	ADRBK2	CHD4
CDC73	AGGF1	ADRM1	CHD7
CDK1	AGO1	AEBP2	CHD8
CDK2	AGO2	AES	CHRNA2
CDK9	AGO3	AF196779.12	CHRNA4
CDKN2A	AGPAT1	AFF1	CHRN2
CDY1	AGPAT6	AFF2	CIC
CDY1B	AGPS	AFF3	CLCN4
CDY2A	AGRN	AFF4	CLIC2
CDY2B	AGTPBP1	AFTPH	CLTC
CDYL	AHCTF1	AGAP1	CNKS2
CECR2	AHCYL1	AGAP2	CNOT3
CENPA	AHDC1	AGAP3	CNTN4
CENPC	AHSA1	AGFG1	CNTNAP2
CENPH	AHSA2	AGO1	COL4A1
CENPI	AIF1L	AGO2	COL4A2
CENPK	AIMP1	AGO3	COL4A3BP
CENPL	AIMP2	AGO4	COL6A1
CENPM	AJUBA	AGPAT1	CORO1A
CENPN	AK2	AGPAT3	CREBBP
CENPO	AK3	AGPS	CSNK1G1

CENPP	AKAP1	AHCTF1	CSNK2A1
CENPQ	AKAP12	AHCYL1	CTCF
CENPR	AKAP2	AHCYL2	CTNNB1
CENPT	AKAP8	AHDC1	CTNND2
CENPU	AKAP8L	AHNAK	CUL3
CENPV	AKIRIN2	AHR	CUL4B
CENPW	AKR1A1	AHSA1	CUX1
CHD1	AKR7A2	AIFM1	DCX
CHD1L	AKR7A3	AJAP1	DDX3X
CHD2	AKT1	AJUBA	DEAF1
CHD3	AKT3	AKAP1	DEPDC5
CHD4	ALAD	AKAP11	DHDDS
CHD5	ALDH16A1	AKAP13	DHX30
CHD6	ALDH18A1	AKAP14	DIP2A
CHD7	ALDH1A3	AKAP17A	DIP2B
CHD8	ALDH2	AKAP4	DIP2C
CHD9	ALDH7A1	AKAP5	DKC1
CHEK1	ALDH9A1	AKAP6	DLG3
CHRA1	ALDOA	AKAP8	DLG4
CLOCK	ALG10	AKIRIN1	DLL4
COPRS	ALG10B	AKIRIN2	DMD
CPA4	ALG2	AKT1	DNM1
CREBBP	ALG3	AKT2	DNMT3A
CRTC2	ALKBH1	AKT3	DPYSL2
CSRP2BP	ALKBH5	ALAS2	DSCAM
CTBP1	ALS2	ALB	DYNC1H1
CTCF	ALX3	ALCAM	DYRK1A
CTCF1	ALX4	ALDH1A1	EBF3
CTD-2132N18.3	ALYREF	ALG13	EBP
CTNNB1	AMBRA1	ALKBH5	EED
CTR9	AMD1	ALYREF	EEF1A2
CUL4B	AMFR	AMBRA1	EFTUD2
CXXC1	AMMECR1L	AMD1	EHMT1
DAPK3	AMOT	AMER1	EIF2S3
DAXX	AMOTL1	AMER3	EIF3G
DDB1	AMOTL2	AMIGO1	ELAVL3
DDB2	AMPD2	AMIGO2	EMC1
DEK	AMT	AMMECR1	EMX2
DKFZp686C08112	ANAPC1	AMMECR1L	EP300
DMAP1	ANAPC16	AMOT	EPB41L1
DMRTC2	ANAPC2	ANAPC1	ERBIN
DNAJC2	ANAPC4	ANAPC2	ERMARD
DNMT1	ANAPC5	ANAPC7	EZH2
DNMT3A	ANAPC7	ANGPT1	FAM111A
DNMT3B	ANKFY1	ANGPT2	FBXO11
DOT1L	ANKHD1	ANK1	FBXO25
DPF3	ANKLE2	ANK2	FGF12
DPPA2	ANKRD10	ANK3	FGFR1
DPPA3	ANKRD11	ANKFY1	FLNA
DPY30	ANKRD13A	ANKHD1	FMR1
DR1	ANKRD13B	ANKHD1-EIF4EBP3	FOXG1

DTX3L	ANKRD17	ANKIB1	FOXP1
EDF1	ANKRD27	ANKRD11	FOXP2
EED	ANKRD28	ANKRD12	FOXP3
EHMT1	ANKRD40	ANKRD13C	FRMD7
EHMT2	ANKRD52	ANKRD17	FRMPD4
EID1	ANKRD6	ANKRD28	FTSJ1
ELK4	ANLN	ANKRD34A	FZD5
ELP3	ANO6	ANKRD46	GABBR2
ELP4	ANP32A	ANKRD50	GABRA1
EMSY	ANP32B	ANKRD52	GABRB2
ENY2	ANP32D	ANKS1A	GABRB3
EP300	ANP32E	ANKS1B	GABRG2
EP400	ANXA5	ANO1	GATAD2B
EPC1	ANXA6	ANO8	GCH1
EPC2	AP000304.12	ANP32A	GDI1
ESR1	AP1AR	ANP32B	GFAP
EYA1	AP1B1	ANP32E	GIGYF1
EYA2	AP1G1	ANTXR1	GIGYF2
EYA3	AP1M1	AP000783.1	GJC2
EYA4	AP1S1	AP1B1	GLI2
EZH1	AP1S3	AP1G1	GLI3
EZH2	AP2A1	AP1M1	GMNN
FAM175A	AP2A2	AP1S2	GNAI1
FBL	AP2B1	AP2A1	GNAO1
FLCN	AP2M1	AP2A2	GNAS
FOXA1	AP2S1	AP2B1	GNB1
FOXA2	AP3B1	AP2M1	GRIA1
FOXA3	AP3D1	AP2S1	GRIA2
FOXP3	AP3S1	AP3B1	GRIA3
FSHR	AP3S2	AP3B2	GRIN1
GATA2	AP4M1	AP3D1	GRIN2A
GATA3	APBA2	APBA1	GRIN2B
GATAD2B	APBB1	APBA2	GRIN2D
GCG	APCDD1	APBB1	GRIP1
GFI1B	APEH	APBB1IP	GSPT2
GSG2	APEX1	APC	HCFC1
GTF3C4	API5	APC2	HCN1
H2AFY	APLP1	APEX2	HDAC4
H2AFY2	APLP2	APH1A	HDAC8
H4_HUMAN	APMAP	API5	HDLBP
HAT1	APP	APLNR	HECTD4
HCFC1	APPBP2	APOO	HECW2
HDAC1	APRT	APPBP2	HESX1
HDAC10	AQR	APPL1	HIST1H1E
HDAC11	ARAF	AQR	HIST1H4C
HDAC2	ARCN1	AR	HIVEP2
HDAC3	ARF1	ARAF	HMGB3
HDAC4	ARF3	ARC	HNRNPH2
HDAC5	ARF4	ARCN1	HNRNPU
HDAC6	ARF5	ARF1	HPD
HDAC7	ARF6	ARF4	HPRT1

HDAC8	ARFGAP1	ARF5	HRAS
HDAC9	ARFGAP2	ARF6	HSD17B10
HELLS	ARFRP1	ARFGEF1	HUWE1
HILS1	ARGLU1	ARFGEF2	IDS
HIPK4	ARHGAP1	ARFIP2	IFIH1
HIRA	ARHGAP11B	ARGLU1	IGBP1
HIST1H1B	ARHGAP19	ARHGAP1	IL1RAPL1
HIST1H2BA	ARHGAP21	ARHGAP21	ILF2
HIST1H4A	ARHGAP23	ARHGAP23	INTS6
HIST1H4B	ARHGAP28	ARHGAP25	IQSEC2
HIST1H4C	ARHGAP29	ARHGAP26	IRF2BPL
HIST1H4D	ARHGAP31	ARHGAP29	ITPR1
HIST1H4E	ARHGAP33	ARHGAP30	KANSL1
HIST1H4F	ARHGAP35	ARHGAP31	KAT2B
HIST1H4H	ARHGAP39	ARHGAP32	KAT6A
HIST1H4I	ARHGDI A	ARHGAP35	KAT6B
HIST1H4J	ARHGEF1	ARHGAP36	KATNAL2
HIST1H4K	ARHGEF10	ARHGAP4	KCNA2
HIST1H4L	ARHGEF17	ARHGAP42	KCNB1
HIST2H4A	ARHGEF2	ARHGAP44	KCNC1
HIST2H4B	ARHGEF25	ARHGAP5	KCNC3
HIST4H4	ARHGEF40	ARHGAP6	KCNH1
HJURP	ARHGEF7	ARHGDIG	KCNH5
HLCS	ARID1A	ARHGEF1	KCNJ11
HLTF	ARID2	ARHGEF11	KCNJ6
HMG20A	ARID3A	ARHGEF12	KCNMA1
HMG20B	ARID3B	ARHGEF17	KCNQ2
HMGA1	ARIH1	ARHGEF2	KCNQ3
HMGA2	ARL1	ARHGEF6	KCNQ5
HMGB1	ARL10	ARHGEF7	KCNT1
HMGB2	ARL2	ARHGEF9	KDM1A
HMGB3	ARL2BP	ARID1A	KDM5B
HMGB4	ARL3	ARID1B	KDM5C
HMG N3	ARL5A	ARID2	KDM6A
HMG N5	ARL5B	ARID3A	KDM6B
HMGXB4	ARL6IP1	ARID4A	KIAA0232
HNF1A	ARL6IP4	ARID4B	KIDINS220
HNRNPC	ARL6IP6	ARID5A	KIF11
HOPX	ARL8A	ARID5B	KIF1A
HR	ARL8B	ARIH1	KIF2A
HSF4	ARMC1	ARIH2	KIF4A
HUWE1	ARMCX2	ARL4A	KIF5C
IKZF1	ARNT	ARL4C	KIRREL3
IL1B	ARNT2	ARL8A	KITLG
ING1	ARPC1A	ARMC1	KLF8
ING2	ARPC2	ARMC8	KLHL15
ING3	ARPC3	ARMCX2	KMT2A
ING4	ARPC4	ARMCX4	KMT2B
ING5	ARPC5	ARNT	KMT2C
INO80	ARPC5L	ARNT2	KMT2D
INO80B	ARPP19	ARNTL	KMT2E

INO80B-WBP1	ARRB1	ARPC1A	KMT5B
INO80C	ARV1	ARPC2	KPNA7
IRF4	ARVCF	ARPC4	KRAS
ITGB3BP	ASAP1	ARPC5	KRIT1
IWS1	ASAP2	ARPC5L	L1CAM
JADE1	ASB6	ARPP19	LAS1L
JADE2	ASCC2	ARRB1	LDB1
JADE3	ASF1B	ARRB2	LEO1
JAK2	ASH2L	ARRDC3	LGI1
JARID1C	ASIP	ARSE	LRP2
JARID2	ASNA1	ARX	LRRC4C
JDP2	ASNS	ASAP1	MAB21L2
JMJD1C	ASNSD1	ASAP2	MAF
JMJD6	ASPSCR1	ASB7	MAGEL2
K7ERQ8	ASUN	ASB9	MAGI2
KANSL1	ASXL1	ASCL1	MAGT1
KANSL2	ATAD1	ASF1A	MAOA
KANSL3	ATAD2	ASH1L	MAP1A
KAT2A	ATAD3A	ASH2L	MAP2K1
KAT2B	ATAD3B	ASIC1	MAP2K2
KAT5	ATAD3C	ASIC2	MAPK10
KAT6A	ATAT1	ASNA1	MBD5
KAT6B	ATF1	ASTN1	MBOAT7
KAT7	ATF2	ASTN2	MECP2
KAT8	ATF4	ASUN	MED12
KDM1A	ATF6B	ASXL2	MED13
KDM1B	ATF7IP	ASXL3	MED13L
KDM2A	ATG12	ATAD2	MEF2C
KDM2B	ATG2A	ATAD2B	MET
KDM3A	ATG4B	ATAD5	MID1
KDM3B	ATIC	ATCAY	MKX
KDM4A	ATN1	ATF1	MORC2
KDM4B	ATP11A	ATF2	MSL3
KDM4C	ATP13A1	ATF7	MSNP1AS
KDM4D	ATP13A2	ATF7IP	MTF1
KDM4E	ATP13A3	ATG13	MTOR
KDM5A	ATP1A1	ATG16L1	MYCN
KDM5B	ATP1B3	ATG4A	MYH10
KDM5C	ATP2A2	ATG4B	MYT1L
KDM5D	ATP2B1	ATG5	NAA10
KDM6A	ATP2C1	ATG9A	NAA15
KDM6B	ATP5A1	ATL1	NACC1
KDM7A	ATP5B	ATN1	NALCN
KDM8	ATP5C1	ATOH8	NCAPD2
KLF1	ATP5D	ATOX1	NCAPD3
KMT2A	ATP5G1	ATP11C	NCKAP1
KMT2B	ATP5G2	ATP13A1	NCOA1
KMT2C	ATP5G3	ATP13A3	NDP
KMT2D	ATP5H	ATP1A1	NDUFA1
KMT2E	ATP5J	ATP1A3	NEDD4L
L3MBTL1	ATP5J2	ATP1B1	NEXMIF

L3MBTL2	ATP5O	ATP2A2	NF1
L3MBTL3	ATP6AP1	ATP2B1	NFIA
L3MBTL4	ATP6V0B	ATP2B2	NFIX
LDB1	ATP6V0C	ATP2B3	NIPBL
LEF1	ATP6V0D1	ATP2C1	NKX2-1
LEO1	ATP6V1A	ATP5A1	NLGN3
LIF	ATP6V1B2	ATP5B	NLGN4X
LOXL2	ATP6V1E1	ATP6AP1	NLRP5
LPIN1	ATP8B2	ATP6AP2	NONO
LRWD1	ATPIF1	ATP6V0A1	NR1I3
M18BP	ATR	ATP6V0B	NR2F1
M18BP_HUMAN	ATRIP	ATP6V0C	NR3C2
MAP3K12	ATRX	ATP6V0D1	NRAS
MAP3K7	ATXN10	ATP6V1A	NRXN1
MAPK3	ATXN1L	ATP6V1B2	NRXN2
MAPK8	ATXN2	ATP6V1E1	NRXN3
MBD2	ATXN2L	ATP7A	NSD1
MBD3	ATXN7L3	ATP9A	NTRK2
MBIP	ATXN7L3B	ATRN	NUP155
MBTD1	AUP1	ATRNL1	NUS1
MCRS1	AURKA	ATRX	OCRL
MEAF6	AURKAIP1	ATXN1	OFD1
MECP2	AURKB	ATXN1L	OPHN1
MED24	AVL9	ATXN2	OTC
MEN1	AXIN1	ATXN2L	OTX2
METTL8	AXIN2	ATXN7	P4HB
MGEA5	AZI1	ATXN7L1	PACS1
MIS18A	AZIN1	ATXN7L2	PACS2
MIS18BP1	B3GALNT2	ATXN7L3	PAFAH1B1
MLL2	B3GNT5	AURKA	PAK3
MORF4L1	B4GALNT4	AUTS2	PAX5
MORF4L2	B4GALT2	AVPR2	PAX6
MRGBP	B4GALT3	AXIN2	PAX8
MS18A_HUMAN	B9D1	AZIN1	PCDH19
MS18B_HUMAN	BABAM1	B2M	PCGF2
MSL1	BACE1	B3GALT2	PDCD10
MSL2	BACH1	B3GNT2	PDE10A
MSL3	BAG1	B3GNT3	PDGFRB
MSL3P1	BAG2	B3GNT5	PDHA1
MT3	BAG6	B3GNT7	PGK1
MTA2	BAK1	B4GALT5	PHF12
MTF2	BANF1	B4GALT6	PHF2
MUC1	BAP1	BABAM1	PHF21A
MYB	BASP1	BACE1	PHF3
MYC	BAX	BACH1	PHF6
MYOCD	BAZ1B	BACH2	PHF8
MYOD1	BAZ2A	BAG3	PHIP
MYSM1	BBX	BAG6	PHOX2B
NAA50	BCAM	BAHD1	PIGA
NAA60	BCAP31	BAI1	PIH1D3
NACC2	BCAR1	BAI2	PIK3R2



NAP1L2	BCAS2	BAI3	PLP1
NASP	BCAT1	BANF1	POGZ
NCOA1	BCCIP	BANP	PPM1D
NCOA2	BCKDK	BAP1	PPP1CB
NCOA3	BCL2L13	BARHL2	PPP1R9B
NCOR1	BCL7B	BARX1	PPP2R1A
NEK11	BCL7C	BASP1	PPP2R5D
NIPBL	BCL9	BATF	PPP3CA
NO66	BCL9L	BATF2	PPP5C
NOC2L	BCLAF1	BAZ1A	PQBP1
NOS1	BCOR	BAZ1B	PRKD1
NPM	BCR	BAZ2A	PRR12
NPM_HUMAN	BDP1	BAZ2B	PRRT2
NPM1	BECN1	BBX	PSMD12
NPM2	BEND3	BCAR1	PTCH1
NR3C1	BEX1	BCAR3	PTCHD1
NSD1	BEX2	BCL11A	PTDSS1
OGT	BGN	BCL11B	PTEN
OIP5	BICD2	BCL2	PTK7
OTUB1	BIN1	BCL2L1	PUF60
PADI2	BIRC5	BCL2L11	PURA
PADI4	BLCAP	BCL3	QKI
PAF1	BLM	BCL6	QRICH1
PAX5	BLMH	BCL9L	RAB11A
PAX7	BLOC1S6	BCOR	RAB11B
PAXBP1	BMI1	BCORL1	RAB39B
PAXIP1	BMP7	BCR	RAC1
PBRM1	BMPR1A	BDNF	RAD21
PCGF1	BMS1	BECN1	RAD51
PCGF2	BNIP2	BEGAIN	RAF1
PER1	BNIP3L	BEND3	RAI1
PER2	BOC	BEND4	RANBP17
PHB	BOLA2	BEX1	RANBP2
PHC1	BOLA2B	BEX4	RARB
PHF1	BOP1	BHLHE22	RBM10
PHF13	BORA	BHLHE40	RELN
PHF19	BPTF	BHLHE41	RERE
PHF2	BRAP	BICC1	RFX3
PHF20	BRD1	BICD2	RIMS1
PHF21A	BRD2	BIN1	RLIM
PHF8	BRD3	BIRC6	RNF113A
PIM3	BRD4	BLCAP	ROR2
PKN1	BRD7	BLNK	RORB
PML	BRD8	BMI1	RPL11
POGZ	BRF1	BMP10	RPS23
POLE3	BRICD5	BMP2	RPS6KA3
POLE4	BRIX1	BMP4	RRAS
POU5F1	BRK1	BMP6	RYR3
PPARGC1A	BRMS1L	BMPR1A	SAMD9L
PPM1F	BRPF1	BMPR1B	SATB1
PPP5C	BRPF3	BMPR2	SATB2

PRDM13	BRWD1	BNC1	SCN1A
PRDM14	BSG	BNC2	SCN1B
PRDM2	BTAF1	BOD1L1	SCN2A
PRDM5	BTBD2	BPTF	SCN3A
PRDM6	BTBD9	BRAF	SCN8A
PRDM7	BTF3	BRD1	SCN9A
PRDM8	BTRC	BRD2	SCRIB
PRDM9	BUB1	BRD3	SET
PRKAA1	BUB1B	BRD4	SETBP1
PRKAA2	BUB3	BRD7	SETD1A
PRKCA	BUD31	BRINP1	SETD5
PRKCB	BYSL	BRINP2	SHANK1
PRKD1	BZW1	BRIX1	SHANK2
PRKD2	BZW2	BRK1	SHANK3
PRMT1	C10orf76	BRPF1	SHH
PRMT2	C11orf24	BRPF3	SIK1
PRMT3	C11orf30	BRS3	SIN3A
PRMT5	C11orf31	BRSK1	SIX3
PRMT6	C11orf49	BRSK2	SKI
PRMT7	C11orf58	BRWD1	SLC12A5
PRMT8	C11orf68	BRWD3	SLC16A2
PSME4	C11orf73	BSN	SLC1A2
PYGO2	C11orf95	BTAF1	SLC25A4
RAG1	C12orf10	BTBD11	SLC2A1
RAG2	C12orf43	BTBD18	SLC35A2
RB1	C12orf45	BTBD2	SLC6A1
RBBP4	C12orf57	BTF3	SLC6A8
RBBP4_HUMAN	C14orf1	BTF3L4	SLC9A6
RBBP5	C14orf166	BTG1	SLC9A9
RBBP7	C14orf2	BTG3	SMARCA2
RBBP7_HUMAN	C14orf37	BTK	SMARCA4
RBL1	C16orf72	BUB3	SMARCB1
RBL2	C16orf80	BZW1	SMARCC2
RBM14	C17orf103	C10orf12	SMARCE1
RCBTB1	C17orf70	C10orf53	SMC1A
RCOR1	C17orf96	C10orf54	SMC3
RERE	C18orf25	C11orf30	SMS
REST	C18orf32	C11orf73	SNAP25
RING1	C19orf10	C11orf84	SNRPB
RNF168	C19orf43	C12orf44	SNX3
RNF2	C19orf52	C12orf5	SON
RNF20	C19orf53	C12orf75	SOS1
RNF40	C1orf112	C14orf2	SOX11
RNF8	C1orf159	C16orf70	SOX2
RPS6KA4	C1orf198	C16orf72	SOX3
RPS6KA5	C1orf21	C17orf103	SOX5
RRP8	C1orf63	C17orf104	SPAST
RSF1	C1orf85	C17orf85	SPTAN1
RSF1_HUMAN	C1QBP	C18orf25	SRCAP
RTF1	C20orf27	C18orf8	SRGAP3
RUVB1_HUMAN	C2CD3	C19orf33	SRP54

RUVBL1	C2CD5	C19orf68	SRPR
RUVBL2	C2orf15	C1GALT1	SRPX2
RYBP	C3orf58	C1GALT1C1	SRSF11
SALL1	C3orf70	C1orf21	STAG1
SAP130	C4orf27	C1orf226	STX1B
SATB1	C4orf29	C1orf51	STXBP1
SATB2	C5orf15	C1orf86	SUV420H1
SCMH1	C5orf24	C1QL3	SYN1
SET	C5orf51	C1QTNF1-AS1	SYNGAP1
SETD1A	C6orf106	C1QTNF5	SYP
SETD1B	C6orf62	C1R	SYT1
SETD2	C7orf26	C20orf112	TAF1
SETD3	C7orf55-LUC7L2	C20orf24	TAOK1
SETD7	C8orf37	C20orf78	TAOK2
SETD8	C8orf76	C2CD2L	TAZ
SETDB1	C9orf114	C2orf82	TBL1XR1
SETDB2	C9orf3	C3	TBR1
SETMAR	C9orf78	C4B	TBX1
SFMBT1	C9orf85	C4orf32	TBX18
SFPQ	C9orf91	C4orf48	TCF20
SIN3A	CA14	C5orf24	TCF4
SIN3B	CA2	C6orf1	TCF7L2
SIRT1	CA4	C6orf106	TEK
SIRT2	CAB39	C6orf136	TGIF1
SIRT3	CABIN1	C6orf62	THAP1
SIRT6	CACFD1	C7orf26	THOC2
SIRT7	CACHD1	C7orf60	THRA
SKI	CACNA2D2	C7orf73	TIMM8A
SKP1	CACNB3	C9orf147	TINF2
SMAD4	CACNG4	C9orf172	TLK2
SMARCA1	CACNG7	CA10	TM4SF20
SMARCA2	CACTIN	CAAP1	TM9SF4
SMARCA4	CACUL1	CABP1	TNRC6B
SMARCA5	CACYBP	CACNA1A	TRAF7
SMARCA1	CAD	CACNA1B	TRIM23
SMARCA1	CADM1	CACNA1C	TRIO
SMARCB1	CALD1	CACNA1D	TRIP12
SMARCC1	CALM1	CACNA1E	TSC1
SMARCC2	CALM3	CACNA1G	TSC2
SMARCD1	CALR	CACNA1I	TSPAN7
SMARCD2	CALU	CACNA2D1	TUBA1A
SMARCD3	CAMK2G	CACNA2D2	TUBB
SMARCE1	CAMSAP1	CACNA2D3	TUBB2A
SMCA5	CAND1	CACNB1	TUBB2B
SMCA5_HUMAN	CAND2	CACNG2	TUBB3
SMYD1	CANT1	CACNG3	TUBB4A
SMYD2	CANX	CACNG7	TUBG1
SMYD3	CAP1	CACNG8	TWIST1
SNAI2	CAPN15	CACTIN	TWIST2
SNCA	CAPN2	CACUL1	UBE2A
SNW1	CAPN7	CACYBP	UBN2

SOX9	CAPNS1	CAD	UBR1
SP100	CAPRIN1	CADM1	UBTF
SP110	CAPZA2	CADM2	UPF3B
SP140	CAPZB	CADM3	USP15
SP140L	CARHSP1	CADM4	USP27X
SPI1	CARKD	CALCRL	USP7
SPIN1	CARM1	CALD1	USP9X
SRCAP	CARS	CALM1	VEZF1
SREBF1	CASC3	CALM2	VIP
SS18L1	CASD1	CALM3	WAC
SSRP1	CASKIN2	CALR	WDFY3
STRA13	CASP2	CAMK1D	WDR26
SUDS3	CASP3	CAMK2A	WDR45
SUPT3H	CAST	CAMK2B	WNT4
SUPT4H1	CAT	CAMK2G	YAP1
SUPT5H	CBFB	CAMK4	YWHAG
SUPT6H	CBLB	CAMKV	YY1
SUPT7L	CBLL1	CAMSAP1	ZBTB18
SUV39H1	CBX1	CAMSAP2	ZBTB20
SUV39H2	CBX2	CAMSAP3	ZC4H2
SUV420H1	CBX3	CAMTA1	ZDHHC15
SUV420H2	CBX5	CAMTA2	ZDHHC9
SUZ12	CCAR1	CAND1	ZEB2
SYCP3	CCAR2	CANX	ZIC1
TADA1	CCDC124	CAP2	ZIC2
TADA2A	CCDC34	CAPN15	ZMYM6
TADA2B	CCDC47	CAPN6	ZMYND11
TADA3	CCDC50	CAPRIN1	ZMYND8
TAF1	CCDC6	CAPZA1	ZNF462
TAF10	CCDC8	CAPZA2	ZNF599
TAF12	CCDC85C	CAPZB	ZNF711
TAF1L	CCDC97	CARD11	ZNF713
TAF5	CCM2	CARM1	ACHE
TAF5L	CCNA2	CASC3	ADA
TAF6L	CCNB1	CASC5	ADCY3
TAF7	CCNB2	CASK	ADSL
TAF9	CCND1	CASKIN1	AGAP2
TBL1X	CCND2	CASKIN2	AGO1
TBL1XR1	CCND3	CASZ1	AGO4
TBL1Y	CCNE1	CBFA2T2	AKAP9
TCF3	CCNF	CBFB	ALDH5A1
TDG	CCNG1	CBLB	AMPD1
TDRD3	CCNG2	CBLL1	AMT
TERF1	CCNI	CBX1	ANK3
TERF2	CCNJ	CBX2	ANXA1
TET1	CCNJL	CBX4	APBB1
TET2	CCNK	CBX5	APH1A
TET3	CCNL1	CBX6	ASAP2
TFAM	CCNL2	CBX7	ASPM
TGFB1	CCNY	CBX8	ASTN2
TLK1	CCT2	CCAR1	ATP10A

TLK2	CCT3	CCAR2	ATP2B2
TNP1	CCT4	CCDC112	AVPR1A
TNRC18	CCT5	CCDC117	BRSK2
TOP1	CCT6A	CCDC121	BTAF1
TOP1MT	CCT7	CCDC132	CACNA1C
TOX	CCT8	CCDC182	CACNB2
TOX2	CCZ1	CCDC22	CASZ1
TOX3	CCZ1B	CCDC6	CC2D1A
TOX4	CD151	CCDC64	CCNG1
TP53	CD164	CCDC71L	CCT4
TP63	CD276	CCDC85C	CDC42BPB
TPR	CD2AP	CCDC88A	CDH13
TRIM16	CD2BP2	CCL2	CEP135
TRIM37	CD34	CCNA2	CEP41
TRIP12	CD3EAP	CCNB3	CGNL1
TRPS1	CD63	CCNC	CHD3
TRRAP	CD81	CCND1	CHMP1A
TSPYL2	CD99L2	CCND2	CHRNA7
TTF1	CDC123	CCND3	CIB2
TWIST1	CDC16	CCNE1	CLASP1
UBE2A	CDC20	CCNE2	CNR1
UBE2B	CDC23	CCNI	CNTN5
UBE2E1	CDC25A	CCNJ	CNTN6
UBE2N	CDC25B	CCNK	CNTNAP3
UBE2U	CDC27	CCNL1	CNTNAP4
UBN1	CDC34	CCNT2	CPEB4
UBR2	CDC37	CCNY	CSDE1
UBR5	CDC42	CCNYL1	CTTNBP2
UBTF	CDC42BPB	CCSER2	CUL7
UCN	CDC42EP4	CCT2	CYFIP1
UHRF1	CDC42SE1	CCT3	DAPP1
UHRF2	CDC42SE2	CCT4	DENR
UIMC1	CDC45	CCT5	DHCR7
USP15	CDC5L	CCT6A	DISC1
USP16	CDC7	CCT7	DLG2
USP17L2	CDC73	CCT8	DLGAP1
USP21	CDCA2	CD19	DLX3
USP22	CDCA3	CD22	DMPK
USP3	CDCA4	CD40	DOCK8
USP49	CDCA5	CD40LG	DPP10
USP51	CDCA7	CD47	EFR3A
USP7	CDCA7L	CD59	ELP4
UTP3	CDCA8	CD79A	EMSY
UTY	CDH11	CD79B	EP400
VEGFA	CDH2	CD81	ETFB
VPRBP	CDH24	CD86	FAM92B
VPS72	CDH5	CDC14B	FBN1
VRK1	CDIP1	CDC16	GABRG3
WAC	CDIPT	CDC23	GALNT8
WBP2	CDK1	CDC25A	GGNBP2
WBSCR22	CDK11A	CDC26	GPC4

WDR5	CDK13	CDC27	GPHN
WDR61	CDK16	CDC34	GRID1
WDR82	CDK17	CDC37	GRIK2
WDR92	CDK2	CDC37L1	GRIK5
WHSC1	CDK4	CDC40	HIVEP3
WHSC1L1	CDK5RAP2	CDC42	HMGN1
YEATS2	CDK5RAP3	CDC42BPA	ICA1
YEATS4	CDK9	CDC42BPB	ITGB3
ZMYND11	CDKN1C	CDC42SE2	JARID2
ZNF335	CDKN2AIPNL	CDC5L	KCNJ10
ZNHIT1	CDON	CDC73	KCNS3
	CDR2L	CDCA3	KDM3B
	CDS2	CDH11	KDM4C
	CDT1	CDH2	KIAA1586
	CDV3	CDH4	KIF14
	CEBPZ	CDH5	LAMB1
	CECR2	CDH6	LMX1B
	CELF1	CDH7	LRP1
	CELF2	CDH8	LZTR1
	CELSR1	CDH9	MACROD2
	CELSR2	CDIP1	MEIS2
	CENPA	CDK1	MFRP
	CENPB	CDK12	MIR137
	CENPE	CDK13	MYO5A
	CENPF	CDK16	MYO9B
	CENPH	CDK17	NAV2
	CENPN	CDK19	NBEA
	CENPQ	CDK2	NCOR1
	CEP104	CDK2AP2	NFE2L3
	CEP120	CDK5R1	NINL
	CEP164	CDK5R2	NLGN1
	CEP170	CDK6	NLGN2
	CEP250	CDKL5	NR4A2
	CEP57	CDKN1B	NUAK1
	CEP68	CDKN1C	NUDCD2
	CEP78	CDKN2AIP	OR52M1
	CEP85	CDV3	OTUD7A
	CERS2	CDX2	OXTR
	CERS5	CDYL	P2RX5
	CETN3	CEBPA	P4HA2
	CFDP1	CEBPD	PAH
	CFL1	CECR2	PAK2
	CFL2	CECR6	PARD3B
	CFLAR	CELF1	PER2
	CGGBP1	CELF2	PHB
	CHAF1A	CELF3	PHRF1
	CHAF1B	CELF4	PLCB1
	CHAMP1	CELF5	PLXNA4
	CHCHD2	CELSR1	PLXNB1
	CHCHD3	CELSR2	POMGNT1
	CHCHD4	CELSR3	PON1

	CHD1	CEND1	PREX1
	CHD3	CENPB	PRICKLE1
	CHD4	CENPI	PRICKLE2
	CHD7	CEP170	PRKCB
	CHD8	CEP170B	PRKD2
	CHEK1	CEP350	PRKN
	CHERP	CEP68	PRODH
	CHFR	CEPT1	PTCHD1-AS
	CHMP3	CETN2	PTPN11
	CHMP4B	CFH	PYHIN1
	CHMP7	CFL1	RAB2A
	CHORDC1	CFLAR	RAB43
	CHST1	CFP	RALGAPB
	CHSY1	CGGBP1	RBFOX1
	CHTF18	CHAF1A	RBM27
	CHTF8	CHAMP1	ROBO2
	CHTOP	CHD1	RPS10P2-AS1
	CIC	CHD2	SAE1
	CIPC	CHD3	SBF1
	CIRBP	CHD4	SEMA5A
	CIRH1A	CHD5	SETD2
	CITED2	CHD6	SHOX
	CIZ1	CHD7	SLC35B1
	CKAP2	CHD8	SLC38A10
	CKAP2L	CHD9	SLC6A3
	CKAP4	CHERP	SLC7A3
	CKAP5	CHIC1	SLC7A5
	CKB	CHIC2	SLITRK5
	CKLF	CHM	SMAD4
	CKS2	CHMP1B	SNX5
	CLASP1	CHMP4B	SPARCL1
	CLASRP	CHMP6	SPEN
	CLCN6	CHMP7	SRPRA
	CLDN12	CHORDC1	ST8SIA2
	CLDN6	CHP1	STXBP5
	CLDND1	CHRM1	SUPT16H
	CLIC1	CHRM3	TAF6
	CLIC4	CHRM4	TANC2
	CLINT1	CHST1	TBC1D31
	CLIP2	CHSY1	TBCK
	CLIP3	CHTF8	TERF2
	CLK1	CHTOP	TET2
	CLK2	CHUK	TMLHE
	CLK3	CIC	TRAPPC9
	CLNS1A	CIT	TRPC6
	CLPP	CITED2	TRPM1
	CLPTM1	CKAP4	TSHZ3
	CLPTM1L	CKAP5	UBE3A
	CLSTN1	CLASP1	UBE3C
	CLTA	CLASP2	UBR5
	CLTC	CLCF1	UNC79

	CLUH	CLCN3	USP45
	CMAS	CLCN4	VIL1
	CMIP	CLCN5	VPS13B
	CMPK1	CLDN11	WDFY4
	CMTM3	CLDN2	WWOX
	CMTR1	CLDN3	ZC3H4
	CNBP	CLDN5	ZMIZ1
	CNDP2	CLINT1	ZNF292
	CNIH1	CLIP1	ZNF804A
	CNIH2	CLIP2	
	CNN2	CLIP3	
	CNN3	CLK2	
	CNOT1	CLOCK	
	CNOT11	CLPP	
	CNOT2	CLPTM1	
	CNOT3	CLPX	
	CNOT6	CLSTN1	
	CNOT7	CLSTN3	
	CNOT8	CLTA	
	CNPY2	CLTC	
	CNPY4	CLUH	
	CNTFR	CLVS1	
	CNTRL	CMAS	
	COA3	CMIP	
	COA5	CMPK1	
	COG1	CMTR1	
	COG4	CNBP	
	COG8	CNIH1	
	COL18A1	CNIH2	
	COL1A1	CNIH3	
	COL1A2	CNKSR2	
	COL2A1	CNN3	
	COL3A1	CNNM2	
	COL4A1	CNOT1	
	COL4A2	CNOT10	
	COL5A2	CNOT11	
	COLEC12	CNOT2	
	COLGALT1	CNOT3	
	COMMD4	CNOT4	
	COPA	CNOT6L	
	COPB1	CNOT7	
	COPB2	CNP	
	COPE	CNR1	
	COPG1	CNTFR	
	COPG2	CNTNAP5	
	COPS2	COG3	
	COPS3	COL11A1	
	COPS4	COL11A2	
	COPS5	COL12A1	
	COPS6	COL1A1	
	COPS7A	COL1A2	



	COPS7B	COL27A1	
	COPS8	COL2A1	
	COPZ1	COL3A1	
	COQ2	COL4A1	
	COQ5	COL4A3BP	
	CORO1B	COL4A5	
	CORO1C	COL4A6	
	COTL1	COL5A1	
	COX15	COL5A2	
	COX16	COL6A1	
	COX19	COLCA2	
	COX20	COLEC12	
	COX411	COPA	
	COX5A	COPB1	
	COX5B	COPB2	
	COX6A1	COPE	
	COX6B1	COPS2	
	COX6C	COPS3	
	COX7A2	COPS4	
	COX8A	COPS5	
	CPE	COPS6	
	CPLX2	COPS7B	
	CPNE1	COPS8	
	CPSF1	COPZ1	
	CPSF2	CORO1A	
	CPSF3	CORO1C	
	CPSF3L	COX5B	
	CPSF4	COX7B	
	CPSF6	COX7C	
	CPSF7	CPE	
	CRABP1	CPEB1	
	CRABP2	CPEB3	
	CRAMP1L	CPEB4	
	CRB2	CPLX1	
	CREB1	CPLX2	
	CREBBP	CPSF6	
	CREBZF	CPSF7	
	CRELD2	CRADD	
	CRIP2	CREB1	
	CRIP2	CREB3L1	
	CRK	CREBBP	
	CRKL	CREBL2	
	CRLF1	CREBRF	
	CRLF3	CREM	
	CRLS1	CRH	
	CRMP1	CRIM1	
	CRTC2	CRK	
	CRY2	CRMP1	
	CS	CRTC1	
	CSDE1	CRTC2	
	CSE1L	CRTC3	

	CSK	CRX	
	CSNK1A1L	CS	
	CSNK1D	CSDE1	
	CSNK1E	CSE1L	
	CSNK1G2	CSF1	
	CSNK1G3	CSF2	
	CSNK2A1	CSK	
	CSNK2A2	CSMD1	
	CSNK2B	CSNK1A1	
	CSRP1	CSNK1D	
	CSRP2	CSNK1E	
	CSRP2BP	CSNK1G1	
	CSTF1	CSNK1G2	
	CSTF2	CSNK1G3	
	CSTF2T	CSNK2A1	
	CSTF3	CSNK2A2	
	CTAGE1	CSNK2B	
	CTAGE5	CSRNP2	
	CTAGE8	CSRNP3	
	CTAGE9	CSTF1	
	CTBP1	CSTF2	
	CTBP2	CSTF3	
	CTC1	CTB-102L5.4	
	CTCF	CTBP1	
	CTDNEP1	CTC-273B12.7	
	CTDP1	CTC-432M15.3	
	CTDSP1	CTCF	
	CTDSP2	CTD-2260A17.2	
	CTGF	CTD-2545M3.6	
	CTNNA1	CTDNEP1	
	CTNNB1	CTDSP1	
	CTNNBL1	CTDSPL2	
	CTNND1	CTIF	
	CTPS1	CTLA4	
	CTR9	CTNNA1	
	CTSA	CTNNB1	
	CTSB	CTNND1	
	CTSD	CTNND2	
	CTSV	CTPS1	
	CTSZ	CTPS2	
	CTTN	CTR9	
	CTXN1	CUL1	
	CUEDC2	CUL2	
	CUL1	CUL3	
	CUL2	CUL4A	
	CUL3	CUL4B	
	CUL4A	CUL5	
	CUL4B	CUL9	
	CUL7	CUX1	
	CUTA	CUX2	
	CUX1	CWC15	

	CWC15	CX3CL1	
	CXADR	CXCL13	
	CXCL12	CXCR5	
	CXCR2	CXorf21	
	CXCR4	CXorf22	
	CXorf38	CXorf23	
	CXXC1	CXorf30	
	CXXC5	CXorf40A	
	CYB5A	CXorf56	
	CYB5B	CXorf65	
	CYB5R3	CXXC1	
	CYC1	CXXC4	
	CYFIP1	CXXC5	
	CYHR1	CYB561	
	CYP51A1	CYBB	
	CYTH2	CYCS	
	DAAM1	CYFIP1	
	DAB1	CYFIP2	
	DAB2IP	CYLC1	
	DAG1	CYLD	
	DAK	CYP26B1	
	DALRD3	CYP46A1	
	DARS	CYR61	
	DAXX	CYTH1	
	DAZAP1	CYTH3	
	DAZAP2	DAAM1	
	DBF4	DAAM2	
	DBI	DAB1	
	DBN1	DAB2IP	
	DBNL	DACH1	
	DCAF11	DACT3	
	DCAF12	DAG1	
	DCAF13	DAGLA	
	DCAF15	DAPK1	
	DCAF7	DAZAP1	
	DCAF8	DAZL	
	DCAKD	DBF4	
	DCBLD2	DBN1	
	DCHS1	DCAF10	
	DCK	DCAF12L1	
	DCLRE1C	DCAF15	
	DCP1A	DCAF5	
	DCP2	DCAF7	
	DCPS	DCAF8	
	DCTN1	DCAF8	
	DCTN2	DCAF8L2	
	DCTN3	DCC	
	DCTN4	DCHS1	
	DCTN5	DCLK1	
	DCTN6	DCLK2	
	DCTPP1	DCLRE1B	

	DCUN1D4	DGP1A	
	DCUN1D5	DGP2	
	DDA1	DCTN2	
	DDB1	DCTN4	
	DDI2	DCUN1D1	
	DDIT4	DCUN1D3	
	DDOST	DCUN1D5	
	DDR1	DDA1	
	DDX1	DDB1	
	DDX11	DDHD1	
	DDX17	DDI2	
	DDX18	DDIT3	
	DDX19A	DDR2	
	DDX20	DDX1	
	DDX21	DDX17	
	DDX23	DDX19A	
	DDX27	DDX21	
	DDX39A	DDX23	
	DDX39B	DDX24	
	DDX3X	DDX26B	
	DDX41	DDX27	
	DDX42	DDX39A	
	DDX46	DDX39B	
	DDX47	DDX3X	
	DDX49	DDX3Y	
	DDX5	DDX4	
	DDX52	DDX42	
	DDX54	DDX46	
	DDX56	DDX5	
	DDX6	DDX53	
	DEAF1	DDX6	
	DEGS1	DEDD	
	DEK	DEF6	
	DENND2A	DENND1A	
	DENND5A	DENND4A	
	DENR	DENND4B	
	DESI1	DENND5B	
	DGAT1	DENR	
	DGCR2	DERL2	
	DGCR8	DESI2	
	DGKD	DET1	
	DGKZ	DGCR8	
	DHCR24	DGKB	
	DHCR7	DGKI	
	DHDDS	DHX15	
	DHRS1	DHX30	
	DHX15	DHX37	
	DHX16	DHX40	
	DHX29	DHX9	
	DHX30	DIAPH1	
	DHX32	DIAPH2	

	DHX33	DICER1	
	DHX34	DIDO1	
	DHX36	DIO1	
	DHX37	DIO2	
	DHX38	DIO3	
	DHX40	DIP2B	
	DHX8	DIP2C	
	DHX9	DIS3L2	
	DICER1	DKC1	
	DIP2B	DKFZP761J1410	
	DIS3	DKK2	
	DKC1	DLC1	
	DLAT	DLG1	
	DLD	DLG2	
	DLG1	DLG3	
	DLG3	DLG4	
	DLG4	DLG5	
	DLG5	DLGAP1	
	DLGAP5	DLGAP2	
	DLK1	DLGAP3	
	DLL1	DLGAP4	
	DLST	DLK2	
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	DMPK	DLL4	
	DMWD	DLX1	
	DNA2	DLX2	
	DNAAF2	DLX6	
	DNAJA1	DMBX1	
	DNAJA2	DMD	
	DNAJB1	DMRT1	
	DNAJB12	DMRTA2	
	DNAJC1	DMRTB1	
	DNAJC10	DMRTC2	
	DNAJC11	DMTF1	
	DNAJC13	DMTN	
	DNAJC2	DMXL1	
	DNAJC5	DMXL2	
	DNAJC7	DNAJA2	
	DNAJC8	DNAJB14	
	DNAJC9	DNAJB6	
	DNM1	DNAJC11	
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	DNM2	DNAJC14	
	DNMT1	DNAJC2	
	DNMT3A	DNAJC5	
	DNMT3B	DNAJC6	
	DNPEP	DNAJC7	
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	DNTTIP2	DNM2	
	DOC2A	DNMT1	
	DOCK7	DNTTIP1	

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	DOLPP1	DOCK3	
	DONSON	DOCK4	
	DOT1L	DOCK9	
	DPF2	DOPEY1	
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	DPM2	DPF1	
	DPP3	DPF2	
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	DPP9	DPP8	
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	DPY30	DPYSL2	
	DPYSL2	DPYSL3	
	DPYSL3	DPYSL5	
	DPYSL4	DR1	
	DPYSL5	DRD1	
	DR1	DRD2	
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	DRG1	DSCAML1	
	DRG2	DSE	
	DROSHA	DSG1	
	DSCR3	DSP	
	DSTN	DST	
	DTL	DSTN	
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	DTYMK	DTX3	
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	DVL3	DYNC1LI2	
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	DYNC1LI2	DYRK1B	
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	DYNLT1	E2F3	
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	DYRK1B	E2F7	
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	ECT2	EEF1A2	
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	EDC4	EEF2	
	EDF1	EFEMP1	
	EED	EFHC2	
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	EEF1B2	EFNB1	
	EEF1D	EFNB2	
	EEF1E1	EFTUD2	
	EEF1G	EGLN1	
	EEF2	EGLN2	
	EFNA2	EGR2	
	EFNA5	EGR3	
	EFNB1	EHD1	
	EFNB2	EHF	
	EFNB3	EHMT1	
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	EGFL7	EIF1AY	
	EGLN1	EIF1B	
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	EHMT1	EIF2B4	
	EHMT2	EIF2S1	
	EI24	EIF2S2	
	EID1	EIF2S3	
	EIF1	EIF3A	
	EIF1AD	EIF3B	
	EIF1AX	EIF3D	
	EIF1B	EIF3F	
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	EIF2AK1	EIF3I	
	EIF2B1	EIF3J	
	EIF2B2	EIF3L	
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	EIF3A	EIF4E2	
	EIF3B	EIF4ENIF1	
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	EIF3CL	EIF4G2	
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	EIF4A3	ELF2	
	EIF4B	ELF3	
	EIF4E	ELFN1	
	EIF4E2	ELFN2	
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	EIF4EBP2	ELL	
	EIF4ENIF1	ELL2	
	EIF4G1	ELMO1	
	EIF4G2	ELMOD1	
	EIF4G3	ELMSAN1	
	EIF4H	ELOVL1	
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	EIF5B	EMC4	
	EIF6	EMC6	
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	ELAVL1	EMC8	
	ELF2	EMD	
	ELMO2	EML1	
	ELOF1	EMX1	
	ELOVL2	EMX2	
	ELOVL5	EN1	
	ELOVL6	EN2	
	ELP2	ENAH	
	ELP3	ENG	
	ELP5	ENY2	
	EMB	EOMES	
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	EMC2	EP400	
	EMC4	EPAS1	
	EMC6	EPB41L1	
	EMC7	EPB41L2	
	EMC8	EPB41L4B	
	EMD	EPC1	
	EME1	EPC2	
	EMILIN1	EPHA4	
	EML1	EPHA6	
	EML3	EPHA7	
	EML4	EPHB1	
	EN2	EPHB2	
	ENAH	EPM2AIP1	
	ENC1	EPN1	



	ENG	EPN2	
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	ENO3	EPS8	
	ENOPH1	EPT1	
	ENSA	ERBB2IP	
	ENY2	ERBB4	
	EP300	ERC2	
	EP400	ERCC6L	
	EPB41	ERF	
	EPB41L2	ERG	
	EPC1	ERGIC1	
	EPHB2	ERH	
	EPHB4	ERN1	
	EPN1	ERO1L	
	EPO	ERP29	
	EPRS	ERP44	
	EPS15L1	ESCO1	
	ERAL1	ESPL1	
	ERBB2	ESR1	
	ERBB2IP	ESRP1	
	ERC1	ESRRA	
	ERCC2	ESX1	
	ERCC3	ETF1	
	ERCC6L	ETNK1	
	ERCC6L2	ETS1	
	ERF	ETS2	
	ERGIC1	ETV1	
	ERGIC2	ETV3	
	ERGIC3	ETV5	
	ERH	ETV6	
	ERI1	EVA1B	
	ERLIN2	EVI5L	
	ERO1L	EVL	
	ESF1	EWSR1	
	ESPL1	EXOC3	
	ESYT2	EXOC3L2	
	ETF1	EXOC5	
	ETFB	EXOC8	
	ETV6	EXOSC6	
	EVL	EXT1	
	EWSR1	EYA1	
	EXD2	EYA3	
	EXOC3	EZH2	
	EXOC5	F8	
	EXOSC10	F9	
	EXOSC2	FADD	
	EXOSC4	FADS2	
	EXOSC7	FAF1	
	EXOSC8	FAF2	
	EXOSC9	FAM115A	
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	EXT2	FAM120C	
	EXTL3	FAM122B	
	EYA2	FAM131B	
	EYA3	FAM135A	
	EZH2	FAM135B	
	EZR	FAM155A	
	F2R	FAM155B	
	FADS1	FAM160A2	
	FADS2	FAM160B1	
	FAF2	FAM168A	
	FAM107B	FAM169A	
	FAM109A	FAM171A1	
	FAM114A2	FAM171A2	
	FAM115A	FAM193A	
	FAM120A	FAM193B	
	FAM127A	FAM196A	
	FAM127B	FAM196B	
	FAM127C	FAM199X	
	FAM134A	FAM208A	
	FAM134C	FAM211A	
	FAM136A	FAM214B	
	FAM149B1	FAM222A	
	FAM162A	FAM229B	
	FAM168A	FAM3A	
	FAM168B	FAM46A	
	FAM171A1	FAM46C	
	FAM171A2	FAM46D	
	FAM172A	FAM49B	
	FAM178A	FAM50A	
	FAM192A	FAM53B	
	FAM193A	FAM57B	
	FAM193B	FAM58A	
	FAM195B	FAM60A	
	FAM206A	FAM65A	
	FAM213A	FAM65B	
	FAM216A	FAM69A	
	FAM21A	FAM83H	
	FAM21B	FAM84A	
	FAM21C	FAM98A	
	FAM222B	FANCB	
	FAM32A	FAR1	
	FAM49B	FAR2	
	FAM53A	FAS	
	FAM53C	FASN	
	FAM57A	FAT3	
	FAM63B	FAT4	
	FAM64A	FAU	
	FAM65A	FAXC	
	FAM76B	FBL	
	FAM91A1	FBLN1	
	FAM96A	FBLN5	

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	FARSA	FBXL16	
	FARSB	FBXL17	
	FASN	FBXL19	
	FASTK	FBXL20	
	FAT1	FBXL3	
	FBF1	FBXL5	
	FBLN1	FBXO11	
	FBN2	FBXO15	
	FBR5	FBXO21	
	FBXL14	FBXO22	
	FBXL19	FBXO28	
	FBXL6	FBXO3	
	FBXO11	FBXO32	
	FBXO18	FBXO33	
	FBXO21	FBXO38	
	FBXO22	FBXO41	
	FBXO38	FBXO42	
	FBXO42	FBXO45	
	FBXO45	FBXO46	
	FBXO5	FBXO5	
	FBXW11	FBXW11	
	FBXW5	FBXW2	
	FBXW8	FBXW7	
	FCF1	FCER1G	
	FCHSD2	FCHO1	
	FECH	FCHO2	
	FEM1B	FCHSD2	
	FEM1C	FEM1C	
	FEN1	FER	
	FERMT2	FERMT2	
	FEZ1	FEZ1	
	FGD1	FEZF1	
	FGF19	FEZF2	
	FGFR1	FGB	
	FGFR1OP	FGD1	
	FGFR1OP2	FGD5	
	FGFR2	FGF10	
	FGFRL1	FGF12	
	FH	FGF13	
	FHL1	FGF14	
	FHOD3	FGF16	
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	FIS1	FGF19	
	FIZ1	FGF20	
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	FKBP3	FGF9	

	FKBP4	FGFBP1	
	FKBP5	FGFR1	
	FKBP8	FGFR2	
	FKBP9	FHL1	
	FLAD1	FIGN	
	FLII	FIP1L1	
	FLNA	FIZ1	
	FLNB	FJX1	
	FLOT2	FKBP1A	
	FLRT2	FKBP5	
	FLRT3	FKBP8	
	FLYWCH1	FLCN	
	FMNL2	FLI1	
	FN1	FLNA	
	FNBP1L	FLNC	
	FNBP4	FLRT2	
	FNDC3A	FLT1	
	FNDC4	FLT3	
	FNTA	FLT3LG	
	FNTB	FLT4	
	FOCAD	FMN2	
	FOXK1	FMNL1	
	FOXK2	FMNL2	
	FOXM1	FMR1	
	FOXP4	FNBP1	
	FPGS	FNBP1L	
	FRAT1	FNBP4	
	FREM2	FNDC3A	
	FRMD8	FNDC3B	
	FRS2	FNDC4	
	FSCN1	FNDC5	
	FSTL1	FNIP1	
	FTH1	FNIP2	
	FTL	FNTA	
	FTSJ3	FOSB	
	FUBP1	FOSL2	
	FUBP3	FOXA2	
	FURIN	FOXA3	
	FUS	FOXB1	
	FXR1	FOXC1	
	FXR2	FOXD1	
	FXVD6	FOXD3	
	FYN	FOXE1	
	FYTTD1	FOXF1	
	FZD1	FOXF2	
	FZD10	FOXG1	
	FZD2	FOXI1	
	FZD3	FOXJ1	
	FZD7	FOXJ2	
	FZR1	FOXJ3	
	G3BP1	FOXK1	

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	G6PD	FOXN3	
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	GABARAP	FOXO1	
	GABPA	FOXO3	
	GAK	FOXO4	
	GALK1	FOXP1	
	GALNT1	FOXP2	
	GALNT16	FOXP3	
	GALNT2	FOXP4	
	GANAB	FOXQ1	
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	GAPDH	FRMD5	
	GAPVD1	FRMD7	
	GAR1	FRMPD4	
	GARS	FRS2	
	GART	FRS3	
	GAS1	FRY	
	GATAD1	FRYL	
	GATAD2A	FSCN1	
	GATAD2B	FST	
	GBA2	FSTL1	
	GBF1	FSTL3	
	GCLC	FTSJ1	
	GCN1L1	FUBP1	
	GCSH	FUBP3	
	GDE1	FURIN	
	GDI1	FUS	
	GDI2	FXR1	
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	GEMIN5	FXYD6	
	GEMIN7	FXYD6-FXYD2	
	GET4	FYN	
	GFM1	FZD2	
	GGA1	FZD4	
	GGA2	FZD5	
	GGA3	FZD8	
	GGNBP2	FZR1	
	GHITM	G2E3	
	GID4	G3BP2	
	GIGYF1	G6PD	
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	GINS2	GAB3	
	GINS4	GABARAPL1	
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	GIT1	GABBR2	
	GJA1	GABPA	
	GJC1	GABPB1	
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	GLE1	GABRA2	

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	GLI2	GABRB1	
	GLI3	GABRB2	
	GLIS2	GABRB3	
	GLO1	GABRD	
	GLOD4	GABRG2	
	GLRX5	GABRG3	
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	GLTSCR2	GALNT13	
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	GLUD2	GAPVD1	
	GLUL	GAS1	
	GLYR1	GAS2L1	
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	GMNN	GATA1	
	GMPPA	GATA2	
	GMPR2	GATA3	
	GMPS	GATA6	
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	GNAQ	GCLM	
	GNAS	GCM1	
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	GNL3	GDI2	
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	GORASP2	GLI3	
	GOSR2	GLIS2	
	GOT1	GLRA2	
	GOT2	GLRX5	
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	GPSM2	GNG2	
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	GPX3	GNL1	
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	GRB2	GOLGA6L18	
	GREB1	GOLT1B	
	GRIK5	GON4L	
	GRINA	GORASP2	
	GRK6	GP1BB	
	GRN	GPATCH8	
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	GRWD1	GPC4	
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	GSK3B	GPKOW	

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	GTF2H1	GPR64	
	GTF2H3	GPR85	
	GTF2H4	GPR88	
	GTF2I	GPRASP2	
	GTF2IRD1	GPRIN1	
	GTF3A	GPS1	
	GTF3C1	GRAMD1B	
	GTF3C2	GRAMD4	
	GTF3C3	GRASP	
	GTF3C4	GRB10	
	GTF3C5	GRB2	
	GTF3C6	GREB1L	
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	GTPBP2	GRHL3	
	GTPBP4	GRIA1	
	GTSE1	GRIA2	
	GUCD1	GRIA3	
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	GYG1	GRID2	
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	GYS1	GRIK3	
	GZF1	GRIK5	
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	H3F3B	GRM3	
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	HADHA	GRM5	
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	HARS	GSE1	
	HAT1	GSG1L	
	HAUS2	GSK3A	
	HAUS6	GSK3B	
	HAUS7	GSPT1	
	HBA1	GSPT2	
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	HBE1	GTF2A1	
	HBG1	GTF2E1	
	HBG2	GTF2H1	



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	HBZ	GTF3C1	
	HCFC1	GTF3C2	
	HDAC2	GTPBP1	
	HDAC3	GTPBP4	
	HDAC6	GULP1	
	HDAC7	H1FO	
	HDDC3	H2AFY	
	HDGFRP2	H2AFY2	
	HDLBP	H2AFZ	
	HEATR1	H3F3B	
	HEATR2	HAPLN1	
	HEATR3	HAS2	
	HECTD1	HAS3	
	HECTD4	HAT1	
	HELLS	HAUS7	
	HELZ	HBG1	
	HERC2	HBG2	
	HES1	HCCS	
	HES5	HCFC1	
	HES6	HCFC2	
	HGS	HCN1	
	HIAT1	HCN4	
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	HINT1	HDAC6	
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	HK2	HECA	
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	HMGB2	HELLS	
	HMGB3	HELZ	
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	HMGN4	HERC4	
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	HNRNPUL2-BSCL2	HLA-DRA	
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	HP1BP3	HLX	
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	HS6ST1	HMBS	
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	HSD3B7	HMGB3	
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	HSF1	HMGCS1	
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	LZTS2	LAMTOR1	
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	MAGT1	LATS1	
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	RCN3	RAF1	
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	RCOR2	RAI14	
	RDX	RAI2	
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	RFWD2	RAP1GAP2	
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	RGL2	RAP2A	
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	RGP1	RAPGEF2	
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	RHOB	RARB	
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	RHOG	RASA1	
	RHOQ	RASAL2	
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	SCAMP4	RPP25L	
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	SDCBP	RPS19	
	SDCCAG3	RPS2	
	SDE2	RPS23	
	SDF4	RPS24	
	SDHA	RPS25	
	SDHB	RPS26	
	SDHC	RPS27	
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	SEC23A	RPS4Y1	
	SEC23B	RPS5	
	SEC23IP	RPS6	
	SEC24B	RPS6KA3	
	SEC24C	RPS6KA4	
	SEC31A	RPS6KA5	
	SEC61A1	RPS6KA6	
	SEC61A2	RPS6KB1	
	SEC61G	RPS7	
	SEC62	RPS8	
	SEC63	RPS9	
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	SEL1L	RPTOR	
	SELO	RQCD1	
	SELT	RRAGB	
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	SEMA4C	RRAGD	
	SEMA5B	RRAS2	
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	SENP2	RRM1	
	SENP3	RRM2	
	SENP6	RS1	
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	SEPHS2	RSL24D1	
	SEPP1	RSPRY1	
	11-Sep	RSRC2	
	2-Sep	RTF1	
	3-Sep	RTN1	
	7-Sep	RTN4R	
	8-Sep	RTN4RL1	
	9-Sep	RTN4RL2	
	SEPW1	RTP4	
	SERBP1	RUNDC3A	
	SERF2	RUNX1	

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	SERPINF1	RUSC2	
	SERPINH1	RUVBL1	
	SET	RUVBL2	
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	SETD1B	RXRA	
	SETD2	RXRB	
	SETD5	RYK	
	SETD7	RYR2	
	SETD8	RYR3	
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	SF3A3	SAFB	
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	SGOL2	SATB2	
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	SHCBP1	SCHIP1	
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	SHH	SCML2	
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	SHMT1	SCN3A	
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	SHOC2	SCN8A	

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	SIRT2	SEC62	
	SIRT6	SEL1L	
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	SIX2	SEMA3F	
	SIX5	SEMA4C	
	SKA2	SEMA4D	
	SKA3	SEMA6A	
	SKI	SEMA6D	
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	SKP2	SENP6	
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	SLC4A2	SHH	
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	SPOP	SMARCA2	
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	STK40	SORT1	
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	STOX2	SOS2	
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	SUCLG2	SOX4	
	SUDS3	SOX5	
	SUFU	SOX6	
	SUGT1	SOX8	
	SULF1	SOX9	
	SULF2	SP1	
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	SUMO2	SP3	
	SUMO3	SP4	
	SUN1	SP5	
	SUPT16H	SP7	
	SUPT20H	SP8	
	SUPT5H	SP9	
	SUPT6H	SPAG9	
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	SURF2	SPAST	
	SURF4	SPATA2	
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	SUV420H2	SPCS2	
	SUZ12	SPCS3	
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	SYDE1	SPDYA	
	SYMPK	SPECC1L	
	SYNCRIP	SPEG	
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	SYT11	SPHKAP	
	SYVN1	SPI1	
	SZRD1	SPIB	
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	TADA1	SPIN4	
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	TADA3	SPOP	
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	TAF2	SPRED1	
	TAF5L	SPRTN	
	TAF6	SPRY2	
	TAF9	SPSB1	
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	TAGLN3	SPTB	
	TALDO1	SPTBN1	

	TAOK2	SPTBN4	
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	TARDBP	SPTSSA	
	TARS	SPTY2D1	
	TAX1BP1	SQLE	
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	TBC1D10B	SRCAP	
	TBC1D13	SRCIN1	
	TBC1D16	SREK1	
	TBC1D20	SRF	
	TBC1D9B	SRGAP1	
	TBCA	SRGAP2	
	TBCB	SRGAP3	
	TBCD	SRGN	
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		ZG16	
		ZHX1	
		ZIC1	
		ZIC2	
		ZIC3	
		ZIC5	
		ZKSCAN1	
		ZMAT2	
		ZMIZ1	
		ZMIZ2	
		ZMYM2	
		ZMYM3	
		ZMYM4	
		ZMYND11	
		ZMYND19	
		ZMYND8	
		ZNF101	
		ZNF131	
		ZNF146	
		ZNF148	
		ZNF182	
		ZNF202	
		ZNF217	
		ZNF219	
		ZNF236	
		ZNF24	
		ZNF280C	
		ZNF281	
		ZNF287	
		ZNF292	
		ZNF296	
		ZNF319	
		ZNF326	
		ZNF331	
		ZNF358	
		ZNF362	
		ZNF367	
		ZNF384	
		ZNF385D	
		ZNF407	
		ZNF423	
		ZNF428	
		ZNF444	
		ZNF445	
		ZNF449	
		ZNF460	
		ZNF462	

		ZNF469	
		ZNF483	
		ZNF496	
		ZNF503	
		ZNF512	
		ZNF512B	
		ZNF513	
		ZNF516	
		ZNF521	
		ZNF526	
		ZNF532	
		ZNF536	
		ZNF541	
		ZNF563	
		ZNF579	
		ZNF580	
		ZNF592	
		ZNF598	
		ZNF608	
		ZNF609	
		ZNF618	
		ZNF625	
		ZNF628	
		ZNF629	
		ZNF638	
		ZNF644	
		ZNF652	
		ZNF654	
		ZNF687	
		ZNF691	
		ZNF704	
		ZNF706	
		ZNF710	
		ZNF711	
		ZNF746	
		ZNF750	
		ZNF770	
		ZNF777	
		ZNF784	
		ZNF787	
		ZNF800	
		ZNF81	
		ZNF813	
		ZNF827	
		ZNF850	
		ZNF865	
		ZNFX1	
		ZNRF1	
		ZNRF3	
		ZRANB1	
		ZRANB2	

		ZRSR2	
		ZSWIM6	
		ZSWIM8	
		ZXDB	
		ZYG11B	
		ZZEF1	
		ZZZ3	

eTable 2: Gene variants

Type	Chromosome	Position	Reference	Alternative	Class	Gene	Amino acid change	chromatin_gene	HBE_gene	NDD_gene	pLI_gene
pLOF	1	878099	G	GC	lof	SAMD11	p.A409fs	FALSE	FALSE	FALSE	FALSE
pLOF	1	900382	C	A	lof	KLHL17	p.Y580X	FALSE	TRUE	FALSE	FALSE
pLOF	1	2116727	TC	T	lof	FAAP20	p.E145fs	FALSE	FALSE	FALSE	FALSE
dDNV/pLOF	1	2337260	AG	A	lof	PEX10	p.Leu329fs	FALSE	FALSE	FALSE	FALSE
pLOF	1	3385463	T	TG	lof	ARHGEF16	p.L275fs	FALSE	FALSE	FALSE	FALSE
pLOF	1	3415312	G	C	lof	MEGF6	p.S1058X	FALSE	TRUE	FALSE	FALSE
pLOF	1	3679753	G	T	lof	CCDC27	p.Glu346*	FALSE	FALSE	FALSE	FALSE
pLOF	1	6270017	C	T	lof	RNF207	p.Q263X	FALSE	FALSE	FALSE	FALSE
pLOF	1	11718389	C	T	lof	FBXO44	p.R111X	FALSE	FALSE	FALSE	FALSE
pLOF	1	12082289	C	CT	lof	MIIP	p.Arg85fs	FALSE	FALSE	FALSE	FALSE
pLOF	1	12815741	G	A	lof	C1orf158	p.W68X	FALSE	FALSE	FALSE	FALSE
pLOF	1	16268676	G	A	lof	ZBTB17	p.Q734X	FALSE	FALSE	FALSE	TRUE
pLOF	1	17331558	AG	A	lof	ATP13A2	p.S99fs	FALSE	TRUE	FALSE	FALSE
pLOF	1	17698832	C	CA	lof	PADI6	p.T31fs	FALSE	FALSE	FALSE	FALSE
dDNV	1	17982581	G	A	misD	ARHGEF10L	p.G897R	FALSE	FALSE	FALSE	FALSE
dDNV	1	18960820	C	T	misD	PAX7	p.Arg37Trp	TRUE	TRUE	FALSE	FALSE
pLOF	1	19493548	G	T	lof	UBR4	p.Y1359X	FALSE	TRUE	FALSE	TRUE
dDNV	1	23760827	G	A	misD	ASAP3	p.T624M	FALSE	FALSE	FALSE	FALSE
pLOF	1	24201921	G	A	lof	CNR2	p.Q63X	FALSE	FALSE	FALSE	FALSE
pLOF	1	26314721	C	T	lof	PAFAH2	.	FALSE	FALSE	FALSE	FALSE
pLOF	1	27120882	A	AG	lof	PIGV	p.V119fs	FALSE	FALSE	FALSE	FALSE
pLOF	1	32126666	C	T	lof	COL16A1	.	FALSE	FALSE	FALSE	FALSE
pLOF	1	32673556	GA	G	lof	IQCC	p.G425fs	FALSE	FALSE	FALSE	FALSE

pLOF	1	36921868	C	A	lof	MRP S15	p.G186X	FALS E	TRUE	FALS E	FALS E
pLOF	1	43111990	T	C	lof	CCD C30	.	FALS E	FALS E	FALS E	FALS E
pLOF	1	43621982	T	A	lof	FAM1 83A	p.X135K	FALS E	FALS E	FALS E	FALS E
pLOF	1	44482802	TCAT TC	T	lof	SLC6 A9	.	FALS E	FALS E	FALS E	FALS E
pLOF	1	45286377	C	T	lof	PTCH 2	.	FALS E	FALS E	FALS E	FALS E
pLOF	1	45288993	GC	G	lof	PTCH 2	p.A1060fs	FALS E	FALS E	FALS E	FALS E
dDNV	1	46976691	G	C	misD	DMB X1	p.E140Q	FALS E	FALS E	FALS E	TRUE
pLOF	1	47155310	AGG TGAC GGA ATGA TCT	A	lof	EFCA B14	p.Q243fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	51584441	C	T	lof	C1orf 185	p.R76X	FALS E	FALS E	FALS E	FALS E
pLOF	1	53287121	T	G	lof	ZYG1 1B	p.Tyr 685*	FALS E	FALS E	FALS E	TRUE
pLOF	1	53442354	G	C	lof	SCP2	.	FALS E	FALS E	FALS E	FALS E
pLOF	1	54661184	AG	A	lof	CYB5 RL	p.P35fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	55472702	G	A	lof	BSND	p.W102X	FALS E	FALS E	FALS E	FALS E
pLOF	1	62672651	G	GA	lof	L1TD 1	p.G117fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	63988799	C	T	lof	ITGB 3BP	.	TRUE	FALS E	FALS E	FALS E
pLOF	1	72748169	C	T	lof	NEG R1	p.Met 1?	FALS E	FALS E	FALS E	TRUE
pLOF	1	76378513	A	T	lof	MSH4	p.K918X	FALS E	FALS E	FALS E	FALS E
pLOF	1	86611813	GC	G	lof	COL2 4A1	p.A37fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	93091493	T	C	lof	EVI5	.	FALS E	FALS E	FALS E	FALS E
pLOF	1	95290047	A	G	lof	SLC4 4A3	.	FALS E	FALS E	FALS E	FALS E

pLOF	1	95712 211	AAG GTAT AATT TAGT ACTA TTGC AGAT GGA AAAG CAAC TGAA TCGA TAAT TATA CTCT GAC AAAT CTAG GCAT ATTC ATGA GTTT CTTT TGTA TAAT GC	A	lof	RWD D3	p.R21 5fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	1.01E +08	C	G	lof	CDC1 4A	p.Y13 9X	FALS E	FALS E	FALS E	FALS E
pLOF	1	1.08E +08	G	A	lof	VAV3	p.R58 4X	FALS E	FALS E	FALS E	FALS E
pLOF	1	1.09E +08	T	TA	lof	FNDC 7	p.I463 fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	1.1E+ 08	A	AG	lof	EPS8 L3	p.L47 0fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	1.12E +08	A	G	lof	FAM2 12B	p.X28 3R	FALS E	FALS E	FALS E	FALS E
pLOF	1	1.13E +08	AT	A	lof	CTTN BP2N L	p.Ser 549fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	1.19E +08	A	T	lof	SPAG 17	p.Y15 58X	FALS E	FALS E	FALS E	FALS E
pLOF	1	1.19E +08	A	AG	lof	SPAG 17	p.P13 75fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	1.2E+ 08	C	A	lof	NOT CH2	.	FALS E	TRUE	FALS E	TRUE
pLOF	1	1.45E +08	C	A	lof	PDE4 DIP	p.E33 0X	FALS E	FALS E	FALS E	FALS E
pLOF	1	1.45E +08	C	CT	lof	TXNI P	p.Val 180fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	1.45E +08	TG	T	lof	ANKR D34A	p.G49 2fs	FALS E	FALS E	FALS E	TRUE
pLOF	1	1.47E +08	T	TA	lof	CHD1 L	p.L36f s	TRUE	FALS E	FALS E	FALS E
pLOF	1	1.5E+ 08	AG	A	lof	SV2A	p.A22 6fs	FALS E	FALS E	FALS E	FALS E

pLOF	1	1.51E+08	G	A	lof	C1orf56	p.W323X	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.51E+08	G	A	lof	PI4KB	p.R333X	FALSE	FALSE	FALSE	TRUE
dDNV/pLOF	1	1.52E+08	C	T	lof	OAZ3	UNK NOW N	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.53E+08	C	T	lof	IVL	p.Q446X	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.54E+08	G	A	lof	SLC39A1	p.Q66X	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.54E+08	C	T	lof	TPM3	NA	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.54E+08	G	A	lof	C1orf43	p.R65X	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.54E+08	G	C	lof	IL6R	.	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.55E+08	C	G	lof	EFNA4	p.Y94X	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.57E+08	CT	C	lof	MRPL24	p.K100fs	FALSE	TRUE	FALSE	FALSE
pLOF	1	1.61E+08	CTG	C	lof	CD84	p.Q139fs	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.68E+08	C	A	lof	GPR161	p.E527X	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.7E+08	TG	T	lof	SELL	p.P216fs	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.7E+08	C	A	lof	SELE	NA	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.72E+08	AG	A	lof	METTL13	p.R49fs	FALSE	TRUE	FALSE	FALSE
dDNV	1	1.72E+08	C	G	misD	DNM3	p.P747A	FALSE	FALSE	FALSE	FALSE
dDNV	1	1.77E+08	A	C	misD	PAPP A2	p.N1746T	FALSE	FALSE	FALSE	FALSE
dDNV	1	1.79E+08	G	T	misD	ABL2	p.S394Y	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.79E+08	TC	T	lof	AXDN D1	p.P94fs	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.8E+08	GC	G	lof	CEP350	p.Ala1896fs	FALSE	FALSE	FALSE	TRUE
pLOF	1	1.84E+08	TG	T	lof	NCF2	p.H302fs	FALSE	FALSE	FALSE	FALSE
pLOF	1	1.84E+08	C	T	lof	RGL1	p.Q519X	FALSE	FALSE	FALSE	TRUE
pLOF	1	1.97E+08	C	A	lof	CFHR4	p.C73X	FALSE	FALSE	FALSE	FALSE
pLOF	1	2.01E+08	A	T	lof	CACNA1S	p.C1338X	FALSE	FALSE	FALSE	FALSE
pLOF	1	2.01E+08	C	T	lof	CACNA1S	p.W417X	FALSE	FALSE	FALSE	FALSE
pLOF	1	2.01E+08	C	T	lof	IGFN1	p.Q404X	FALSE	FALSE	FALSE	FALSE

pLOF	1	2.01E+08	AC	A	lof	LAD1	.	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.03E+08	C	T	lof	PPP1 R12B	p.R20 7X	FALS E	FALS E	FALS E	FALS E
dDNV	1	2.03E+08	G	A	misD	MYO G	p.T18 9M	FALS E	FALS E	FALS E	TRUE
pLOF	1	2.03E+08	AG	A	lof	ADO RA1	p.Val 174fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.03E+08	T	C	lof	MYB PH	.	FALS E	FALS E	FALS E	FALS E
dDNV	1	2.04E+08	G	T	misD	ATP2 B4	p.D62 1Y	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.04E+08	C	T	lof	PIK3 C2B	p.W2 56X	FALS E	FALS E	FALS E	TRUE
pLOF	1	2.06E+08	A	AC	lof	PM20 D1	p.S20 7fs	FALS E	FALS E	FALS E	FALS E
dDNV	1	2.08E+08	G	A	misD	CR2	p.C15 4Y	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.08E+08	A	G	lof	CR2	NA	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.1E+08	T	TA	lof	LAMB 3	p.Y27 fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.12E+08	AG	A	lof	TRAF 5	p.G9f s	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.16E+08	AG	A	lof	USH2 A	p.L35 67X	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.16E+08	CT	C	lof	USH2 A	p.P11 45fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.23E+08	CCCT T	C	lof	HHIP L2	p.E46 8fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.23E+08	G	T	lof	FAM1 77B	.	FALS E	FALS E	FALS E	FALS E
dDNV	1	2.23E+08	G	A	misD	DISP 1	p.R63 1Q	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.25E+08	TA	T	lof	DNA H14	p.L18 05fs	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	1	2.25E+08	G	A	lof	DNA H14	p.Trp 1808*	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.26E+08	C	T	lof	EPHX 1	p.R33 8X	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.27E+08	G	T	lof	ADCK 3	p.E63 4X	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.28E+08	C	A	lof	C1orf 35	.	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.28E+08	TCA	T	lof	OBS CN	p.V32 51fs	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.3E+08	T	C	lof	URB2	NA	FALS E	FALS E	FALS E	FALS E
dDNV	1	2.31E+08	T	C	misD	GNP AT	p.I262 T	FALS E	TRUE	FALS E	FALS E
pLOF	1	2.32E+08	G	A	lof	DISC 1	p.W6 70X	FALS E	FALS E	TRUE	FALS E
pLOF	1	2.33E+08	G	GA	lof	PCNX L2	p.F17 72fs	FALS E	FALS E	FALS E	FALS E



pLOF	1	2.35E+08	T	TAC	lof	TARB P1	p.T12 46fs	FALS E	FALS E	FALS E	FALS E
dDNV	1	2.38E+08	A	G	misD	RYR2	p.Met 4058 Val	FALS E	FALS E	FALS E	TRUE
pLOF	1	2.38E+08	G	A	lof	ZP4	p.Q23 6X	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.42E+08	G	A	lof	CHM L	p.Gln 473*	FALS E	FALS E	FALS E	FALS E
pLOF	1	2.49E+08	C	CAA	lof	ZNF6 72	p.Arg 41fs	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	1	2.49E+08	AGC GCC ACG CTG GT	A	lof	ZNF6 72	p.S23 9fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	10199 057	C	A	lof	CYS1	p.E13 4X	FALS E	FALS E	FALS E	FALS E
pLOF	2	11960 624	AAG	A	lof	LPIN1	p.K91 8fs	TRUE	FALS E	FALS E	FALS E
pLOF	2	21232 182	G	A	lof	APOB	p.R25 20X	FALS E	FALS E	FALS E	FALS E
pLOF	2	25964 922	GCA	G	lof	ASXL 2	p.C14 28fs	TRUE	FALS E	TRUE	TRUE
pLOF	2	27293 033	TC	T	lof	AGBL 5	p.S85 5fs	FALS E	FALS E	FALS E	FALS E
dDNV	2	27445 073	C	T	misD	CAD	p.R12 2W	FALS E	TRUE	TRUE	TRUE
pLOF	2	27706 245	T	TA	lof	IFT17 2	.	FALS E	TRUE	FALS E	FALS E
pLOF	2	28812 887	C	T	lof	PLB1	p.Q67 8X	FALS E	FALS E	FALS E	FALS E
pLOF	2	29287 883	CA	C	lof	C2orf 71	p.Cys 124ofs	FALS E	FALS E	FALS E	FALS E
pLOF	2	29606 630	AC	A	lof	ALK	p.V41 7fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	30986 012	G	GT	lof	CAPN 13	p.T23 7fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	37032 808	G	A	lof	VIT	.	FALS E	FALS E	FALS E	FALS E
pLOF	2	37321 291	G	T	lof	GPAT CH11	p.E22 5X	FALS E	FALS E	FALS E	FALS E
pLOF	2	37543 642	G	C	lof	PRKD 3	p.S9X	FALS E	TRUE	FALS E	FALS E
dDNV /pLOF	2	47136 161	C	G	lof	MCF D2	NA	FALS E	TRUE	FALS E	FALS E
pLOF	2	48915 301	G	T	lof	LHCG R	p.C54 5X	FALS E	FALS E	FALS E	FALS E
pLOF	2	55253 349	GCA CC	G	lof	RTN4	p.Gly 628fs	FALS E	TRUE	FALS E	FALS E
pLOF	2	55253 354	A	AT	lof	RTN4	p.Gly 628fs	FALS E	TRUE	FALS E	FALS E

pLOF	2	55872 531	GT	G	lof	PNPT 1	p.T59 2fs	FALS E	TRUE	FALS E	FALS E
pLOF	2	68740 211	G	A	lof	APLF	.	FALS E	FALS E	FALS E	FALS E
pLOF	2	70488 452	G	A	lof	PCY OX1	p.W1 43X	FALS E	TRUE	FALS E	FALS E
pLOF	2	74652 826	T	C	lof	WDR 54	p.X33 5R	FALS E	FALS E	FALS E	FALS E
pLOF	2	74758 465	G	A	lof	HTRA 2	.	FALS E	TRUE	FALS E	FALS E
pLOF	2	75921 366	C	A	lof	GCF C2	.	FALS E	FALS E	FALS E	FALS E
pLOF	2	88474 314	TC	T	lof	THNS L2	p.F12 7fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	88874 920	G	T	lof	EIF2A K3	p.S69 4X	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.03E +08	GA	G	lof	IL1RL 1	p.R62 fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.1E+ 08	A	AG	lof	SH3R F3	p.G54 0fs	FALS E	FALS E	FALS E	FALS E
dDNV	2	1.28E +08	C	T	misD	MYO 7B	p.R20 03W	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.28E +08	AC	A	lof	LIMS 2	.	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.31E +08	GC	G	lof	PTPN 18	p.Pro 67fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.32E +08	AG	A	lof	AME R3	p.G82 3fs	FALS E	FALS E	FALS E	TRUE
dDNV	2	1.32E +08	C	T	misD	ARH GEF4	p.P42 3L	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.33E +08	G	T	lof	GPR3 9	p.Glu 416*	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	2	1.36E +08	G	A	lof	MAP3 K19	p.R70 2X	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.36E +08	CAG	C	lof	ZRAN B3	p.L58 6fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.38E +08	C	T	lof	THSD 7B	p.R72 3X	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.39E +08	A	C	lof	HNM T	.	FALS E	FALS E	FALS E	FALS E
dDNV	2	1.41E +08	C	T	misD	LRP1 B	p.S36 62N	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.52E +08	G	A	lof	NMI	p.Q24 7X	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.52E +08	C	CTTG A	lof	NEB	p.E81 00fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.57E +08	AT	A	lof	GPD2	p.Ile7 03fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.59E +08	C	T	lof	ACVR 1	p.W4 78X	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.61E +08	AAAT T	A	lof	LY75	p.Glu 773fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.65E +08	T	TAAA G	lof	GRB1 4	.	FALS E	FALS E	FALS E	FALS E

pLOF	2	1.71E+08	A	G	lof	MYO3B	.	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.74E+08	G	GA	lof	MLTK	p.Arg 617fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.75E+08	G	A	lof	GPR155	p.R76 4X	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.79E+08	G	A	lof	TTN	p.R21 604X	FALS E	FALS E	FALS E	FALS E
pLOF	2	1.89E+08	G	A	lof	GULP1	p.Trp 112*	FALS E	FALS E	FALS E	TRUE
pLOF	2	2.02E+08	C	T	lof	NIF3L1	p.R24 1X	FALS E	TRUE	FALS E	FALS E
pLOF	2	2.04E+08	CAG	C	lof	ABI2	p.S12 5fs	FALS E	TRUE	FALS E	FALS E
pLOF	2	2.06E+08	A	G	lof	PARD3B	.	FALS E	FALS E	TRUE	FALS E
pLOF	2	2.07E+08	AT	A	lof	NDUF51	p.I225 fs	FALS E	TRUE	FALS E	FALS E
pLOF	2	2.09E+08	CA	C	lof	IDH1	p.L35 2fs	FALS E	TRUE	FALS E	FALS E
pLOF	2	2.19E+08	C	A	lof	SLC11A1	p.Y25 8X	FALS E	FALS E	FALS E	FALS E
pLOF	2	2.19E+08	AAGA T	A	lof	VIL1	p.K39 1fs	FALS E	FALS E	TRUE	FALS E
pLOF	2	2.2E+08	G	A	lof	CFAP65	p.R92 2X	FALS E	FALS E	FALS E	FALS E
pLOF	2	2.2E+08	G	A	lof	CNPPD1	p.R76 X	FALS E	FALS E	FALS E	FALS E
pLOF	2	2.28E+08	T	G	lof	COL4A3	p.Y28 3X	FALS E	FALS E	FALS E	FALS E
pLOF	2	2.28E+08	G	A	lof	COL4A3	.	FALS E	FALS E	FALS E	FALS E
pLOF	2	2.31E+08	C	A	lof	SP110	.	TRUE	FALS E	FALS E	FALS E
pLOF	2	2.32E+08	G	T	lof	CAB39	p.E34 0X	FALS E	TRUE	FALS E	FALS E
dDNV	2	2.34E+08	C	T	misD	DGKD	p.Arg 962C ys	FALS E	TRUE	FALS E	FALS E
dDNV	2	2.35E+08	T	A	misD	UGT1A6	p.L23 7H	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	2	2.35E+08	A	AT	lof	TRPM8	p.Y23 5fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	2.38E+08	ACG CCA GT	A	lof	PRLH	p.Y42 fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	2.39E+08	G	GC	lof	FAM132B	p.Gly 124fs	FALS E	FALS E	FALS E	FALS E
pLOF	2	2.41E+08	C	CGT GGA TGAA GAG CT	lof	PRR21	p.R12 fs	FALS E	FALS E	FALS E	FALS E

pLOF	2	2.42E+08	AG	A	lof	PASK	p.Trp241fs	FALSE	FALSE	FALSE	FALSE
pLOF	2	2.42E+08	TTC	T	lof	STK25	p.E371fs	FALSE	TRUE	FALSE	FALSE
pLOF	3	9695344	C	T	lof	MTMR14	p.R67X	FALSE	TRUE	FALSE	FALSE
pLOF	3	9877003	GA	G	lof	TTL3	p.D860fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	9979296	T	TC	lof	CRELD1	p.Glu104fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	10254918	GA	G	lof	IRAK2	p.E186fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	10320063	T	TG	lof	TATDN2	p.W688fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	12780071	CA	C	lof	TMEM40	p.V124fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	14200140	G	A	lof	XPC	p.R415X	FALSE	FALSE	FALSE	FALSE
pLOF	3	14745975	A	AC	lof	C3orf20	p.Y337fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	20042879	G	A	lof	PP2D1	p.Q245X	FALSE	FALSE	FALSE	FALSE
dDNV	3	27333034	G	C	misD	NEK10	p.H473D	FALSE	FALSE	FALSE	FALSE
dDNV/pLOF	3	32611912	C	G	lof	DYNC1LI1	NA	FALSE	TRUE	FALSE	TRUE
pLOF	3	36879869	CA	C	lof	TRANK1	p.L1793fs	FALSE	FALSE	FALSE	FALSE
dDNV	3	38592918	C	G	misD	SCN5A	p.Ala1649Pro	FALSE	FALSE	FALSE	TRUE
pLOF	3	38793799	G	A	lof	SCN10A	p.Q556X	FALSE	FALSE	FALSE	FALSE
pLOF	3	39374845	C	A	lof	CCR8	p.C341X	FALSE	FALSE	FALSE	FALSE
pLOF	3	43759162	G	A	lof	ABHD5	.	FALSE	FALSE	FALSE	FALSE
pLOF	3	48602273	TC	T	lof	COL7A1	p.G2920fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	48716340	C	A	lof	NCK1PSD	p.E581X	FALSE	FALSE	FALSE	FALSE
pLOF	3	49053766	AG	A	lof	DALRD3	p.Leu385fs	FALSE	TRUE	FALSE	FALSE
pLOF	3	49163457	CAGAG	C	lof	LAMB2	p.P761fs	FALSE	TRUE	FALSE	FALSE
pLOF	3	49850818	T	C	lof	UBA7	.	FALSE	TRUE	FALSE	FALSE
pLOF	3	51990710	A	AC	lof	GPR62	p.T348fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	52430632	A	G	lof	DNAH1	.	FALSE	FALSE	FALSE	FALSE
pLOF	3	52512570	C	T	lof	NISCH	p.Q427X	FALSE	TRUE	FALSE	TRUE

pLOF	3	52512 570	C	T	lof	NISC H	p.Gln 427*	FALS E	TRUE	FALS E	TRUE
pLOF	3	52825 797	G	A	lof	ITIH1	NA	FALS E	FALS E	FALS E	FALS E
pLOF	3	56114 964	T	A	lof	ERC2	p.K50 8X	FALS E	FALS E	FALS E	TRUE
pLOF	3	57303 701	G	T	lof	APPL 1	p.E70 6X	FALS E	FALS E	FALS E	TRUE
dDNV /pLOF	3	69082 783	G	A	lof	TMF1	p.R77 3X	FALS E	FALS E	FALS E	FALS E
pLOF	3	73523 667	AT	A	lof	PDZR N3	p.Met 8fs	FALS E	TRUE	FALS E	TRUE
pLOF	3	97668 731	G	GA	lof	MINA	p.L33 9fs	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.02E +08	C	T	lof	ZPLD 1	p.R28 4X	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.08E +08	G	A	lof	MYH1 5	p.R18 7X	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.08E +08	TG	T	lof	KIAA 1524	p.Asn 553fs	FALS E	TRUE	FALS E	FALS E
pLOF	3	1.12E +08	C	T	lof	TMP RSS7	p.R14 X	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.13E +08	CTT	C	lof	GTPB P8	p.Phe 14fs	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.21E +08	G	A	lof	POLQ	p.Q23 50X	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.21E +08	CA	C	lof	GOL GB1	p.M22 47fs	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.25E +08	G	GTC	lof	HEG1	p.Ser 7fs	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.26E +08	T	TA	lof	TXNR D3NB	p.K66 _R67 delins X	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.27E +08	TA	T	lof	TPRA 1	p.V30 6fs	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.31E +08	C	A	lof	NEK1 1	p.Tyr 29*	TRUE	FALS E	FALS E	FALS E
pLOF	3	1.31E +08	AC	A	lof	NEK1 1	p.Y47 9X	TRUE	FALS E	FALS E	FALS E
pLOF	3	1.38E +08	G	A	lof	NME9	p.R14 2X	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	3	1.39E +08	G	C	lof	COP B2	p.S28 3X	FALS E	TRUE	FALS E	TRUE
pLOF	3	1.49E +08	GA	G	lof	CPA3	p.N21 1fs	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.49E +08	G	A	lof	CPA3	.	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.49E +08	C	A	lof	HPS3	p.Y56 2X	FALS E	FALS E	FALS E	FALS E
pLOF	3	1.51E +08	A	G	lof	GPR8 7	p.X35 9Q	FALS E	FALS E	FALS E	FALS E

pLOF	3	1.51E+08	G	GT	lof	P2RY13	p.N249fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	1.54E+08	C	CT	lof	GPR149	.	FALSE	FALSE	FALSE	FALSE
pLOF	3	1.55E+08	C	CT	lof	PLCH1	p.S1318fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	1.59E+08	T	TGGGCGTGGCC	lof	MFS D1	p.M1fs	FALSE	TRUE	FALSE	FALSE
pLOF	3	1.6E+08	TAAA GA	T	lof	SMC4	p.K397fs	FALSE	TRUE	FALSE	FALSE
pLOF	3	1.6E+08	G	GGTGT	lof	SMC4	p.Q801fs	FALSE	TRUE	FALSE	FALSE
pLOF	3	1.6E+08	TC	T	lof	ARL14	p.I42fs	FALSE	FALSE	FALSE	FALSE
dDNV	3	1.65E+08	G	A	misD	SI	p.P475S	FALSE	FALSE	FALSE	FALSE
pLOF	3	1.66E+08	AT	A	lof	BCHE	p.N209fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	1.72E+08	CA	C	lof	GHSR	p.W215fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	1.79E+08	GCA GTA	G	lof	ZMAT3	p.Y71fs	FALSE	TRUE	FALSE	FALSE
pLOF	3	1.83E+08	TC	T	lof	MCF2L2	p.G187fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	1.84E+08	C	A	lof	ECE2	p.S230X	FALSE	FALSE	FALSE	FALSE
pLOF	3	1.85E+08	A	G	lof	VPS8	p.Met1?	FALSE	FALSE	FALSE	FALSE
pLOF	3	1.9E+08	C	T	lof	TME M207	.	FALSE	FALSE	FALSE	FALSE
pLOF	3	1.93E+08	TC	T	lof	ATP13A5	p.E107fs	FALSE	FALSE	FALSE	FALSE
pLOF	3	1.97E+08	C	T	lof	SENP5	p.Q269X	FALSE	FALSE	FALSE	TRUE
pLOF	3	1.98E+08	C	T	lof	IQCG	p.W330X	FALSE	FALSE	FALSE	FALSE
pLOF	4	657557	A	G	lof	PDE6B	.	FALSE	FALSE	FALSE	FALSE
pLOF	4	995352	G	A	lof	IDUA	.	FALSE	FALSE	FALSE	FALSE
pLOF	4	1165675	AG	A	lof	SPO N2	p.L62fs	FALSE	FALSE	FALSE	FALSE
pLOF	4	2210193	G	A	lof	POLN	p.Q79X	FALSE	FALSE	FALSE	FALSE
pLOF	4	9909936	CT	C	lof	SLC2A9	p.K316fs	FALSE	FALSE	FALSE	FALSE
pLOF	4	22390565	C	T	lof	ADG RA3	p.W910X	FALSE	FALSE	FALSE	FALSE
pLOF	4	25270817	A	AG	lof	PI4K2B	p.R422fs	FALSE	FALSE	FALSE	FALSE
pLOF	4	38117333	C	T	lof	TBC1D1	p.R948X	FALSE	TRUE	FALSE	FALSE

pLOF	4	42965062	G	T	lof	GRXCR1	p.Glu180*	FALSE	FALSE	FALSE	FALSE
pLOF	4	48501484	TAG	T	lof	FRYL	p.L2999fs	FALSE	FALSE	FALSE	TRUE
dDNV/pLOF	4	48584641	TAAAC	T	lof	FRYL	p.V619fs	FALSE	FALSE	FALSE	TRUE
pLOF	4	57181627	G	GCT	lof	KIAA1211	p.K653fs	FALSE	TRUE	FALSE	FALSE
pLOF	4	68930574	G	GA	lof	TMPRSS11F	p.H282fs	FALSE	FALSE	FALSE	FALSE
pLOF	4	72316150	G	GTCTTT	lof	SLC4A4	p.L366fs	FALSE	FALSE	FALSE	TRUE
pLOF	4	76532365	A	C	lof	CDKL2	.	FALSE	FALSE	FALSE	FALSE
pLOF	4	76956270	ATAC TGT	A	lof	CXCL11	p.I63fs	FALSE	FALSE	FALSE	FALSE
pLOF	4	78080585	CTT	C	lof	CCN2	p.Phe70fs	FALSE	TRUE	FALSE	FALSE
dDNV/pLOF	4	79186194	C	T	lof	FRAS1	p.Arg207*	FALSE	FALSE	FALSE	FALSE
pLOF	4	87671811	C	T	lof	PTPN13	p.Q947X	FALSE	TRUE	FALSE	FALSE
pLOF	4	87720325	TAGAG	T	lof	PTPN13	p.I2163fs	FALSE	TRUE	FALSE	FALSE
pLOF	4	90857226	GTT	G	lof	MMRN1	p.V799fs	FALSE	FALSE	FALSE	FALSE
pLOF	4	90857627	C	CA	lof	MMRN1	p.Asn933fs	FALSE	FALSE	FALSE	FALSE
pLOF	4	1E+08	A	G	lof	C4orf17	p.X360W	FALSE	FALSE	FALSE	FALSE
pLOF	4	1.07E+08	G	GAA	lof	TBCK	p.F101fs	FALSE	FALSE	TRUE	FALSE
pLOF	4	1.09E+08	C	A	lof	PAPS1	p.E236X	FALSE	TRUE	FALSE	FALSE
pLOF	4	1.11E+08	GTCT CAAA GTGT AGG TGA	G	lof	LRIT3	p.S636fs	FALSE	FALSE	FALSE	FALSE
pLOF	4	1.14E+08	C	T	lof	ZGRF1	p.W1387X	FALSE	FALSE	FALSE	FALSE
pLOF	4	1.23E+08	G	A	lof	KIAA1109	.	FALSE	FALSE	FALSE	FALSE
pLOF	4	1.35E+08	C	A	lof	PABPC4L	p.E365X	FALSE	FALSE	FALSE	FALSE
dDNV	4	1.46E+08	G	A	misD	ABCE1	p.R22Q	FALSE	TRUE	FALSE	TRUE
pLOF	4	1.49E+08	CTA	C	lof	ARHGAP10	p.Y290fs	FALSE	FALSE	FALSE	FALSE
pLOF	4	1.52E+08	A	C	lof	PRSS48	p.X329S	FALSE	FALSE	FALSE	FALSE

pLOF	4	1.56E+08	G	GT	lof	MAP9	p.T94fs	FALS E	FALS E	FALS E	FALS E
pLOF	4	1.57E+08	C	T	lof	GUCY1A3	p.R614X	FALS E	FALS E	FALS E	FALS E
pLOF	4	1.7E+08	AG	A	lof	SH3RF1	p.P329fs	FALS E	FALS E	FALS E	FALS E
pLOF	5	7870882	G	A	lof	MTRR	.	FALS E	FALS E	FALS E	FALS E
pLOF	5	1372167	GA	G	lof	DNAH5	p.S4074fs	FALS E	FALS E	FALS E	FALS E
pLOF	5	14711397	G	T	lof	ANKH	p.S463X	FALS E	FALS E	TRUE	FALS E
pLOF	5	16699557	A	G	lof	MYO10	.	FALS E	TRUE	FALS E	FALS E
pLOF	5	35910098	GT	G	lof	CAPSL	p.T132fs	FALS E	FALS E	FALS E	FALS E
pLOF	5	38511915	C	T	lof	LIFR	p.W238X	FALS E	FALS E	FALS E	FALS E
pLOF	5	39383375	T	A	lof	DAB2	.	FALS E	FALS E	FALS E	FALS E
pLOF	5	52365994	CA	C	lof	ITGA2	p.Arg714fs	FALS E	FALS E	FALS E	FALS E
pLOF	5	54529089	T	TGG GCC GGG CC	lof	CCNO	p.Q88fs	FALS E	FALS E	FALS E	FALS E
pLOF	5	54618194	TAAT GGA AA	T	lof	SKIV2L2	p.Asn59fs	FALS E	TRUE	FALS E	TRUE
pLOF	5	63496764	A	AT	lof	RNF180	p.I44fs	FALS E	FALS E	FALS E	FALS E
pLOF	5	64020297	CT	C	lof	SREK1IP1	p.K127fs	FALS E	TRUE	FALS E	FALS E
pLOF	5	64625312	T	C	lof	ADAMTS6	.	FALS E	FALS E	FALS E	TRUE
pLOF	5	65054518	C	T	lof	NLN	p.Gln56*	FALS E	FALS E	FALS E	FALS E
pLOF	5	79029202	GA	G	lof	CMYA5	p.K1539fs	FALS E	FALS E	FALS E	FALS E
pLOF	5	94731814	G	A	lof	FAM81B	.	FALS E	FALS E	FALS E	FALS E
pLOF	5	96430453	T	A	lof	LIX1	p.X283L	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.02E+08	TG	T	lof	SLCO4C1	p.T449fs	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.03E+08	T	TA	lof	C5orf30	p.Arg92fs	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.1E+08	C	A	lof	TME232	p.E115X	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.11E+08	C	T	lof	STAR4D	.	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.12E+08	C	T	lof	REEP5	.	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.12E+08	G	A	lof	MCC	p.Q810X	FALS E	FALS E	FALS E	FALS E



pLOF	5	1.15E+08	G	A	lof	LVRN	p.W544X	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.26E+08	GC	G	lof	ALDH7A1	p.A462fs	FALS E	TRUE	FALS E	FALS E
pLOF	5	1.39E+08	G	A	lof	SLC23A1	p.R293X	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.4E+08	G	T	lof	ANKHD1	p.E564X	FALS E	TRUE	FALS E	TRUE
pLOF	5	1.4E+08	C	T	lof	TMC06	p.Gln252*	FALS E	FALS E	FALS E	FALS E
dDNV	5	1.4E+08	C	T	misD	PCDHA3	p.A266V	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.41E+08	C	G	lof	PCDHGB7	p.Y401X	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.45E+08	T	TC	lof	PLAC8L1	p.Glu155fs	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.47E+08	T	A	lof	STK32A	p.Tyr223*	FALS E	FALS E	FALS E	FALS E
dDNV	5	1.5E+08	G	T	misD	ARSI	p.S217R	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.5E+08	G	GC	lof	MYOZ3	p.A123fs	FALS E	FALS E	FALS E	FALS E
dDNV	5	1.68E+08	C	T	misD	SLIT3	p.Glu1162Lys	FALS E	FALS E	FALS E	TRUE
pLOF	5	1.76E+08	G	T	lof	GPRI N1	p.S40X	FALS E	FALS E	FALS E	TRUE
pLOF	5	1.77E+08	G	T	lof	FGFR4	p.G705X	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.77E+08	C	A	lof	DBN1	p.Met1?	FALS E	TRUE	FALS E	TRUE
pLOF	5	1.77E+08	CCT	C	lof	B4GALT7	p.Tyr194fs	FALS E	FALS E	FALS E	FALS E
dDNV	5	1.8E+08	C	T	misD	FLT4	p.Gly781A sp	FALS E	FALS E	FALS E	TRUE
pLOF	5	1.8E+08	T	A	lof	ZFP62	p.Lys831*	FALS E	TRUE	FALS E	TRUE
pLOF	5	1.8E+08	TCC	T	lof	BTNL3	p.I208fs	FALS E	FALS E	FALS E	FALS E
pLOF	5	1.8E+08	G	A	lof	BTNL9	NA	FALS E	FALS E	FALS E	FALS E
pLOF	6	4047423	A	T	lof	PRPF4B	p.K626X	FALS E	TRUE	FALS E	TRUE
pLOF	6	5431312	AC	A	lof	FARS2	p.T271fs	FALS E	FALS E	FALS E	FALS E
pLOF	6	13616731	T	TG	lof	NOL7	p.Leu122fs	FALS E	TRUE	FALS E	FALS E
pLOF	6	24415304	TC	T	lof	MRS2	p.I214fs	FALS E	FALS E	FALS E	FALS E
pLOF	6	24570129	A	T	lof	KIAA0319	.	FALS E	FALS E	FALS E	FALS E
pLOF	6	26056362	T	TG	lof	HIST1H1C	p.Thr99fs	FALS E	FALS E	FALS E	FALS E

pLOF	6	28331 535	C	T	lof	ZKSC AN3	p.Q23 4X	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	6	32007 337	GC	G	lof	CYP2 1A2	0	FALS E	FALS E	FALS E	FALS E
pLOF	6	32064 726	TG	T	lof	TNXB	p.Y30 1X	FALS E	FALS E	FALS E	FALS E
pLOF	6	38885 167	G	A	lof	DNA H8	p.Trp 3419*	FALS E	FALS E	FALS E	FALS E
pLOF	6	38885 727	G	A	lof	DNA H8	p.Trp 3433*	FALS E	FALS E	FALS E	FALS E
pLOF	6	39387 746	TA	T	lof	KIF6	p.I596 fs	FALS E	FALS E	FALS E	FALS E
pLOF	6	40400 345	G	A	lof	LRFN 2	p.R17 0X	FALS E	FALS E	FALS E	FALS E
pLOF	6	41117 598	AAAG GCA ATTC AGC	A	lof	TRE ML1	p.Ala 223fs	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	6	41884 521	A	G	lof	MED2 0	NA	FALS E	TRUE	FALS E	FALS E
pLOF	6	42928 596	TG	T	lof	GNM T	p.W3 1fs	FALS E	FALS E	FALS E	FALS E
pLOF	6	43010 706	G	GTT	lof	CUL7	p.T11 60fs	FALS E	TRUE	TRUE	FALS E
dDNV /pLOF	6	44328 227	AT	A	lof	SPAT S1	NA	FALS E	FALS E	FALS E	FALS E
pLOF	6	44328 227	AT	A	lof	SPAT S1	p.His 112fs	FALS E	FALS E	FALS E	FALS E
pLOF	6	46607 355	TA	T	lof	CYP3 9A1	p.Met 122fs	FALS E	FALS E	FALS E	FALS E
pLOF	6	50011 381	G	T	lof	DEFB 112	p.C83 X	FALS E	FALS E	FALS E	FALS E
pLOF	6	51586 784	C	G	lof	PKHD 1	p.X33 97Y	FALS E	FALS E	FALS E	FALS E
pLOF	6	55192 375	G	A	lof	GFRA L	.	FALS E	FALS E	FALS E	FALS E
pLOF	6	74492 480	T	C	lof	CD10 9	.	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	6	85457 637	C	T	lof	TBX1 8	NA	FALS E	FALS E	TRUE	TRUE
pLOF	6	87994 477	CA	C	lof	GJB7	p.F51 fs	FALS E	FALS E	FALS E	FALS E
pLOF	6	88315 682	G	GC	lof	ORC3	p.A12 4fs	FALS E	TRUE	FALS E	FALS E
pLOF	6	90340 298	C	T	lof	ANKR D6	p.Arg 587*	FALS E	TRUE	FALS E	FALS E
dDNV	6	1.07E +08	G	A	misD	PRD M1	p.C68 9Y	FALS E	FALS E	FALS E	TRUE
pLOF	6	1.07E +08	CT	C	lof	AIM1	p.Leu 1506f s	FALS E	FALS E	FALS E	FALS E

dDNV	6	1.1E+08	G	A	misD	FIG4	p.G281D	FALS E	FALS E	FALS E	FALS E
pLOF	6	1.13E+08	CA	C	lof	RFPL4B	p.Q82fs	FALS E	FALS E	FALS E	FALS E
pLOF	6	1.28E+08	G	GA	lof	RSP03	p.R220fs	FALS E	FALS E	FALS E	FALS E
pLOF	6	1.33E+08	C	A	lof	MOXD1	p.G436X	FALS E	FALS E	FALS E	FALS E
pLOF	6	1.33E+08	AG	A	lof	TAAR6	p.Q329fs	FALS E	FALS E	FALS E	FALS E
pLOF	6	1.49E+08	CG	C	lof	SASH1	p.P19fs	FALS E	TRUE	FALS E	FALS E
pLOF	6	1.5E+08	AC	A	lof	LRP11	.	FALS E	FALS E	FALS E	FALS E
pLOF	6	1.56E+08	TG	T	lof	TIAM2	p.Val1657fs	FALS E	FALS E	FALS E	FALS E
pLOF	6	1.6E+08	C	A	lof	PNLDC1	p.S92X	FALS E	FALS E	FALS E	FALS E
pLOF	6	1.64E+08	TG	T	lof	PACRG	p.G261fs	FALS E	FALS E	FALS E	FALS E
pLOF	7	2644541	CA	C	lof	IQCE	p.R554fs	FALS E	FALS E	FALS E	FALS E
pLOF	7	6057531	T	A	lof	AIMP2	p.C143X	FALS E	TRUE	FALS E	FALS E
pLOF	7	6509298	G	A	lof	KDELR2	p.R94X	FALS E	TRUE	FALS E	FALS E
pLOF	7	7222452	G	A	lof	C1GALT1	NA	FALS E	FALS E	FALS E	TRUE
pLOF	7	11514154	G	A	lof	THSD7A	p.R687X	FALS E	FALS E	FALS E	TRUE
pLOF	7	17865710	A	T	lof	SNX13	p.L547X	FALS E	FALS E	FALS E	FALS E
pLOF	7	20685726	G	T	lof	ABCB5	p.G316X	FALS E	FALS E	FALS E	FALS E
dDNV	7	23340587	G	A	misD	MALSU1	p.G129E	FALS E	FALS E	FALS E	FALS E
pLOF	7	24843989	C	A	lof	OSBP13	p.E838X	FALS E	FALS E	FALS E	FALS E
dDNV	7	36194427	G	A	misD	EEPD1	p.R165H	FALS E	FALS E	FALS E	FALS E
pLOF	7	36589044	C	A	lof	AOAH	.	FALS E	FALS E	FALS E	FALS E
pLOF	7	37960615	G	A	lof	EPDR1	p.W25X	FALS E	FALS E	FALS E	FALS E
pLOF	7	39612204	TC	T	lof	YAE1D1	p.S194X	FALS E	FALS E	FALS E	FALS E
pLOF	7	43447331	G	A	lof	HECW1	NA	FALS E	FALS E	FALS E	TRUE
pLOF	7	44579274	GCAAC	G	lof	NPC1L1	p.Val240fs	FALS E	FALS E	FALS E	FALS E
pLOF	7	45009011	C	T	lof	MYO1G	.	FALS E	FALS E	FALS E	FALS E
pLOF	7	47840312	G	A	lof	PKD1L1	p.Q2710X	FALS E	FALS E	FALS E	FALS E

pLOF	7	55886818	A	G	lof	14-Sep	.	FALSE	FALSE	FALSE	FALSE
pLOF	7	56082817	C	A	lof	PSPH	p.G157X	FALSE	FALSE	FALSE	FALSE
pLOF	7	63982537	G	GT	lof	ZNF680	p.Gln199fs	FALSE	FALSE	FALSE	FALSE
pLOF	7	76908378	G	T	lof	CCDC146	p.E552X	FALSE	FALSE	FALSE	FALSE
pLOF	7	86991162	AGGACT	A	lof	CROT	p.R209fs	FALSE	FALSE	FALSE	FALSE
pLOF	7	87180040	C	CAAG	lof	ABCB1	.	FALSE	FALSE	FALSE	FALSE
pLOF	7	99145077	GT	G	lof	FAM200A	p.N318fs	FALSE	FALSE	FALSE	FALSE
pLOF	7	99226935	CT	C	lof	ZSCAN25	p.C310fs	FALSE	FALSE	FALSE	FALSE
pLOF	7	99802722	TC	T	lof	STAG3	p.Arg1018fs	FALSE	FALSE	FALSE	FALSE
pLOF	7	99811411	TAC	T	lof	STAG3	p.T1218fs	FALSE	FALSE	FALSE	FALSE
pLOF	7	1E+08	C	A	lof	ZCWPW1	p.G467X	FALSE	FALSE	FALSE	FALSE
pLOF	7	1E+08	TCA	T	lof	SRRT	NA	FALSE	TRUE	FALSE	TRUE
pLOF	7	1.02E+08	C	T	lof	ALKBH4	p.W97X	FALSE	FALSE	FALSE	FALSE
pLOF	7	1.05E+08	T	A	lof	RINT1	p.Y55X	FALSE	FALSE	FALSE	FALSE
pLOF	7	1.05E+08	TC	T	lof	RINT1	p.P759fs	FALSE	FALSE	FALSE	FALSE
pLOF	7	1.06E+08	C	T	lof	CDHR3	p.R166X	FALSE	FALSE	FALSE	FALSE
pLOF	7	1.07E+08	C	CA	lof	SLC26A4	p.A51fs	FALSE	FALSE	FALSE	FALSE
pLOF	7	1.08E+08	C	A	lof	PNPLA8	p.E173X	FALSE	FALSE	FALSE	FALSE
pLOF	7	1.23E+08	ACACTT	A	lof	SLC13A1	p.E185fs	FALSE	FALSE	FALSE	FALSE
dDNV	7	1.27E+08	G	A	misD	PAX4	0	FALSE	FALSE	FALSE	FALSE
pLOF	7	1.28E+08	G	A	lof	FAM71F1	.	FALSE	FALSE	FALSE	FALSE
dDNV	7	1.29E+08	G	A	misD	IRF5	p.V78M	FALSE	FALSE	FALSE	FALSE
pLOF	7	1.34E+08	G	A	lof	LRGUK	.	FALSE	FALSE	FALSE	FALSE
pLOF	7	1.34E+08	A	G	lof	LRGUK	.	FALSE	FALSE	FALSE	FALSE
pLOF	7	1.38E+08	A	G	lof	SVOP	L	FALSE	FALSE	FALSE	FALSE
pLOF	7	1.41E+08	G	A	lof	TAS2R3	p.W89X	FALSE	FALSE	FALSE	FALSE
pLOF	7	1.42E+08	G	C	lof	MGA	M	FALSE	FALSE	FALSE	FALSE

pLOF	7	1.42E+08	GC	G	lof	MGA M	p.Ile345fs	FALS E	FALS E	FALS E	FALS E
pLOF	7	1.43E+08	A	AG	lof	EPHA 1	p.S334fs	FALS E	FALS E	FALS E	FALS E
pLOF	7	1.5E+08	G	A	lof	SSPO	p.W2685X	FALS E	FALS E	FALS E	FALS E
pLOF	7	1.51E+08	AC	A	lof	ABCB 8	p.T494fs	FALS E	FALS E	FALS E	FALS E
pLOF	7	1.59E+08	CCC CATC CGAT	C	lof	VIPR 2	p.Ile388fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	2065710	CG	C	lof	MYO M2	p.T1141fs	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	8	11566422	C	T	lof	GATA 4	p.Arg201*	FALS E	FALS E	FALS E	FALS E
pLOF	8	17739583	C	A	lof	FGL1	p.E57X	FALS E	FALS E	FALS E	FALS E
pLOF	8	20004768	C	G	lof	SLC18A1	.	FALS E	FALS E	FALS E	FALS E
pLOF	8	20028637	G	A	lof	SLC18A1	p.Q279X	FALS E	FALS E	FALS E	FALS E
pLOF	8	22006410	AAG	A	lof	LGI3	p.S303fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	22398262	G	GT	lof	PPP3 CC	p.A505fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	27369388	C	A	lof	EPHX 2	p.C232X	FALS E	FALS E	FALS E	FALS E
pLOF	8	33358006	ACT	A	lof	TTI2	p.R420fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	33369537	C	A	lof	TTI2	p.E199X	FALS E	FALS E	FALS E	FALS E
pLOF	8	37699776	A	AG	lof	ADG RA2	p.K1307fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	38008325	CGC TAGC A	C	lof	STAR	p.L2fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	38848927	C	T	lof	TM2D 2	p.Trp190*	FALS E	TRUE	FALS E	FALS E
pLOF	8	54764525	G	A	lof	RGS2 0	p.Trp22*	FALS E	FALS E	FALS E	FALS E
dDNV	8	54870931	G	A	misD	RGS2 0	p.M360I	FALS E	FALS E	FALS E	FALS E
pLOF	8	56910991	CAT	C	lof	LYN	p.M380fs	FALS E	FALS E	FALS E	TRUE
pLOF	8	66594687	G	A	lof	MTFR 1	.	FALS E	TRUE	FALS E	FALS E
pLOF	8	66619392	G	GA	lof	MTFR 1	p.G222fs	FALS E	TRUE	FALS E	FALS E
pLOF	8	75928931	C	T	lof	CRIS PLD1	p.Q287X	FALS E	FALS E	FALS E	FALS E
dDNV	8	81577102	C	G	misD	ZNF704	p.S292T	FALS E	FALS E	FALS E	TRUE
dDNV	8	94797492	C	G	misD	TME M67	p.P311A	FALS E	FALS E	FALS E	FALS E

pLOF	8	95262551	AG	A	lof	GEM	p.L293fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	96057773	GA	G	lof	NDUF AF6	p.E160fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	97342501	C	T	lof	PTDS S1	p.R412X	FALS E	FALS E	TRUE	FALS E
pLOF	8	1.01E+08	CA	C	lof	VPS1 3B	p.Q1420fs	FALS E	FALS E	TRUE	FALS E
pLOF	8	1.05E+08	T	A	lof	RIMS 2	.	FALS E	FALS E	FALS E	TRUE
dDNV /pLOF	8	1.08E+08	C	G	lof	OXR1	p.S822X	FALS E	FALS E	FALS E	TRUE
pLOF	8	1.21E+08	C	T	lof	DSC C1	NA	FALS E	FALS E	FALS E	FALS E
pLOF	8	1.21E+08	G	T	lof	COL1 4A1	p.E674X	FALS E	FALS E	FALS E	FALS E
pLOF	8	1.21E+08	C	T	lof	COL1 4A1	p.Q1776X	FALS E	FALS E	FALS E	FALS E
pLOF	8	1.25E+08	C	T	lof	FER1 L6	p.Q1412X	FALS E	FALS E	FALS E	FALS E
dDNV	8	1.42E+08	C	A	misD	AGO2	p.G201V	FALS E	TRUE	FALS E	TRUE
pLOF	8	1.44E+08	G	GT	lof	GML	p.Cys48fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	1.44E+08	C	CCA	lof	ZNF6 96	p.H167fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	1.45E+08	AG	A	lof	MRO H6	p.L422fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	1.45E+08	CG	C	lof	MRO H6	p.P234fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	1.45E+08	C	CG	lof	EEF1 D	p.Leu272fs	FALS E	TRUE	FALS E	FALS E
pLOF	8	1.45E+08	C	T	lof	TSTA 3	p.W208X	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	8	1.45E+08	GCTT T	G	lof	ZNF6 23	p.A343fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	1.45E+08	C	A	lof	CCD C166	p.X440L	FALS E	FALS E	FALS E	FALS E
pLOF	8	1.45E+08	CT	C	lof	EPPK 1	p.E1281fs	FALS E	FALS E	FALS E	FALS E
pLOF	8	1.45E+08	G	GCT	lof	OPLA H	p.S1153fs	FALS E	FALS E	FALS E	FALS E
dDNV	8	1.45E+08	G	A	misD	EXOS C4	p.G37S	FALS E	TRUE	FALS E	FALS E
pLOF	8	1.46E+08	C	CA	lof	FBXL 6	p.L39fs	FALS E	TRUE	FALS E	FALS E
pLOF	8	1.46E+08	G	C	lof	SLC3 9A4	p.Y329X	FALS E	FALS E	FALS E	FALS E
pLOF	9	4684970	C	T	lof	CDC3 7L1	p.Gln76*	FALS E	FALS E	FALS E	TRUE
pLOF	9	13138141	C	A	lof	MPD Z	p.E1339X	FALS E	TRUE	FALS E	FALS E

pLOF	9	15433562	GT	G	lof	SNAPC3	p.F136fs	FALSE	TRUE	FALSE	FALSE
pLOF	9	15745534	GT	G	lof	CCDC171	p.R859fs	FALSE	FALSE	FALSE	FALSE
pLOF	9	17502606	A	T	lof	CNTLN	p.K1393X	FALSE	FALSE	FALSE	FALSE
dDNV	9	19049689	T	C	misD	RRA GA	p.L11P	FALSE	TRUE	FALSE	FALSE
pLOF	9	21007120	T	C	lof	HACD4	.	FALSE	FALSE	FALSE	FALSE
pLOF	9	32436396	G	A	lof	ACO1	.	FALSE	TRUE	FALSE	FALSE
dDNV	9	34372784	T	G	misD	KIAA1161	p.Asp19Ala	FALSE	FALSE	FALSE	FALSE
pLOF	9	34520656	GA	G	lof	DNAI1	p.E668fs	FALSE	FALSE	FALSE	FALSE
pLOF	9	35906601	C	CCA	lof	HRCT1	p.His107fs	FALSE	FALSE	FALSE	FALSE
pLOF	9	37729761	C	T	lof	FRMPD1	p.R217X	FALSE	FALSE	FALSE	FALSE
dDNV/pLOF	9	71833276	G	T	lof	TJP2	NA	FALSE	TRUE	FALSE	FALSE
pLOF	9	72929753	G	T	lof	SMC5	.	FALSE	TRUE	FALSE	FALSE
pLOF	9	75315444	G	T	lof	TMC1	p.E83X	FALSE	FALSE	FALSE	FALSE
pLOF	9	79321843	C	A	lof	PRUNE2	p.Glu1783*	FALSE	FALSE	FALSE	FALSE
dDNV	9	85926815	G	A	misD	FRMD3	p.H254Y	FALSE	FALSE	FALSE	FALSE
pLOF	9	99227618	G	A	lof	HABP4	.	FALSE	FALSE	FALSE	FALSE
pLOF	9	99525916	T	C	lof	ZNF510	.	FALSE	FALSE	FALSE	FALSE
pLOF	9	99799532	A	G	lof	CTSV	NA	FALSE	TRUE	FALSE	FALSE
pLOF	9	1.07E+08	A	AC	lof	OR13C3	p.V316fs	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.08E+08	ACGG	A	lof	NIPSNAP3B	p.T27fs	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.08E+08	C	T	lof	ABCA1	.	FALSE	FALSE	FALSE	FALSE
dDNV	9	1.08E+08	G	A	misD	SLC44A1	p.D63N	FALSE	FALSE	FALSE	TRUE
pLOF	9	1.15E+08	G	T	lof	HSDL2	p.E185X	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.16E+08	G	A	lof	SLC46A2	p.R392X	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.16E+08	TATATG	T	lof	SLC46A2	p.I291fs	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.3E+08	T	A	lof	ZNF79	.	FALSE	FALSE	FALSE	FALSE

pLOF	9	1.3E+08	CAT	C	lof	TOR2A	p.Y101fs	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.31E+08	CAG GA CT TCCT G	C	lof	PKN3	p.Q439fs	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.32E+08	A	G	lof	TBC1D13	p.Met1?	FALSE	TRUE	FALSE	FALSE
pLOF	9	1.36E+08	CCT GCC CCC CGA AGA	C	lof	GBGT1	p.V264fs	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.36E+08	G	A	lof	MED22	p.Q47X	FALSE	TRUE	FALSE	FALSE
pLOF	9	1.39E+08	G	T	lof	NOTCH1	p.C1521X	FALSE	TRUE	FALSE	TRUE
pLOF	9	1.39E+08	GT	G	lof	NOTCH1	p.Tyr899fs	FALSE	TRUE	FALSE	TRUE
pLOF	9	1.4E+08	G	T	lof	FAM69B	.	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.4E+08	T	TG	lof	C9orf142	p.Asp2fs	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.4E+08	C	T	lof	ENTPD2	.	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.4E+08	C	T	lof	ENTPD2	.	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.4E+08	C	CG	lof	DPP7	p.R143fs	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.4E+08	G	A	lof	TPRN	p.Q586X	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.4E+08	C	T	lof	EXD3	.	FALSE	FALSE	FALSE	FALSE
pLOF	9	1.4E+08	G	GT	lof	NOXA1	p.D440fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	1094841	GA	G	lof	IDI1	p.H34fs	FALSE	TRUE	FALSE	FALSE
pLOF	10	5765639	G	A	lof	FAM208B	.	FALSE	FALSE	FALSE	FALSE
pLOF	10	17432555	C	A	lof	ST8SLA6	p.E89X	FALSE	FALSE	FALSE	FALSE
pLOF	10	23295906	T	TA	lof	ARMC3	p.Y609_V610delinsX	FALSE	FALSE	FALSE	FALSE
pLOF	10	26241208	GTAA GTCA	G	lof	MYO3A	.	FALSE	FALSE	FALSE	FALSE
dDNV /pLOF	10	27066140	G	A	lof	ABI1	p.R123X	FALSE	TRUE	FALSE	TRUE
pLOF	10	28413937	AC	A	lof	MPP7	.	FALSE	FALSE	FALSE	FALSE
pLOF	10	45486395	G	A	lof	RASSF4	NA	FALSE	FALSE	FALSE	FALSE



pLOF	10	50025435	T	TC	lof	WDFY4	p.F1829fs	FALSE	FALSE	TRUE	FALSE
pLOF	10	50950998	C	CAA	lof	OGDHL	p.A630fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	70105527	A	T	lof	RUFY2	p.X642R	FALSE	TRUE	FALSE	FALSE
dDNV	10	73047432	C	T	misD	UNC5B	p.R271W	FALSE	FALSE	FALSE	FALSE
pLOF	10	74879790	TGAA G	T	lof	NUDT13	p.L33fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	74994978	C	T	lof	FAM149B1	p.Q502X	FALSE	TRUE	FALSE	FALSE
pLOF	10	82187174	G	A	lof	FAM213A	p.W166X	FALSE	TRUE	FALSE	FALSE
pLOF	10	82330050	C	T	lof	SH2D4B	p.Q109X	FALSE	FALSE	FALSE	FALSE
pLOF	10	85992201	G	A	lof	LRIT1	p.Q452X	FALSE	FALSE	FALSE	FALSE
pLOF	10	90574328	AC	A	lof	LIPM	p.N169fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	92680094	C	CT	lof	ANKRD1	p.K13fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	96066442	C	T	lof	PLCE1	p.R1961X	FALSE	FALSE	FALSE	FALSE
pLOF	10	98087253	CTG	C	lof	DNTT	p.Val303fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	99969478	CAG	C	lof	R3HC1L	p.S536fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	1E+08	AG	A	lof	PYROXD2	p.L446fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	1.02E+08	G	GC	lof	SEC31B	p.R247fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	1.04E+08	GC	G	lof	PPRC1	p.L155fs	FALSE	TRUE	FALSE	TRUE
pLOF	10	1.04E+08	GC	G	lof	C10orf95	p.Q242fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	1.06E+08	CCTGTTT T	C	lof	OBFC1	p.I54fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	1.16E+08	C	A	lof	PLEKHS1	p.Y113X	FALSE	FALSE	FALSE	FALSE
pLOF	10	1.18E+08	GTCGGC GT	G	lof	PNLIP	p.S154fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	1.26E+08	CG	C	lof	CPXM2	p.P263fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	1.26E+08	TG	T	lof	LHPP	p.Leu142fs	FALSE	FALSE	FALSE	FALSE
pLOF	10	1.35E+08	G	A	lof	ECHS1	p.Q162X	FALSE	FALSE	FALSE	FALSE
pLOF	10	1.35E+08	G	T	lof	MTG1	.	FALSE	FALSE	FALSE	FALSE
dDNV /pLOF	11	609337	GCA	G	lof	PHRF1	p.S1293fs	FALSE	TRUE	TRUE	FALSE

pLOF	11	613848	CTG	C	lof	IRF7	p.Pro274fs	FALS E	FALS E	FALS E	FALS E
pLOF	11	798081	AC	A	lof	PAN O1	p.P15 3fs	FALS E	FALS E	FALS E	FALS E
pLOF	11	1078667	G	A	lof	MUC 2	NA	FALS E	FALS E	FALS E	FALS E
pLOF	11	2909674	CT	C	lof	SLC2 2A18 AS	p.K16 6fs	FALS E	FALS E	FALS E	FALS E
pLOF	11	3114102	G	C	lof	OSBP L5	p.Y70 9X	FALS E	FALS E	FALS E	FALS E
pLOF	11	3661226	G	A	lof	ART5	p.R14 5X	FALS E	FALS E	FALS E	FALS E
pLOF	11	4566632	TTGA C	T	lof	OR52 M1	p.I71f s	FALS E	FALS E	TRUE	FALS E
pLOF	11	5529357	G	GC	lof	UBQL N3	p.P47 8fs	FALS E	FALS E	FALS E	FALS E
pLOF	11	5624690	C	T	lof	TRIM 6,TRI M6- TRIM 34	p.Q50 X	FALS E	FALS E	FALS E	FALS E
pLOF	11	5701123	A	T	lof	TRIM 5	p.C95 X	FALS E	FALS E	FALS E	FALS E
pLOF	11	5969442	C	CA	lof	OR56 A3	p.A28 9fs	FALS E	FALS E	FALS E	FALS E
pLOF	11	7091688	G	A	lof	NLRP 14	.	FALS E	FALS E	FALS E	FALS E
pLOF	11	7726182	C	T	lof	OVC H2	p.W4 3X	FALS E	FALS E	FALS E	FALS E
pLOF	11	12495531	G	A	lof	PARV A	.	FALS E	TRUE	FALS E	FALS E
pLOF	11	17428606	C	T	lof	ABCC 8	p.W9 98X	FALS E	FALS E	FALS E	FALS E
pLOF	11	18425273	GTC	G	lof	LDHA	p.V20 9fs	FALS E	TRUE	FALS E	FALS E
pLOF	11	18745690	TTGT C	T	lof	IGSF 22	p.Thr 31fs	FALS E	FALS E	FALS E	FALS E
pLOF	11	19186675	G	A	lof	ZDHH C13	p.Trp 458*	FALS E	FALS E	FALS E	FALS E
pLOF	11	19197500	C	A	lof	ZDHH C13	p.S62 1X	FALS E	FALS E	FALS E	FALS E
pLOF	11	34218927	C	A	lof	ABTB 2	p.E39 7X	FALS E	FALS E	FALS E	FALS E
pLOF	11	34905048	A	C	lof	APIP	p.Y15 5X	FALS E	FALS E	FALS E	FALS E
pLOF	11	44626642	T	A	lof	CD82	p.Y57 X	FALS E	FALS E	FALS E	FALS E
pLOF	11	46385929	G	A	lof	DGKZ	NA	FALS E	TRUE	FALS E	FALS E
pLOF	11	48238802	G	A	lof	OR4B 1	p.W1 47X	FALS E	FALS E	FALS E	FALS E
pLOF	11	59947354	CT	C	lof	MS4A 6A	p.Val 106fs	FALS E	FALS E	FALS E	FALS E

pLOF	11	61041980	A	AC	lof	VWCE	p.C524fs	FALSE	FALSE	FALSE	FALSE
dDNV/pLOF	11	63065135	C	T	lof	SLC22A10	p.R256X	FALSE	FALSE	FALSE	FALSE
pLOF	11	64787900	G	T	lof	ARL2	p.G117X	FALSE	TRUE	FALSE	FALSE
pLOF	11	65546682	C	A	lof	AP5B1	p.E428X	FALSE	FALSE	FALSE	FALSE
pLOF	11	66061941	A	AGGCC	lof	TME M151A	p.E75fs	FALSE	FALSE	FALSE	FALSE
pLOF	11	66101688	GA	G	lof	RIN1	p.V431fs	FALSE	FALSE	FALSE	FALSE
pLOF	11	66358747	G	GT	lof	CCDC87	p.N580fs	FALSE	FALSE	FALSE	FALSE
pLOF	11	66742862	T	A	lof	C11orf86	p.L10X	FALSE	FALSE	FALSE	FALSE
pLOF	11	67412557	A	AG	lof	ACY3	p.Leu198fs	FALSE	FALSE	FALSE	FALSE
pLOF	11	68204467	G	T	lof	LRP5	p.E1371X	FALSE	TRUE	FALSE	TRUE
pLOF	11	68483305	C	CT	lof	MTL5	p.K340fs	FALSE	FALSE	FALSE	FALSE
dDNV/pLOF	11	68839405	CT	C	lof	TPCN2	p.S326fs	FALSE	FALSE	FALSE	FALSE
pLOF	11	72465786	A	ATT	lof	STAR D10	p.Asp138fs	FALSE	FALSE	FALSE	FALSE
pLOF	11	73834032	C	T	lof	C2CD3	.	FALSE	TRUE	FALSE	FALSE
pLOF	11	74988484	G	T	lof	ARRB1	p.Tyr209*	TRUE	TRUE	FALSE	TRUE
pLOF	11	85367363	GCT	G	lof	TME M126A	p.Leu137fs	FALSE	TRUE	FALSE	FALSE
pLOF	11	87908538	G	A	lof	RAB38	p.Gln22*	FALSE	FALSE	FALSE	FALSE
pLOF	11	88911360	G	A	lof	TYR	p.W80X	FALSE	FALSE	FALSE	FALSE
pLOF	11	93428801	G	A	lof	KIAA1731	NA	FALSE	TRUE	FALSE	FALSE
pLOF	11	93886656	G	A	lof	PANX1	.	FALSE	TRUE	FALSE	FALSE
pLOF	11	94823392	G	C	lof	ENDOD1	NA	FALSE	FALSE	FALSE	FALSE
pLOF	11	94862041	CA	C	lof	ENDOD1	p.N268fs	FALSE	FALSE	FALSE	FALSE
pLOF	11	1.02E+08	C	A	lof	TME M123	p.E65X	FALSE	TRUE	FALSE	TRUE
pLOF	11	1.03E+08	G	A	lof	DYN C2H1	p.Trp3297*	FALSE	FALSE	FALSE	FALSE
pLOF	11	1.07E+08	CAA	C	lof	ALKBH8	p.L52fs	FALSE	FALSE	FALSE	FALSE

dDNV /pLOF	11	1.08E+08	T	TA	lof	ATM	p.Tyr731fs	TRUE	FALS E	FALS E	FALS E
pLOF	11	1.08E+08	T	TA	lof	ATM	p.Tyr731fs	TRUE	FALS E	FALS E	FALS E
pLOF	11	1.08E+08	T	C	lof	EXPH5	.	FALS E	FALS E	FALS E	FALS E
pLOF	11	1.1E+08	C	T	lof	ZC3H12C	p.Arg161*	FALS E	FALS E	FALS E	TRUE
pLOF	11	1.14E+08	GC	G	lof	TMPRSS5	p.G339fs	FALS E	FALS E	FALS E	FALS E
pLOF	11	1.14E+08	A	G	lof	REXO2	NA	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	11	1.21E+08	T	TCGA CG	lof	TECTA	p.F1498fs	FALS E	FALS E	FALS E	FALS E
pLOF	11	1.21E+08	A	T	lof	TECTA	.	FALS E	FALS E	FALS E	FALS E
pLOF	11	1.23E+08	T	A	lof	C11orf63	.	FALS E	FALS E	FALS E	FALS E
pLOF	11	1.23E+08	G	A	lof	CLMP	p.R274X	FALS E	FALS E	FALS E	FALS E
pLOF	11	1.23E+08	G	A	lof	GRAMD1B	.	FALS E	FALS E	FALS E	TRUE
pLOF	11	1.24E+08	GC	G	lof	TME M225	p.S202fs	FALS E	FALS E	FALS E	FALS E
pLOF	11	1.25E+08	CA	C	lof	SIAE	p.F164fs	FALS E	FALS E	FALS E	FALS E
pLOF	11	1.26E+08	CCTC TGCT GAA	C	lof	CDO N	p.Phe1208fs	FALS E	TRUE	TRUE	FALS E
pLOF	11	1.26E+08	GC	G	lof	CDO N	p.Ser441fs	FALS E	TRUE	TRUE	FALS E
dDNV /pLOF	11	1.26E+08	G	A	lof	RPUS D4	p.R272X	FALS E	FALS E	FALS E	FALS E
pLOF	11	1.26E+08	ATT	A	lof	RPUS D4	p.K230fs	FALS E	FALS E	FALS E	FALS E
pLOF	11	1.26E+08	C	T	lof	DCPS	p.Q332X	FALS E	TRUE	FALS E	FALS E
pLOF	11	1.3E+08	G	A	lof	TME M45B	.	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	11	1.32E+08	CA	C	lof	NTM	p.N205fs	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	12	2973909	G	A	lof	FOX M1	p.R344X	FALS E	TRUE	FALS E	FALS E
pLOF	12	4554720	TTC	T	lof	FGF6	p.Q5fs	FALS E	FALS E	FALS E	FALS E
pLOF	12	4634436	TG	T	lof	C12orf4	p.P237fs	FALS E	FALS E	FALS E	FALS E
pLOF	12	4652929	A	AT	lof	RAD51AP1	p.Asp24fs	FALS E	FALS E	FALS E	FALS E

dDNV /pLOF	12	7244261	G	GAGGT	lof	C1R	p.Leu5fs	FALSEE	FALSEE	FALSEE	TRUE
pLOF	12	7480967	T	C	lof	ACSM4	p.X581Q	FALSEE	FALSEE	FALSEE	FALSEE
dDNV	12	9355165	A	T	misD	PZP	p.V128D	FALSEE	FALSEE	FALSEE	FALSEE
dDNV /pLOF	12	9747903	TGTTA	T	lof	KLRB1	0	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	9875299	G	A	lof	CLECL1	p.Gln143*	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	10145887	C	T	lof	CLEC1B	.	FALSEE	FALSEE	FALSEE	FALSEE
dDNV /pLOF	12	18836192	T	TAAAC	lof	PLCZ1	p.Y603fs	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	21051414	C	G	lof	LST3	p.Ser576*	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	21445271	C	G	lof	SLCO1A2	.	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	22214388	T	G	lof	CMA5	.	FALSEE	TRUE	FALSEE	TRUE
pLOF	12	25257341	C	T	lof	LRMP	p.R365X	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	27135750	AGCAGG	A	lof	TM7SF3	p.A302fs	FALSEE	FALSEE	FALSEE	FALSEE
dDNV	12	27470296	T	G	misD	STK38L	p.Y289D	FALSEE	FALSEE	FALSEE	TRUE
pLOF	12	32134323	A	ACGTACC CAAT ATGC	lof	KIAA1551	p.N145fs	FALSEE	TRUE	FALSEE	FALSEE
pLOF	12	40034773	A	T	lof	C12orf40	p.K14X	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	40742210	G	C	lof	LRRK2	.	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	40835700	G	GTACC	lof	MUC19	p.Gln685fs	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	49170134	C	A	lof	ADCY6	.	FALSEE	TRUE	FALSEE	FALSEE
dDNV	12	49663619	C	T	misD	TUBA1C	p.R44C	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	50727773	T	TG	lof	FAM186A	p.Q2206fs	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	50835386	TAAGAG	T	lof	LARP4	p.L255fs	FALSEE	FALSEE	FALSEE	TRUE
pLOF	12	51279028	G	T	lof	TMPRSS12	.	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	53456906	CAG	C	lof	TNS2	p.T1162fs	FALSEE	FALSEE	FALSEE	FALSEE
pLOF	12	53701431	TAAACCGT GGA	T	lof	AAAS	p.F491fs	FALSEE	TRUE	FALSEE	FALSEE

pLOF	12	55886553	TG	T	lof	OR6C68	p.M131fs	FALSE	FALSE	FALSE	FALSE
pLOF	12	57638387	G	A	lof	STAC3	p.Q247X	FALSE	FALSE	FALSE	FALSE
pLOF	12	57892220	AGT GGA ACAC C	A	lof	MARS	p.Q302fs	FALSE	TRUE	FALSE	FALSE
pLOF	12	57910957	AT	A	lof	DDIT3	p.E48fs	FALSE	FALSE	FALSE	TRUE
pLOF	12	58204710	C	T	lof	AVIL	.	FALSE	FALSE	FALSE	FALSE
pLOF	12	64509674	G	A	lof	SRGAP1	NA	FALSE	FALSE	FALSE	TRUE
pLOF	12	66563708	G	T	lof	TMBIM4	p.Y8X	FALSE	FALSE	FALSE	FALSE
pLOF	12	80200107	GGA GC	G	lof	PPP1R12A	p.C553fs	FALSE	TRUE	FALSE	TRUE
pLOF	12	96260916	GC	G	lof	CCDC38	p.Gln543fs	FALSE	FALSE	FALSE	FALSE
pLOF	12	96370453	CT	C	lof	HAL	p.Q562fs	FALSE	FALSE	FALSE	FALSE
pLOF	12	1.02E+08	AC	A	lof	SLC5A8	p.V197fs	FALSE	FALSE	FALSE	FALSE
pLOF	12	1.06E+08	CT	C	lof	APPL2	p.K613fs	FALSE	FALSE	FALSE	FALSE
pLOF	12	1.07E+08	C	T	lof	TCP1L2	p.R500X	FALSE	FALSE	FALSE	FALSE
pLOF	12	1.07E+08	G	A	lof	POLR3B	.	FALSE	FALSE	FALSE	FALSE
pLOF	12	1.07E+08	A	G	lof	CRY1	.	FALSE	FALSE	FALSE	FALSE
pLOF	12	1.1E+08	CA	C	lof	UBE3B	p.T872fs	FALSE	TRUE	FALSE	FALSE
pLOF	12	1.14E+08	G	A	lof	RASAL1	p.R472X	FALSE	FALSE	FALSE	FALSE
pLOF	12	1.15E+08	C	A	lof	TBX5	.	FALSE	FALSE	FALSE	TRUE
pLOF	12	1.17E+08	TC	T	lof	FBXW8	p.P342fs	FALSE	TRUE	FALSE	FALSE
dDNV	12	1.18E+08	G	A	misD	KSR2	p.R689W	FALSE	FALSE	FALSE	TRUE
pLOF	12	1.21E+08	G	GA	lof	UNC119B	p.K27fs	FALSE	TRUE	FALSE	TRUE
dDNV /pLOF	12	1.33E+08	G	A	lof	POLE	p.R1371X	FALSE	TRUE	FALSE	FALSE
pLOF	13	28008941	G	A	lof	GTF3A	.	FALSE	TRUE	FALSE	FALSE
pLOF	13	32937315	G	C	lof	BRCA2	.	TRUE	FALSE	FALSE	FALSE
pLOF	13	36900732	ACT	A	lof	SPG20	p.K422fs	FALSE	TRUE	FALSE	FALSE
pLOF	13	41947910	CT	C	lof	NAA16	p.L765fs	FALSE	FALSE	FALSE	FALSE

pLOF	13	46627 751	A	T	lof	CPB2	p.X42 4K	FALS E	FALS E	FALS E	FALS E
pLOF	13	46824 577	C	CTTA GAAT T	lof	LRRC 63	p.Phe 396fs	FALS E	FALS E	FALS E	FALS E
pLOF	13	52249 371	AC	A	lof	WDF Y2	p.T91 fs	FALS E	FALS E	FALS E	FALS E
pLOF	13	52523 865	GT	G	lof	ATP7 B	p.T82 2fs	FALS E	FALS E	FALS E	FALS E
pLOF	13	52684 702	C	T	lof	NEK5	p.W1 08X	FALS E	FALS E	FALS E	FALS E
pLOF	13	73401 890	CTG	C	lof	PIBF1	p.Val 313fs	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	13	76123 966	C	T	lof	UCHL 3	p.Q4 X	FALS E	TRUE	FALS E	FALS E
pLOF	13	76195 885	ATG	A	lof	LMO7	p.D19 fs	FALS E	FALS E	FALS E	FALS E
pLOF	13	1.03E +08	A	AG	lof	CCD C168	p.F70 15fs	FALS E	FALS E	FALS E	FALS E
pLOF	13	1.14E +08	CA	C	lof	MCF2 L	p.Ala 654fs	FALS E	FALS E	FALS E	FALS E
dDNV	13	1.14E +08	C	T	misD	TFDP 1	p.P38 9L	FALS E	TRUE	FALS E	TRUE
pLOF	14	23863 399	T	A	lof	MYH6	p.Lys 855*	FALS E	FALS E	FALS E	FALS E
dDNV	14	23874 859	G	A	misD	MYH6	p.R10 8C	FALS E	FALS E	FALS E	FALS E
pLOF	14	24683 589	CT	C	lof	MDP1 ,NED D8- MDP1	p.K12 7fs	FALS E	FALS E	FALS E	FALS E
pLOF	14	24780 124	AGG CCT GGC CGC TGG GCC AGG CG	A	lof	LTB4 R2	p.Q85 fs	FALS E	FALS E	FALS E	FALS E
pLOF	14	24877 074	G	A	lof	NYN RIN	.	FALS E	TRUE	FALS E	FALS E
pLOF	14	31771 509	C	T	lof	HEAT R5A	p.W1 819X	FALS E	FALS E	FALS E	FALS E
pLOF	14	31814 331	A	T	lof	HEAT R5A	p.L10 07X	FALS E	FALS E	FALS E	FALS E
pLOF	14	50801 301	A	AT	lof	CDKL 1	p.P26 0fs	FALS E	FALS E	FALS E	FALS E
pLOF	14	55168 778	A	G	lof	SAM D4A	.	FALS E	FALS E	FALS E	TRUE
pLOF	14	59789 695	C	T	lof	DAA M1	p.R17 6X	FALS E	TRUE	FALS E	TRUE
pLOF	14	59950 733	CTG	C	lof	L3HY PDH	p.Tyr 100fs	FALS E	FALS E	FALS E	FALS E

pLOF	14	69994 619	C	T	lof	PLEK HD1	p.R44 1X	FALS E	FALS E	FALS E	FALS E
pLOF	14	76249 674	TC	T	lof	TTLL 5	p.H93 0fs	FALS E	FALS E	FALS E	FALS E
pLOF	14	77872 312	CT	C	lof	NOX RED1	p.K28 3fs	FALS E	FALS E	FALS E	FALS E
pLOF	14	88737 118	TA	T	lof	KCNK 10	p.F5fs	FALS E	FALS E	FALS E	FALS E
dDNV	14	90738 657	G	A	misD	PSM C1	p.R41 0H	FALS E	TRUE	FALS E	TRUE
pLOF	14	92537 354	C	CTG CTG CTG CTG CTG	lof	ATXN 3	p.Gly 315fs	FALS E	FALS E	FALS E	FALS E
pLOF	14	92537 354	C	CTG CTG CTG CTG CTG CTG	lof	ATXN 3	p.Gly 315fs	FALS E	FALS E	FALS E	FALS E
dDNV	14	1.01E +08	T	G	misD	WAR S	p.T12 4P	FALS E	TRUE	FALS E	FALS E
pLOF	14	1.04E +08	A	AT	lof	TDRD 9	p.N63 4fs	FALS E	FALS E	FALS E	FALS E
dDNV	14	1.06E +08	G	A	misD	JAG2	p.P54 2L	FALS E	FALS E	FALS E	TRUE
pLOF	15	28211 835	C	T	lof	OCA2	.	FALS E	FALS E	FALS E	FALS E
pLOF	15	40502 360	C	G	lof	BUB1 B	p.Y77 8X	FALS E	TRUE	FALS E	FALS E
pLOF	15	40864 065	C	CT	lof	RPUS D2	p.S29 0fs	FALS E	FALS E	FALS E	FALS E
pLOF	15	42980 923	C	T	lof	STAR D9	p.Gln 2383*	FALS E	FALS E	FALS E	FALS E
pLOF	15	43452 954	CT	C	lof	TME M62	p.L42 0fs	FALS E	FALS E	FALS E	FALS E
pLOF	15	44067 918	ACCT	A	lof	ELL3	p.E16 1fs	FALS E	FALS E	FALS E	FALS E
pLOF	15	44892 685	CTTG A	C	lof	SPG1 1	p.I122 1fs	FALS E	FALS E	FALS E	FALS E
pLOF	15	45965 862	A	T	lof	SQR DL	p.K17 3X	FALS E	FALS E	FALS E	FALS E
pLOF	15	51633 962	GGC	G	lof	GLDN	p.Leu 29fs	FALS E	FALS E	FALS E	FALS E
pLOF	15	52186 011	G	C	lof	TMO D3	.	FALS E	TRUE	FALS E	FALS E
pLOF	15	52574 978	C	A	lof	MYO 5C	.	FALS E	FALS E	FALS E	FALS E
dDNV	15	52689 492	C	T	misD	MYO 5A	p.A40 9T	FALS E	TRUE	TRUE	TRUE
pLOF	15	56243 788	C	A	lof	NED D4	.	FALS E	TRUE	FALS E	FALS E



dDNV /pLOF	15	65903443	C	T	lof	VWA9	p.Trp9*	FALSE	TRUE	FALSE	FALSE
pLOF	15	66845592	TCTTC	T	lof	LCTL	p.G308fs	FALSE	FALSE	FALSE	FALSE
pLOF	15	67652194	A	T	lof	IQCH	p.R242X	FALSE	FALSE	FALSE	FALSE
pLOF	15	67813588	T	C	lof	C15orf61	p.Met1?	FALSE	FALSE	FALSE	FALSE
pLOF	15	69682073	GC	G	lof	PAQR5	p.A156fs	FALSE	FALSE	FALSE	FALSE
pLOF	15	69745350	GAC	G	lof	RPLP1	p.T22fs	FALSE	TRUE	FALSE	FALSE
pLOF	15	74743142	C	T	lof	UBL7	NA	FALSE	TRUE	FALSE	FALSE
pLOF	15	78882254	TCA	T	lof	CHRNA5	p.V174fs	FALSE	FALSE	FALSE	FALSE
pLOF	15	82563942	A	C	lof	SAXO2	.	FALSE	FALSE	FALSE	FALSE
pLOF	15	90294294	G	GCA	lof	MESP1	p.R57fs	FALSE	FALSE	FALSE	FALSE
pLOF	15	90431856	CCAA T	C	lof	AP3S2,C15orf38-AP3S2	p.I257fs	FALSE	FALSE	FALSE	FALSE
pLOF	15	90809010	C	CGC GAC CCG	lof	NGRN	p.Gly26fs	FALSE	FALSE	FALSE	FALSE
pLOF	15	91304231	TAGAA	T	lof	BLM	p.L543fs	FALSE	TRUE	FALSE	FALSE
pLOF	15	91358377	CA	C	lof	BLM	p.Ser1375fs	FALSE	TRUE	FALSE	FALSE
pLOF	15	91434410	C	T	lof	FES	p.Q507X	FALSE	FALSE	FALSE	FALSE
pLOF	15	91434410	C	T	lof	FES	p.Q507X	FALSE	FALSE	FALSE	FALSE
pLOF	15	91542943	C	CA	lof	VPS33B	p.Glu580fs	FALSE	FALSE	FALSE	FALSE
pLOF	15	91795123	C	T	lof	SV2B	p.R176X	FALSE	FALSE	FALSE	FALSE
pLOF	15	91811837	T	G	lof	SV2B	.	FALSE	FALSE	FALSE	FALSE
dDNV	15	93173457	C	T	misD	FAM174B	p.D155N	FALSE	FALSE	FALSE	FALSE
pLOF	15	93198824	G	GGG AGC GGC CA	lof	FAM174B	p.Ala23fs	FALSE	FALSE	FALSE	FALSE
pLOF	15	94942216	T	G	lof	MCTP2	p.Y605X	FALSE	FALSE	FALSE	FALSE
pLOF	15	99251313	G	A	lof	IGF1R	p.W206X	FALSE	TRUE	FALSE	TRUE

pLOF	15	1.02E+08	C	T	lof	LRRK1	p.Q471X	FALSE	FALSE	FALSE	FALSE
pLOF	16	321537	A	G	lof	RGS11	NA	FALSE	FALSE	FALSE	FALSE
pLOF	16	708923	C	T	lof	WDR90	p.Q975X	FALSE	TRUE	FALSE	FALSE
pLOF	16	732362	A	T	lof	STUB1	.	FALSE	TRUE	FALSE	FALSE
dDNV/pLOF	16	2139950	G	GT	lof	PKD1	p.N4230fs	FALSE	FALSE	FALSE	TRUE
pLOF	16	2809175	T	TA	lof	SRRM2	.	FALSE	TRUE	FALSE	TRUE
pLOF	16	3274302	G	A	lof	ZNF200	p.Q260X	FALSE	FALSE	FALSE	FALSE
pLOF	16	4852437	C	T	lof	ROGDI	p.W21X	FALSE	FALSE	FALSE	FALSE
pLOF	16	4934846	G	C	lof	PPL	p.Y1270X	FALSE	FALSE	FALSE	FALSE
dDNV/pLOF	16	4935373	G	A	lof	PPL	p.Q1095X	FALSE	FALSE	FALSE	FALSE
pLOF	16	10788361	G	A	lof	TEKT5	p.Q124X	FALSE	FALSE	FALSE	FALSE
pLOF	16	13002408	G	A	lof	SHISA9	p.W212X	FALSE	FALSE	FALSE	TRUE
pLOF	16	21983384	A	AGCC	lof	UQRC2	p.S303fs	FALSE	TRUE	FALSE	FALSE
pLOF	16	21985269	C	CT	lof	UQRC2	p.T340fs	FALSE	TRUE	FALSE	FALSE
pLOF	16	30770379	CG	C	lof	C16orf93	p.Pro322fs	FALSE	FALSE	FALSE	FALSE
pLOF	16	31092069	G	GGGGGGACTGGGAAATCATAA	lof	ZNF646	p.S1475fs	FALSE	TRUE	FALSE	FALSE
pLOF	16	31121535	C	T	lof	BCKDK	p.Q145X	FALSE	TRUE	TRUE	FALSE
pLOF	16	46766333	C	A	lof	MYLK3	p.E417X	FALSE	FALSE	FALSE	FALSE
dDNV	16	46952596	G	A	misD	GPT2	p.E322K	FALSE	FALSE	FALSE	FALSE
pLOF	16	49408002	T	C	lof	C16orf78	.	FALSE	FALSE	FALSE	FALSE
pLOF	16	50745252	C	G	lof	NOD2	p.S477X	FALSE	FALSE	FALSE	FALSE
pLOF	16	67323476	TC	T	lof	KCTD19	p.Asp926fs	FALSE	FALSE	FALSE	FALSE
pLOF	16	67375953	T	A	lof	LRRC36	p.L55X	FALSE	FALSE	FALSE	FALSE
pLOF	16	67404851	G	GT	lof	LRRC36	p.L400fs	FALSE	FALSE	FALSE	FALSE

pLOF	16	67577 259	AG	A	lof	FAM6 5A	p.G83 0fs	FALS E	TRUE	FALS E	TRUE
pLOF	16	68358 622	AGC AGG GT	A	lof	PRM T7	p.S57 fs	TRUE	TRUE	FALS E	FALS E
pLOF	16	69752 315	CA	C	lof	NQO 1	p.Y43 X	FALS E	FALS E	FALS E	FALS E
dDNV	16	72110 496	A	C	misD	HPR	p.Asp 225Al a	FALS E	FALS E	FALS E	FALS E
pLOF	16	75258 741	C	T	lof	CTRB 1	p.Q25 7X	FALS E	FALS E	FALS E	FALS E
pLOF	16	75662 505	G	A	lof	KARS	p.R58 1X	FALS E	TRUE	FALS E	FALS E
pLOF	16	76350 368	CG	C	lof	CNTN AP4	p.E24 fs	FALS E	FALS E	TRUE	FALS E
pLOF	16	77317 885	G	A	lof	ADA MTS1 8	p.Q12 12X	FALS E	FALS E	FALS E	FALS E
pLOF	16	77323 309	C	G	lof	ADA MTS1 8	NA	FALS E	FALS E	FALS E	FALS E
pLOF	16	82034 394	A	C	lof	SDR4 2E1	.	FALS E	FALS E	FALS E	FALS E
pLOF	16	82131 883	GC	G	lof	HSD1 7B2	p.A33 6fs	FALS E	FALS E	FALS E	FALS E
pLOF	16	82131 883	GC	G	lof	HSD1 7B2	p.A33 6fs	FALS E	FALS E	FALS E	FALS E
pLOF	16	84485 601	A	T	lof	ATP2 C2	p.R57 9X	FALS E	FALS E	FALS E	FALS E
pLOF	16	88499 538	CCC ACC CTA	C	lof	ZNF4 69	p.T18 59fs	FALS E	FALS E	FALS E	TRUE
pLOF	16	88876 854	A	AG	lof	APRT	p.S10 0fs	FALS E	TRUE	FALS E	FALS E
pLOF	16	88904 097	AG	A	lof	GALN S	p.H16 6fs	FALS E	FALS E	FALS E	FALS E
pLOF	16	88931 528	G	T	lof	PABP N1L	p.Tyr 156*	FALS E	FALS E	FALS E	FALS E
pLOF	16	89986 342	A	T	lof	MC1 R	p.Lys 226*	FALS E	FALS E	FALS E	FALS E
pLOF	17	69480 1	TGCT CCG G	T	lof	RNM TL1	p.V25 2fs	FALS E	FALS E	FALS E	FALS E
pLOF	17	16128 05	A	T	lof	TLCD 2	p.C11 0X	FALS E	FALS E	FALS E	FALS E
pLOF	17	16128 05	A	T	lof	TLCD 2	p.C11 0X	FALS E	FALS E	FALS E	FALS E
pLOF	17	22212 10	T	A	lof	SRR	p.L72 X	FALS E	FALS E	FALS E	FALS E
dDNV	17	25985 35	G	A	misD	CLUH	p.H82 3Y	FALS E	TRUE	FALS E	TRUE
pLOF	17	33434 43	A	C	lof	SPAT A22	p.X36 4E	FALS E	FALS E	FALS E	FALS E

pLOF	17	3438930	CG	C	lof	TRPV3	p.D240fs	FALSE	FALSE	FALSE	FALSE
pLOF	17	3808158	G	T	lof	P2RX1	p.C117X	FALSE	FALSE	FALSE	FALSE
pLOF	17	4863614	C	T	lof	SPAG7	.	FALSE	TRUE	FALSE	FALSE
pLOF	17	5126610	A	G	lof	RP11-333E1.1	NA	FALSE	FALSE	FALSE	FALSE
pLOF	17	5314065	AT	A	lof	NUP88	p.I213fs	FALSE	TRUE	FALSE	FALSE
pLOF	17	10219265	CTG	C	lof	MYH13	p.Q1272fs	FALSE	FALSE	FALSE	FALSE
pLOF	17	11757318	A	G	lof	DNAH9	.	FALSE	FALSE	FALSE	FALSE
pLOF	17	11757746	G	C	lof	DNAH9	.	FALSE	FALSE	FALSE	FALSE
pLOF	17	16330045	C	T	lof	TRPV2	p.R369X	FALSE	FALSE	FALSE	FALSE
pLOF	17	19284454	CAG	C	lof	MAPK7	p.T311fs	FALSE	TRUE	FALSE	FALSE
pLOF	17	19698933	A	T	lof	ULK2	.	FALSE	FALSE	FALSE	FALSE
pLOF	17	20200305	G	A	lof	SPEC1	p.W991X	FALSE	FALSE	FALSE	FALSE
pLOF	17	28601136	T	TA	lof	BLMH	p.Y242fs	FALSE	TRUE	FALSE	FALSE
pLOF	17	33497167	C	T	lof	UNC45B	p.R528X	FALSE	FALSE	FALSE	FALSE
dDNV/pLOF	17	33592485	C	T	lof	SLFN5	p.Q752X	FALSE	FALSE	FALSE	FALSE
pLOF	17	33806192	CT	C	lof	SLFN12L	p.R346fs	FALSE	FALSE	FALSE	FALSE
pLOF	17	35830637	G	A	lof	TADA2A	NA	TRUE	TRUE	FALSE	FALSE
pLOF	17	36486756	AG	A	lof	GPR179	p.L899fs	FALSE	FALSE	FALSE	FALSE
pLOF	17	39135216	G	A	lof	KRT40	p.Q346X	FALSE	FALSE	FALSE	FALSE
pLOF	17	39183406	A	G	lof	KRTA1-5	p.Met1?	FALSE	FALSE	FALSE	FALSE
pLOF	17	39645871	GC	G	lof	KRT36	p.G82fs	FALSE	FALSE	FALSE	FALSE
pLOF	17	39967718	G	T	lof	P3H4	p.Y150X	FALSE	FALSE	FALSE	FALSE
pLOF	17	40259709	C	CGG TGT	lof	DHX58	p.A304fs	FALSE	FALSE	FALSE	FALSE
pLOF	17	40271595	G	A	lof	KAT2A	p.Q281X	TRUE	TRUE	FALSE	TRUE
pLOF	17	41164211	C	T	lof	IFI35	p.Q13X	FALSE	FALSE	FALSE	FALSE
pLOF	17	41570095	C	T	lof	DHX8	p.R184X	FALSE	TRUE	FALSE	FALSE

pLOF	17	46620 757	CG	C	lof	HOX B2	p.Pro 248fs	FALS E	FALS E	FALS E	FALS E
pLOF	17	46628 464	CCC GCC GCC GCC ACC GCC CCC GCT GCC ACCA CTG CCT	C	lof	HOX B3	p.Gly 90fs	FALS E	FALS E	FALS E	TRUE
pLOF	17	47014 397	T	A	lof	SNF8	p.K11 2X	FALS E	FALS E	FALS E	FALS E
pLOF	17	47219 506	C	T	lof	B4GA LNT2	p.Q16 9X	FALS E	FALS E	FALS E	FALS E
pLOF	17	48452 656	A	AC	lof	EME1	p.E29 fs	FALS E	TRUE	FALS E	FALS E
dDNV	17	48761 349	A	G	misD	ABCC 3	p.Met 1332 Val	FALS E	FALS E	FALS E	FALS E
pLOF	17	49238 569	G	T	lof	NME1 ,NME 1- NME2	p.E11 8X	FALS E	FALS E	FALS E	FALS E
pLOF	17	52993 152	C	T	lof	TOM1 L1	p.R21 7X	FALS E	FALS E	FALS E	FALS E
pLOF	17	53026 951	CAG	C	lof	TOM1 L1	p.Q41 9fs	FALS E	FALS E	FALS E	FALS E
pLOF	17	54893 116	C	G	lof	C17or f67	.	FALS E	FALS E	FALS E	FALS E
pLOF	17	56355 363	G	T	lof	MPO	p.Y34 3X	FALS E	FALS E	FALS E	FALS E
pLOF	17	56357 349	G	GAG CCG CTG CGA	lof	MPO	p.S92 fs	FALS E	FALS E	FALS E	FALS E
pLOF	17	58156 125	C	A	lof	HEAT R6	p.E51 X	FALS E	FALS E	FALS E	FALS E
dDNV	17	61557 725	G	A	misD	ACE	0	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	17	61759 225	A	AG	lof	MAP3 K3	p.E23 2fs	FALS E	TRUE	FALS E	TRUE
dDNV /pLOF	17	62558 993	G	A	lof	SMU RF2	p.R37 0X	FALS E	TRUE	FALS E	TRUE
pLOF	17	66992 092	C	CA	lof	ABCA 9	p.G11 67fs	FALS E	FALS E	FALS E	FALS E
pLOF	17	67189 740	ATAA T	A	lof	ABCA 10	p.I511 fs	FALS E	FALS E	FALS E	FALS E

pLOF	17	73489 944	C	CCA	lof	TME M94	p.P78 5fs	FALS E	FALS E	FALS E	FALS E
pLOF	17	73570 751	T	TG	lof	LLGL 2	.	FALS E	FALS E	FALS E	FALS E
pLOF	17	73953 636	G	A	lof	ACO X1	p.R14 8X	FALS E	FALS E	FALS E	FALS E
pLOF	17	76566 381	GGT	G	lof	DNA H17	p.Pro 331fs	FALS E	FALS E	FALS E	FALS E
pLOF	17	76676 428	T	C	lof	CYTH 1	.	FALS E	FALS E	FALS E	TRUE
pLOF	17	76823 301	G	A	lof	USP3 6	p.Gln 239*	FALS E	FALS E	FALS E	FALS E
pLOF	17	77708 889	C	G	lof	ENPP 7	p.Tyr 149*	FALS E	FALS E	FALS E	FALS E
pLOF	17	78064 032	A	ACGT GCA CGA ACAA CAC GGG ACG CGC GCG	lof	CCD C40	p.Gln 976fs	FALS E	FALS E	FALS E	FALS E
pLOF	17	78286 962	A	AT	lof	RNF2 13	p.I936 fs	FALS E	FALS E	FALS E	FALS E
pLOF	17	78399 347	GGA	G	lof	END OV	p.R21 4fs	FALS E	FALS E	FALS E	FALS E
pLOF	17	80010 276	GGC ACG GCC GGG GAC	G	lof	GPS1	p.G32 fs	FALS E	TRUE	FALS E	TRUE
pLOF	18	19236 850	AG	A	lof	ABHD 3	p.S34 3fs	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	18	19751 617	ACT	A	lof	GATA 6	GATA 6:NM _0052 57:ex on2:c. 513_5 14del: p.H17 1fs	FALS E	FALS E	FALS E	TRUE
pLOF	18	19751 617	ACT	A	lof	GATA 6	p.Ser 172fs	FALS E	FALS E	FALS E	TRUE
dDNV	18	21110 376	T	C	misD	C18or f8	p.I565 T	FALS E	FALS E	FALS E	TRUE
pLOF	18	21496 564	C	T	lof	LAMA 3	p.Arg 2610*	FALS E	FALS E	FALS E	FALS E
pLOF	18	21736 416	TA	T	lof	CABY R	p.I318 fs	FALS E	FALS E	FALS E	FALS E
pLOF	18	28612 216	G	T	lof	DSC3	p.Cys 32*	FALS E	FALS E	FALS E	FALS E
pLOF	18	28667 778	T	C	lof	DSC2	.	FALS E	FALS E	FALS E	FALS E

dDNV	18	29116 237	T	A	misD	DSG2	p.L49 9Q	FALS E	FALS E	FALS E	FALS E
dDNV	18	32400 761	C	T	misD	DTNA	p.P29 5S	FALS E	FALS E	FALS E	TRUE
pLOF	18	32585 514	C	G	lof	MAP RE2	p.S28 X	FALS E	TRUE	FALS E	TRUE
pLOF	18	32720 304	C	T	lof	MAP RE2	p.Q30 7X	FALS E	TRUE	FALS E	TRUE
pLOF	18	33558 882	GTTA C	G	lof	C18or f21	p.L19 3fs	FALS E	FALS E	FALS E	FALS E
pLOF	18	34359 413	C	T	lof	FHO D3	p.R15 97X	FALS E	TRUE	FALS E	FALS E
pLOF	18	34740 228	AC	A	lof	KIAA 1328	p.D43 3fs	FALS E	TRUE	FALS E	FALS E
dDNV /pLOF	18	45374 845	C	T	lof	SMA D2	NA	FALS E	TRUE	FALS E	TRUE
pLOF	18	47432 872	TC	T	lof	MYO 5B	p.Gly 777fs	FALS E	FALS E	FALS E	FALS E
pLOF	18	47777 259	G	A	lof	CFAP 53	p.Q28 9X	FALS E	FALS E	FALS E	FALS E
pLOF	18	53252 953	A	G	lof	TCF4	NA	FALS E	TRUE	TRUE	TRUE
pLOF	18	61600 279	TAGA C	T	lof	SERP INB10	p.T21 2fs	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	18	72347 212	C	T	lof	ZNF4 07	p.R14 13X	FALS E	FALS E	FALS E	TRUE
pLOF	18	76754 984	GC	G	lof	SALL 3	p.S99 8fs	FALS E	FALS E	FALS E	FALS E
pLOF	18	77474 559	C	T	lof	CTDP 1	p.Gln 367*	FALS E	TRUE	FALS E	FALS E
pLOF	19	68136 9	C	A	lof	FSTL 3	p.Ser 181*	FALS E	FALS E	FALS E	TRUE
pLOF	19	87105 6	G	A	lof	MED1 6	p.Q76 6X	FALS E	TRUE	FALS E	FALS E
pLOF	19	10446 61	AC	A	lof	ABCA 7	p.Pro 379fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	35479 05	CA	C	lof	MFS D12	p.Ala 260fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	38168 29	TG	T	lof	ZFR2	p.Q64 9fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	61772 62	T	TC	lof	ACSB G2	p.V25 4fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	69086 99	G	A	lof	ADG RE1	.	FALS E	FALS E	FALS E	FALS E
pLOF	19	75052 32	TCG CTCA AGG AGC AC	T	lof	ARH GEF1 8	p.S13 6fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	76910 20	A	G	lof	XAB2	.	FALS E	TRUE	FALS E	TRUE
pLOF	19	79991 24	C	A	lof	TIMM 44	.	FALS E	TRUE	FALS E	FALS E

pLOF	19	9054234	C	A	lof	MUC16	.	FALSE	FALSE	FALSE	FALSE
pLOF	19	10124273	C	T	lof	RDH8	p.Q54X	FALSE	FALSE	FALSE	FALSE
pLOF	19	11215894	A	C	lof	LDLR	.	FALSE	FALSE	FALSE	FALSE
pLOF	19	11686002	TG	T	lof	ACP5	p.S267X	FALSE	FALSE	FALSE	FALSE
pLOF	19	12880697	G	A	lof	HOO K2	p.Gln368*	FALSE	FALSE	FALSE	FALSE
pLOF	19	13080596	G	A	lof	DAN D5	p.W41X	FALSE	FALSE	FALSE	FALSE
pLOF	19	13135494	C	CGT	lof	NFIX	p.A16fs	FALSE	FALSE	TRUE	TRUE
pLOF	19	13882967	A	AC	lof	MRI1	p.T281fs	FALSE	FALSE	FALSE	FALSE
pLOF	19	14867079	C	T	lof	ADGRE2	p.W388X	FALSE	FALSE	FALSE	FALSE
pLOF	19	16025185	AG	A	lof	CYP4F11	p.P442fs	FALSE	FALSE	FALSE	FALSE
pLOF	19	16861144	AC	A	lof	NWD1	p.H429fs	FALSE	FALSE	FALSE	FALSE
pLOF	19	17759726	C	A	lof	UNC13A	p.E531X	FALSE	FALSE	FALSE	TRUE
pLOF	19	17831358	C	T	lof	MAP1S	p.Arg65*	FALSE	TRUE	FALSE	FALSE
pLOF	19	18284739	C	T	lof	IFI30	p.Q30X	FALSE	FALSE	FALSE	FALSE
pLOF	19	18979514	G	T	lof	GDF1	p.C337X	FALSE	FALSE	FALSE	FALSE
pLOF	19	21607218	C	G	lof	ZNF493	p.S586X	FALSE	FALSE	FALSE	FALSE
pLOF	19	35451829	G	A	lof	ZNF792	p.Gln35*	FALSE	FALSE	FALSE	FALSE
pLOF	19	35514188	G	A	lof	GRAMD1A	p.W634X	FALSE	TRUE	FALSE	FALSE
pLOF	19	36340248	CAG	C	lof	NPHS1	p.P243fs	FALSE	FALSE	FALSE	FALSE
pLOF	19	36342694	G	GCC	lof	NPHS1	p.L16fs	FALSE	FALSE	FALSE	FALSE
pLOF	19	36558868	C	T	lof	WDR62	p.Q280X	FALSE	FALSE	FALSE	FALSE
pLOF	19	36643294	C	T	lof	COX7A1	.	FALSE	FALSE	FALSE	FALSE
pLOF	19	37917191	AT	A	lof	ZNF569	p.N35fs	FALSE	FALSE	FALSE	FALSE
dDNV /pLOF	19	38853114	C	G	lof	CATSPERG	p.Y752X	FALSE	FALSE	FALSE	FALSE
pLOF	19	38853130	AT	A	lof	CATSPERG	p.I758fs	FALSE	FALSE	FALSE	FALSE
pLOF	19	38873900	G	A	lof	PSMD8	p.Trp308*	FALSE	TRUE	FALSE	FALSE



pLOF	19	38885 396	GC	G	lof	SPRE D3	p.P18 0fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	38897 596	TTC	T	lof	FAM9 8C	p.V26 6fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	39096 371	C	T	lof	MAP4 K1	.	FALS E	FALS E	FALS E	TRUE
pLOF	19	39669 106	C	T	lof	PAK4	p.R55 5X	FALS E	TRUE	FALS E	FALS E
pLOF	19	39688 691	A	G	lof	NCC RP1	.	FALS E	FALS E	FALS E	FALS E
pLOF	19	39971 376	TG	T	lof	TIMM 50	p.G65 fs	FALS E	TRUE	FALS E	FALS E
pLOF	19	40478 298	TC	T	lof	PSM C4	p.F53 fs	FALS E	TRUE	FALS E	FALS E
pLOF	19	40902 869	G	A	lof	PRX	p.Arg 464*	FALS E	FALS E	FALS E	FALS E
dDNV	19	41928 260	C	T	misD	BCKD HA	p.R28 0C	FALS E	FALS E	FALS E	FALS E
pLOF	19	42820 662	TG	T	lof	TME M145	p.Gly 227fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	44118 000	G	GC	lof	SRR M5	p.S57 6fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	45295 751	T	TGCT GCC TG	lof	CBLC	p.C37 3fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	45912 350	AG	A	lof	CD3E AP	p.Q37 5fs	FALS E	TRUE	FALS E	FALS E
pLOF	19	46299 133	ATC	A	lof	RSPH 6A	p.D71 6fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	47549 896	C	CCC CGAT G	lof	TME M160	p.V86 fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	48950 092	C	T	lof	GRW D1	p.R15 4X	FALS E	TRUE	FALS E	FALS E
pLOF	19	48953 589	AGC	A	lof	GRW D1	p.E16 3fs	FALS E	TRUE	FALS E	FALS E
pLOF	19	48953 589	AGC	A	lof	GRW D1	p.Glu 163fs	FALS E	TRUE	FALS E	FALS E
pLOF	19	49963 000	C	T	lof	ALDH 16A1	p.R13 2X	FALS E	TRUE	FALS E	FALS E
pLOF	19	51955 787	GT	G	lof	SIGL EC8	p.T44 9fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	53304 400	TG	T	lof	ZNF2 8	p.H23 3fs	FALS E	TRUE	FALS E	FALS E
pLOF	19	55175 352	A	T	lof	LILRB 4	p.R71 X	FALS E	FALS E	FALS E	FALS E
pLOF	19	55525 985	GA	G	lof	GP6	p.S44 3fs	FALS E	FALS E	FALS E	FALS E
pLOF	19	55823 281	G	T	lof	BRSK 1	p.E72 8X	FALS E	FALS E	FALS E	TRUE
pLOF	19	56005 093	C	T	lof	SSC5 D	p.R34 3X	FALS E	FALS E	FALS E	FALS E
pLOF	19	57835 102	GA	G	lof	ZNF5 43	p.G24 fs	FALS E	FALS E	FALS E	FALS E

pLOF	19	57985062	G	GT	lof	ZNF772	p.Y350_K351delinsX	FALS E	FALS E	FALS E	FALS E
pLOF	20	2375100	AT	A	lof	TGM6	p.I4fs	FALS E	FALS E	FALS E	FALS E
pLOF	20	3543875	C	T	lof	ATRN	p.R551X	FALS E	FALS E	FALS E	TRUE
pLOF	20	3758910	C	CCG	lof	SPEF1	p.R220fs	FALS E	FALS E	FALS E	FALS E
pLOF	20	3758927	G	A	lof	SPEF1	p.Gln215*	FALS E	FALS E	FALS E	FALS E
pLOF	20	5283357	T	A	lof	PROKR2	p.K162X	FALS E	FALS E	FALS E	FALS E
pLOF	20	6021974	G	GT	lof	LRRN4	p.Y639_G640delinsX	FALS E	FALS E	FALS E	FALS E
pLOF	20	13763572	TA	T	lof	ESF1	p.Tyr72fs	FALS E	TRUE	FALS E	FALS E
pLOF	20	17937639	G	A	lof	SNX5	p.Q32X	FALS E	TRUE	TRUE	FALS E
pLOF	20	31494648	GTGAC	G	lof	EFCAB8	p.Thr387fs	FALS E	FALS E	FALS E	FALS E
pLOF	20	33329542	TTTA A	T	lof	NCOA6	p.I1505fs	FALS E	TRUE	FALS E	TRUE
pLOF	20	34085825	CTGT T	C	lof	CEP250	p.S1195fs	FALS E	TRUE	FALS E	FALS E
pLOF	20	34828403	G	T	lof	AAR2	p.E205X	FALS E	TRUE	FALS E	FALS E
pLOF	20	35173466	CGC TGG GTG A	C	lof	MYL9	p.S60fs	FALS E	FALS E	FALS E	FALS E
pLOF	20	36789985	CCTC T	C	lof	TGM2	p.E8fs	FALS E	FALS E	FALS E	FALS E
pLOF	20	37263370	CTG	C	lof	ARH GAP40	p.C297fs	FALS E	FALS E	FALS E	FALS E
pLOF	20	39832029	T	A	lof	ZHX3	p.K510X	FALS E	FALS E	FALS E	FALS E
pLOF	20	44640253	C	A	lof	MMP9	p.C288X	FALS E	FALS E	FALS E	FALS E
pLOF	20	47846805	GC	G	lof	DDX27	p.G348fs	FALS E	TRUE	FALS E	TRUE
dDNV /pLOF	20	52198777	C	CT	lof	ZNF217	p.A197fs	FALS E	FALS E	FALS E	TRUE
pLOF	20	52775630	AT	A	lof	CYP24A1	p.N341fs	FALS E	FALS E	FALS E	FALS E
pLOF	20	55059207	C	T	lof	RTFD C1	p.R177X	FALS E	TRUE	FALS E	FALS E
pLOF	20	57582065	T	TC	lof	CTSZ	p.D40fs	FALS E	TRUE	FALS E	FALS E

pLOF	20	61953 465	T	C	lof	COL2 0A1	NA	FALS E	FALS E	FALS E	FALS E
pLOF	20	62333 571	T	G	lof	ARFR P1	NA	FALS E	TRUE	FALS E	FALS E
pLOF	21	15558 287	A	AT	lof	LIPI	p.I200 fs	FALS E	FALS E	FALS E	FALS E
pLOF	21	30415 806	TAGT G	T	lof	USP1 6	p.S41 5fs	TRUE	FALS E	FALS E	FALS E
pLOF	21	30715 007	TG	T	lof	BACH 1	p.E68 9fs	FALS E	TRUE	FALS E	TRUE
pLOF	21	34997 067	C	T	lof	CRYZ L1	.	FALS E	FALS E	FALS E	FALS E
pLOF	21	38516 934	C	CA	lof	TTC3	p.Q62 8fs	FALS E	TRUE	FALS E	FALS E
pLOF	21	38524 331	T	C	lof	TTC3	.	FALS E	TRUE	FALS E	FALS E
pLOF	21	40800 320	CTG GG	C	lof	LCA5 L	p.Ser 32fs	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	21	42811 689	C	T	lof	MX1	p.R16 9X	FALS E	FALS E	FALS E	FALS E
dDNV	21	42845 382	C	T	misD	TMP RSS2	p.V25 7M	FALS E	FALS E	FALS E	FALS E
pLOF	21	43508 540	TG	T	lof	UMO DL1	p.L24 7fs	FALS E	FALS E	FALS E	FALS E
pLOF	21	43524 017	C	T	lof	UMO DL1	p.R44 7X	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	21	47337 539	CG	C	lof	PCBP 3	p.P23 8fs	FALS E	FALS E	FALS E	TRUE
pLOF	21	47419 607	G	A	lof	COL6 A1	NA	FALS E	FALS E	TRUE	TRUE
pLOF	22	18210 166	A	T	lof	BCL2 L13	p.R44 2X	FALS E	TRUE	FALS E	FALS E
dDNV	22	19076 893	C	T	misD	DGC R2	p.A64 T	FALS E	TRUE	FALS E	FALS E
pLOF	22	25119 170	G	GA	lof	PIWIL 3	p.L76 2fs	FALS E	FALS E	FALS E	FALS E
pLOF	22	29095 881	CG	C	lof	CHEK 2	p.R97 fs	FALS E	FALS E	FALS E	FALS E
pLOF	22	31685 303	C	CT	lof	PIK3I P1	p.K19 5fs	FALS E	FALS E	FALS E	FALS E
dDNV /pLOF	22	36141 969	C	G	lof	RBFO X2	NA	FALS E	TRUE	FALS E	TRUE
pLOF	22	36538 003	AC	A	lof	APOL 3	p.W8 0fs	FALS E	FALS E	FALS E	FALS E
pLOF	22	37398 251	GAG GTGT C	G	lof	TEX3 3	p.D37 fs	FALS E	FALS E	FALS E	FALS E
dDNV	22	37533 655	C	T	misD	IL2RB	p.R17 0Q	FALS E	FALS E	FALS E	FALS E
pLOF	22	38151 106	A	G	lof	TRIO BP	NA	FALS E	TRUE	FALS E	FALS E

pLOF	22	38221060	GGG CCG CGC GGG GCG CGC CATG CTG GCG GT	G	lof	GALR3	p.Gly234fs	FALS E	FALS E	FALS E	FALS E
pLOF	22	39817965	C	T	lof	TAB1	p.Q304X	FALS E	FALS E	FALS E	FALS E
pLOF	22	40757290	T	TA	lof	ADSL	p.I269fs	FALS E	TRUE	TRUE	FALS E
pLOF	22	41969738	AC	A	lof	CSDC2	p.T86fs	FALS E	FALS E	FALS E	FALS E
pLOF	22	44892952	A	T	lof	LDOC1L	p.L162X	FALS E	FALS E	FALS E	FALS E
pLOF	22	45740492	TGA GA	T	lof	SMC1B	p.S1217fs	FALS E	FALS E	FALS E	FALS E
dDNV	22	46614260	G	A	misD	PPARA	p.R157Q	FALS E	FALS E	FALS E	FALS E
dDNV	22	50898382	T	C	misD	SBF1	p.S1164G	FALS E	TRUE	TRUE	TRUE
pLOF	22	50957619	GC	G	lof	NCAPH2	p.Ser246fs	FALS E	TRUE	FALS E	FALS E
pLOF	X	41419006	TG	T	lof	CASK	p.His588fs	FALS E	FALS E	TRUE	TRUE
pLOF	X	48923276	A	G	lof	CCDC120	.	FALS E	FALS E	FALS E	FALS E
pLOF	X	54783695	CA	C	lof	ITIH6	p.P937fs	FALS E	FALS E	FALS E	FALS E
pLOF	X	67938438	C	G	lof	STAR8D8	p.S561X	FALS E	FALS E	FALS E	FALS E
dDNV	X	78616853	G	A	misD	ITM2A	p.R226C	FALS E	TRUE	FALS E	FALS E
pLOF	X	1E+08	TG	T	lof	TRMT2B	p.His495fs	FALS E	FALS E	FALS E	FALS E
dDNV	X	1.03E+08	C	T	misD	SLC25A53	0	FALS E	FALS E	FALS E	FALS E
dDNV	X	1.07E+08	G	A	misD	VSIG1	p.V33M	FALS E	FALS E	FALS E	FALS E
pLOF	X	1.14E+08	G	A	lof	RBMXL3	p.W317X	FALS E	FALS E	FALS E	FALS E
pLOF	X	1.31E+08	G	T	lof	RAP2C-AS1	NA	FALS E	FALS E	FALS E	FALS E
pLOF	X	1.35E+08	TGAT GA	T	lof	ADGRG4	p.D2504fs	FALS E	FALS E	FALS E	FALS E

**eTable 3: Neurodevelopmental tests**

Domain	Measure	Mode	Age Range	Completed By	Published Mean	Published Standard Deviation	Score Direction Indicating Impairment
Visual-Motor	VMI-6	Direct Testing	≥ 8 yrs	Participant	100	15	Lower
Intelligence	<b>WISC-V - Core Subtests:</b>						
	• Similarities	Direct Testing	< 16 yrs	Participant	100	15	Lower
	• Vocabulary	Direct Testing		Participant	100	15	Lower
	• Block Design	Direct Testing		Participant	100	15	Lower
	• Matrix Reasoning	Direct Testing		Participant	100	15	Lower
	• Figure Weights	Direct Testing		Participant	100	15	Lower
	• Digit Span	Direct Testing		Participant	100	15	Lower
	• Coding	Direct Testing		Participant	100	15	Lower
	• Symbol Search	Direct Testing		Participant	100	15	Lower
Intelligence	<b>WAIS-IV - Core Subtests:</b>						
	• Block Design	Direct Testing	≥ 16 yrs	Participant	100	15	Lower
	• Similarities	Direct Testing		Participant	100	15	Lower
	• Digit Span	Direct Testing		Participant	100	15	Lower
	• Matrix Reasoning	Direct Testing		Participant	100	15	Lower
	• Vocabulary	Direct Testing		Participant	100	15	Lower
	• Arithmetic	Direct Testing		Participant	100	15	Lower
	• Symbol Search	Direct Testing		Participant	100	15	Lower
	• Visual Puzzles	Direct Testing		Participant	100	15	Lower
	• Information	Direct Testing		Participant	100	15	Lower
	• Coding	Direct Testing		Participant	100	15	Lower

Memory	<b>WRAML-2 Story Memory &amp; Picture Memory Immediate Recall Tasks</b>	Direct Testing	≥8 yrs	Participant	100	15	Lower
Academics	<b>WRAT-4 Word Reading</b>	Direct Testing	≥8 yrs	Participant	100	15	Lower
Memory	<b>WRAML-2 Story Memory &amp; Delayed Recognition Recall Tasks</b>	Direct Testing	≥8 yrs	Participant	100	15	Lower
Academics	<b>WRAT-4 Remaining Subtests</b>						
	• <b>Sentence Comprehension</b>	Direct Testing	≥8 yrs	Participant	100	15	Lower
	• <b>Spelling</b>	Direct Testing		Participant	100	15	Lower
	• <b>Math Computation</b>	Direct Testing		Participant	100	15	Lower
Executive Function	<b>D-KEFS (Selected Subtests)</b>						
	• <b>Verbal Fluency</b>	Direct Testing	≥ 8 yrs	Participant	10	3	Lower
	• <b>Trail Making</b>	Direct Testing		Participant	10	3	Lower
	• <b>Tower Subtests</b>	Direct Testing		Participant	10	3	Lower
Language	<b>WIAT-III</b>						
	• <b>Listening Comprehension</b>	Direct Testing	≥ 8 yrs	Participant	100	15	Lower
	• <b>Oral Expression Subtests Only</b>	Direct Testing		Participant	100	15	Lower
Social Cognition	<b>ADOS-2, administered if SRS-2 total score ≥60 or strong likelihood of autism spectrum disorder</b>	Direct Testing	≥ 8 yrs	Participant	Categorical	N/A	Higher
Social Cognition	<b>Social Responsiveness Scale, 2<sup>nd</sup> Edition (SRS-2)</b>	Questionnaire	≥ 8 yrs	Parent/care giver	Categorical	N/A	Higher
Executive Function	<b>BRIEF-2 Parent Report</b>	Questionnaire	< 18 yrs	Parent/care giver	50	10	Higher

Depression	<b>Children's Depression Inventory, 2<sup>nd</sup> Edition (CDI-2)</b>	Questionnaire	< 18 yrs	Parent/care giver	50	10	Higher
Executive Function	<b>Conners-3 Parent Report</b>	Questionnaire	< 18 yrs	Parent/care giver	50	10	Higher
Anxiety	<b>MASC-2 Parent Report</b>	Questionnaire	< 18 yrs	Parent/care giver	50	10	Higher
Adaptive functioning	<b>Vineland-3 Caregiver Rating Form**</b>	Questionnaire	≥ 8 yrs	Parent/care giver	100	15	Lower
Anxiety	<b>Beck Anxiety Inventory</b>	Questionnaire	≥ 18 yrs	Participant	Categorical	N/A	Higher
Depression	<b>Beck Depression Inventory, 2<sup>nd</sup> Edition (BDI-2)</b>	Questionnaire	≥ 18 yrs	Participant	Categorical	N/A	Higher
Executive Function	<b>Conners-3</b>	Questionnaire	< 18 yrs	Teacher	50	10	Higher
Executive Function	<b>BRIEF-2</b>	Questionnaire	< 18 yrs	Teacher	50	10	Higher

<b>eTable 4: Full results for neurodevelopmental outcomes by case/control status</b>				
<b>ND test</b>	<b>Scores</b>	<b>Case</b>	<b>Control</b>	<b>P-value from Mixed model</b>
		<b>(N=109)</b>	<b>(N=110)</b>	
<b>Intelligence</b>				
WISC-V (< 16 yrs) & WAIS-IV (>= 16 yrs)	<b>Processing Speed Index All Ages Standard Score</b>			0.71
	N	105	107	
	Min-Max	44.0-135.0	45.0-132.0	
	Mean (SD)	93.9 (17.93)	92.6 (16.36)	
	Median (Q1, Q3)	95.0 (86.0, 105.0)	94.0 (84.0, 103.0)	
	Missing	4	3	
WAIS-IV (>= 16 yrs)	<b>Working Memory</b>			0.3
	N	44	46	
	Min-Max	49.0-136.0	60.0-136.0	
	Mean (SD)	97.6 (16.65)	95.4 (15.70)	
	Median (Q1, Q3)	97.0 (92.0, 105.0)	97.0 (83.0, 105.0)	
	Missing	65	64	
<b>Executive Function</b>				
Conners-3 Parent (< 18 yrs)	<b>Executive Functioning</b>			0.27
	N	56	59	
	Min-Max	0.0-88.0	35.0-89.0	
	Mean (SD)	54.3 (16.00)	56.9 (14.12)	
	Median (Q1, Q3)	54.0 (45.0, 62.0)	55.0 (45.0, 65.0)	
	Missing	53	51	
Conners-3 Teacher (< 18 yrs)	<b>Executive Functioning</b>			0.1
	N	31	42	
	Min-Max	39.0-73.0	39.0-81.0	
	Mean (SD)	51.4 (9.79)	55.8 (11.51)	
	Median (Q1, Q3)	51.0 (43.0, 59.0)	53.5 (46.0, 66.0)	
	Missing	78	68	
D-KEFS (>= 8 yrs)	<b>Category Switching Total Accuracy</b>			0.24
	N	107	108	
	Min-Max	0.0-19.0	1.0-19.0	
	Mean (SD)	10.6 (3.97)	9.8 (3.59)	



	Median (Q1, Q3)	11.0 (9.0, 13.0)	10.0 (7.0, 12.5)	
	Missing	2	2	
<b>Memory</b>				
WRAML-2 (>= 8 yrs)	<b>IMMEDIATE Recall: Story Memory</b>			0.33
	N	108	110	
	Min-Max	0.0-18.0	1.0-19.0	
	Mean (SD)	10.5 (3.49)	10.1 (3.12)	
	Median (Q1, Q3)	11.0 (8.5, 13.0)	11.0(8,12)	
	Missing	1	0	
	<b>IMMEDIATE Recall: Picture Memory</b>			0.71
	N	104	107	
	Min-Max	0.0-16.0	3.0-16.0	
	Mean (SD)	8.4 (3.14)	8.6 (3.04)	
	Median (Q1, Q3)	9.0 (6.0, 11.0)	8.0 (7.0, 11.0)	
	Missing	5	3	
<b>ADOS and SRS</b>				
Conners-3 Parent (< 18 yrs)	<b>Peer Relations</b>			0.77
	N	56	59	
	Min-Max	1.0-99.0	41.0-99.0	
	Mean (SD)	54.7 (16.60)	55.9 (16.47)	
	Median (Q1, Q3)	49.0 (44.0, 62.0)	49.0 (43.0, 62.0)	
	Missing	53	51	
Conners-3 Teacher (< 18 yrs)	<b>Peer Relations</b>			0.44
	N	32	43	
	Min-Max	2.0-99.0	41.0-99.0	
	Mean (SD)	56.4 (18.68)	53.5 (14.34)	
	Median (Q1, Q3)	51.0 (45.5, 67.5)	48.0 (43.0, 57.0)	
	Missing	77	67	
Screening classification	<b>Composite outcome defined by ADOS-2 and SRS-2 Total Score<sup>1</sup></b>			0.73
	Non Spectrum	76 (91.6%)	80 (94.1%)	
	Autism/Autism Spectrum	7 (8.4%)	5 (5.9%)	
	Missing	26	25	
<b>Language Deficits</b>				
WIAT-III (>= 8 yrs)	<b>Oral Language Index</b>			0.83
	N	91	92	
	Min-Max	39.0-141.0	62.0-140.0	

	Mean (SD)	104.1 (19.71)	104.5 (16.18)	
	Median (Q1, Q3)	107.0 (94.0, 116.0)	105.0 (93.0, 117.0)	
	Missing	18	18	
<b>Adaptive Functioning</b>				
Vineland-3 (>= 8 yrs)	<b>Communication</b>			0.49
	N	79	82	
	Min-Max	49.0-137.0	53.0-120.0	
	Mean (SD)	100.4 (13.99)	102.0 (11.86)	
	Median (Q1, Q3)	103.0 (96.0, 109.0)	107.0 (98.0, 109.0)	
	Missing	30	28	
	<b>Daily Living Skills</b>			0.24
	N	78	82	
	Min-Max	58.0-135.0	50.0-131.0	
	Mean (SD)	102.2 (15.06)	100.2 (14.59)	
	Median (Q1, Q3)	104.0 (93.0, 116.0)	102.0 (93.0, 108.0)	
	Missing	31	28	
	<b>Socialization</b>			0.27
	N	79	82	
	Min-Max	40.0-122.0	68.0-122.0	
	Mean (SD)	99.5 (14.35)	101.8 (11.36)	
	Median (Q1, Q3)	102.0 (94.0, 110.0)	104.5 (98.0, 110.0)	
	Missing	30	28	
	<b>Motor Skills</b>			0.06
	N	17	19	
	Min-Max	81.0-118.0	62.0-111.0	
	Mean (SD)	100.8 (11.16)	93.7 (12.64)	
	Median (Q1, Q3)	102.0 (92.0, 111.0)	96.0 (83.0, 105.0)	
	Missing	92	91	
<b>Anxiety and Depression</b>				
Beck Anxiety Inventory (>= 18 yrs)	<b>BAI Total Raw Score Binary<sup>2</sup></b>			-
	Low	30 (81.1%)	31 (88.6%)	
	Moderate/Potentially concerning	7 (18.9%)	4 (11.4%)	
	Missing	72	75	

Beck Depression Inventory (>= 18 yrs)	<b>BDI-2 Total Raw Score Binary<sup>3</sup></b>			-
	None/Mild	33 (89.2%)	31 (88.6%)	
	Moderate/Severe	4 (10.8%)	4 (11.4%)	
	Missing	72	75	
<b>ADHD/Attention</b>				
Conners-3 Parent (< 18 yrs)	<b>DSM-5 ADHD Inattentive</b>			0.71
	N	56	59	
	Min-Max	6.0-90.0	35.0-90.0	
	Mean (SD)	55.6 (14.98)	56.6 (14.94)	
	Median (Q1, Q3)	52.0 (45.0, 64.5)	54.0 (45.0, 68.0)	
	Missing	53	51	
	<b>DSM-5 ADHD Hyperactive-Impulsive</b>			0.4
	N	56	59	
	Min-Max	0.0-99.0	39.0-89.0	
	Mean (SD)	55.9 (17.46)	54.3 (13.81)	
	Median (Q1, Q3)	53.0 (43.5, 68.5)	50.0 (43.0, 60.0)	
	Missing	53	51	
Conners-3 Teacher (< 18 yrs)	<b>DSM-5 ADHD Inattentive</b>			0.13
	N	31	43	
	Min-Max	39.0-80.0	41.0-89.0	
	Mean (SD)	52.1 (10.78)	56.3 (13.39)	
	Median (Q1, Q3)	46.0 (44.0, 61.0)	53.0 (44.0, 62.0)	
	Missing	78	67	
	<b>DSM-5 ADHD Hyperactive-Impulsive</b>			0.92
	N	31	43	
	Min-Max	42.0-91.0	42.0-90.0	
	Mean (SD)	55.7 (14.47)	55.7 (14.85)	
	Median (Q1, Q3)	51.0 (44.0, 61.0)	49.0 (44.0, 63.0)	
	Missing	78	67	
Conners' Adult ADHD Rating Scales (>= 18 yrs)	<b>DSM-IV ADHD Symptoms Total</b>			0.24
	N	37	36	
	Min-Max	31.0-91.0	31.0-85.0	
	Mean (SD)	53.5 (16.56)	50.1 (12.65)	
	Median (Q1, Q3)	49.0 (41.0, 57.0)	48.5 (42.5, 57.5)	
	Missing	72	74	

<sup>1</sup> Screening classification outcome is defined as the following: = Autism/Autism Spectrum, if "Autism" or "Autism Spectrum" were marked on ADOS form; = Non-Spectrum, if 1) "Non-Spectrum" was marked on ADOS form; or 2) no ADOS data and SRS total score < 60; = missing, if 1) neither ADOS nor SRS was done; or 2) no ADOS data and SRS total score >= 60.		
<sup>2</sup> BAI Total Raw Score Binary is defined as the following: 0-21: low, >=22: Moderate/Potentially concerning.		
<sup>3</sup> BDI-2 Total Raw Score Binary Binary is defined as the following: 0-19: None/Mild, >=20: Moderate/Severe.		
Absent p-value is because the model did not converge due to limited sample size and small event rate.		
Normative values: The normative mean score is 100 and standard deviation (SD) is 15 for all tests with these exceptions: Behavior Rating Inventory of Executive Function, Second Edition (BRIEF-2), Children's Depression Index, Second Edition (CDI-2), Conners' Scales, Multidimensional Anxiety Scale for Children, Second Edition (MASC-2) has mean 50, SD 10; Delis-Kaplan Executive Function System (D-KEFS) has mean 10, SD 3; Social Responsiveness Scale, Second Edition (SRS-2) reports T-score ≥ 76 for severe symptoms, 66-75 for moderate, 60-65 for mild, and < 60 typical; Beck Anxiety Inventory (BAI) and Beck Depression Inventory, Second Edition (BDI-II) score 30-63 for severe symptoms, 17-29 for moderate, 10-16 for mild, and 0-9 for minimal.		

<b>eTable 5: Brain MRI findings by case/control status</b>			
	<b>Case</b>	<b>Control</b>	<b>P-value*</b>
<b>MRI Findings</b>	<b>(N=53) Number(%)</b>	<b>(N=55) Number (%)</b>	
<b>Focal infarct: number</b>			0.56
0	48 (90.6%)	47 (85.5%)	
1-5	5 (9.4%)	8 (14.5%)	
<b>Focal infarct: size (out of Focal infarct number unequal 0)</b>			
None	48 (90.6%)	47 (85.5%)	
<1 cm	4 (7.5%)	5 (9.1%)	
1-3 cm	1 (1.9%)	2 (3.6%)	
> 3 cm		1 (1.8%)	
<b>Foci of low T2: number</b>			0.49
0	52 (98.1%)	55 (100%)	
1-5	1 (1.9%)		
<b>Foci of high T2: number</b>			0.97
0	37 (69.8%)	39 (70.9%)	
1-5	14 (26.4%)	13 (23.6%)	
6-10	2 (3.8%)	2 (3.6%)	
>20		1 (1.8%)	
<b>Other abnormalities missing or not</b>			>0.99
No	29 (54.7%)	31 (56.4%)	
Yes	24 (45.3%)	24 (43.6%)	
* Fisher's exact test p-value.			

<b>eTable 6: MRI differences by case/control status and post hoc analysis</b>															
	Case/ Control		Mixed model p-value	HBE LOF Variant		Mixed model p-value	NDD LOF Variant		Mixed model p-value	pLI LOF Variant		Mixed model p-value	Chromatin LOF Variant		Mixed model p-value
MRI Scores	Case	Control		Yes	No		Yes	No		Yes	No		Yes	No	
	(N=50)	(N=49)		(N=62)	(N=38)		(N=8)	(N=92)		(N=40)	(N=60)		(N=9)	(N=91)	
<b>Cortical Thickness</b>			0.33			0.61			0.71			0.85			0.87
N	47	47		59	36		8	87		38	57		8	87	
Min-Max	2.4-2.9	2.3-3.1		2.4-3.0	2.3-3.1		2.5-2.8	2.3-3.1		2.4-3.0	2.3-3.1		2.6-2.8	2.3-3.1	
Mean (SD)	2.7 (0.14)	2.7 (0.16)		2.7 (0.14)	2.6 (0.15)		2.6 (0.10)	2.7 (0.15)		2.7 (0.14)	2.7 (0.15)		2.7 (0.10)	2.6 (0.15)	
<b>Cortical Surface Area</b>			0.72			0.87			0.79			0.45			0.69
N	47	47		59	36		8	87		38	57		8	87	
Min-Max	152691-223062	142443-219342		142443-223062	148797-220943		168102-197667	142443-223062		142443-223062	152691-220943		142443-208264	147078-223062	
Mean (SD)	177002 (17183.49)	179026 (17504.49)		177256 (16488.30)	178445 (19137.49)		181490 (11727.87)	177358 (17891.93)		177740 (18496.76)	177684 (16881.60)		174739 (22436.08)	177979 (17055.88)	
<b>Whole Brain Volume</b>			0.64			0.81			0.69			0.27			0.60
N	47	47		59	36		8	87		38	57		8	87	
Min-Max	971595-1403608	926895-1393940		926895-1403608	965679-1393940		104517-1290853	926895-1403608		926895-1403608	965679-1393940		926895-1382723	965679-1403608	
Mean (SD)	1142510 (114597.50)	1153743 (113885.57)		1141161 (106609.15)	1154673 (127705.76)		1158059 (88489.53)	1145199 (117040.24)		1152890 (119706.42)	1141876 (111893.33)		1123947 (155149.70)	1148335 (111085.07)	
<b>Ventricular Volume</b>			0.33			0.40			<b>0.02</b>			0.86			0.81

N	47	47		59	36		<b>8</b>	<b>87</b>		38	57		8	87	
Min-Max	6361-82836	6626-40141		6361-82836	6601-30983		<b>9261-58017</b>	<b>6361-82836</b>		6361-58017	6601-82836		7565-20074	6361-82836	
Mean (SD)	16318 (13519.40)	14276 (7398.05)		15797 (12748.09)	14237 (6796.41)		<b>24792 (16597.92)</b>	<b>14325 (9862.87)</b>		14870 (9691.28)	15430 (11660.87)		14107 (5040.27)	15307 (11262.46)	
<b>Diffusion DTI</b>			0.51			0.84			<b>0.05</b>			0.65			0.10
N	45	44		55	35		<b>7</b>	<b>83</b>		37	53		8	82	
Min-Max	0.73-0.86	0.73-0.85		0.74-0.86	0.73-0.84		<b>0.76-0.86</b>	<b>0.73-0.84</b>		0.73-0.84	0.73-0.86		0.78-0.84	0.73-0.86	
Mean (SD)	0.78 (0.02)	0.78 (0.03)		0.79 (0.03)	0.78 (0.02)		<b>0.80 (0.04)</b>	<b>0.78 (0.02)</b>		0.78 (0.03)	0.78 (0.03)		0.80 (0.02)	0.78 (0.03)	
<b>Diffusion RSI</b>			0.28			0.07			0.06			0.25			0.71
N	45	45		55	35		7	83		37	53		8	82	
Min-Max	0.60-0.72	0.64-0.73		0.60-0.73	0.64-0.73		0.60-0.69	0.64-0.73		0.64-0.72	0.60-0.73		0.64-0.69	0.60-0.73	
Mean (SD)	0.68 (0.02)	0.69 (0.02)		0.68 (0.02)	0.69 (0.02)		0.67 (0.03)	0.69 (0.02)		0.68 (0.02)	0.69 (0.02)		0.67 (0.02)	0.69 (0.02)	
<b>RS-fMRI Gordon Network</b>			0.43			0.16			0.46			<b>0.02</b>			0.50
N	42	42		52	33		4	81		<b>34</b>	<b>51</b>		8	77	
Min-Max	0.12-0.48	0.11-0.42		0.12-0.48	0.11-0.42		0.15-0.28	0.11-0.48		<b>0.17-0.37</b>	<b>0.11-0.48</b>		0.22-0.34	0.11-0.48	
Mean (SD)	0.26 (0.07)	0.26 (0.06)		0.25 (0.06)	0.27 (0.07)		0.22 (0.05)	0.26 (0.06)		<b>0.25 (0.04)</b>	<b>0.26 (0.08)</b>		0.27 (0.04)	0.26 (0.07)	

eTable 7: Neurodevelopmental outcomes in post hoc analysis													
ND test	Scores	Presence of HBE			Presence of NDD			Presence of PLI			Presence of Chromatin		
		Yes	No	P-value from Mixed model	Yes	No	P-value from Mixed model	Yes	No	P-value from Mixed model	Yes	No	P-value from Mixed model
		(N=132)	(N=86)		(N=25)	(N=193)		(N=95)	(N=123)		(N=16)	(N=202)	
Primary outcome measure: Academics													
WRAT-IV (>= 8 yrs)	Reading Composite			0.60			0.11			0.28			0.08
	N	118	74		23	169		89	103		15	177	
	Min-Max	54.0-137.0	67.0-133.0		54.0-122.0	54.0-137.0		54.0-132.0	66.0-137.0		54.0-131.0	54.0-137.0	
	Mean (SD)	102.5 (16.52)	105.1 (13.84)		97.9 (15.82)	104.3 (15.41)		102.1 (16.26)	104.7 (14.91)		95.5 (20.30)	104.2 (14.97)	
	Spelling			0.50			0.16			0.58			0.15
	N	119	73		24	168		89	103		15	177	
	Min-Max	54.0-145.0	55.0-142.0		54.0-122.0	54.0-145.0		54.0-145.0	55.0-142.0		54.0-117.0	54.0-145.0	
	Mean (SD)	102.8 (17.61)	102.7 (14.76)		98.3 (16.81)	103.4 (16.46)		103.1 (17.61)	102.4 (15.65)		95.4 (15.86)	103.4 (16.49)	
	Math Computation			0.24			0.71			0.73			0.51
	N	129	80		23	186		93	116		16	193	
	Min-Max	41.0-139.0	59.0-130.0		54.0-136.0	41.0-139.0		54.0-136.0	41.0-139.0		54.0-124.0	41.0-139.0	
	Mean (SD)	96.3 (19.26)	99.4 (16.05)		96.9 (20.62)	97.6 (17.85)		97.3 (19.36)	97.6 (17.15)		94.0 (19.89)	97.8 (18.00)	
Intelligence													



WISC-V (< 16 yrs) & WAIS-IV (>= 16 yrs)	Full-Scale IQ All Ages Standard Score			0.18			0.49			0.52			0.13
	N	129	80		23	186		93	116		16	193	
	Min-Max	39.0-136.0	45.0-130.0		39.0-130.0	39.0-136.0		39.0-136.0	45.0-130.0		39.0-129.0	39.0-136.0	
	Mean (SD)	95.4 (18.40)	100.2 (16.49)		94.9 (20.97)	97.5 (17.42)		97.0 (19.00)	97.5 (16.88)		89.9 (20.47)	97.8 (17.49)	
	Verbal Comprehension Index All Ages Standard Score			0.24			0.26			0.26			0.01
	N	131	85		24	192		95	121		16	200	
	Min-Max	44.0-143.0	55.0-145.0		49.0-136.0	44.0-145.0		44.0-143.0	55.0-145.0		49.0-130.0	44.0-145.0	
	Mean (SD)	100.9 (18.70)	104.9 (17.38)		98.8 (19.41)	103.0 (18.11)		101.3 (19.28)	103.4 (17.43)		91.4 (20.42)	103.4 (17.83)	
WAIS-IV (>= 16 yrs)	Working Memory			0.28			0.62			0.90			0.03
	N	51	41		11	81		43	49		5	87	
	Min-Max	49.0-136.0	60.0-136.0		49.0-136.0	49.0-136.0		49.0-136.0	63.0-117.0		49.0-95.0	49.0-136.0	
	Mean (SD)	96.9 (17.12)	94.6 (15.75)		95.5 (25.76)	96.0 (15.03)		96.1 (20.76)	95.7 (11.73)		73.8 (16.39)	97.2 (15.65)	
Executive Function													
Conners-3 Teacher (< 18 yrs)	Executive Functioning			0.79			0.56			0.80			0.09
	N	51	22		8	65		33	40		9	64	
	Min-Max	39.0-74.0	39.0-81.0		40.0-73.0	39.0-81.0		39.0-71.0	39.0-81.0		49.0-71.0	39.0-81.0	

	Mean (SD)	54.1 (11.31)	53.6 (10.36)		57.6 (12.64)	53.5 (10.76)		53.4 (10.61)	54.4 (11.36)		58.7 (7.23)	53.3 (11.27)	
BRIEF-2 Teacher (< 18 yrs)	Global Executive Composite			0.25			0.58			0.88			0.62
	N	59	30		7	82		40	49		10	79	
	Min-Max	38.0-87.0	40.0-75.0		47.0-66.0	38.0-87.0		40.0-84.0	38.0-87.0		46.0-73.0	38.0-87.0	
	Mean (SD)	55.8 (12.77)	52.8 (9.64)		55.6 (7.85)	54.7 (12.15)		54.7 (11.48)	54.9 (12.24)		56.5 (9.96)	54.6 (12.09)	
Memory													
WRAML-2 (>= 8 yrs)	IMMEDIATE Recall: Story Memory			0.16			0.38			0.03			0.24
	N	132	85		25	192		95	122		16	201	
	Min-Max	0.0-18.0	1.0-19.0		0.0-16.0	0.0-19.0		0.0-16.0	3.0-19.0		0.0-14.0	0.0-19.0	
	Mean (SD)	9.9 (3.56)	10.7 (2.96)		9.8 (3.52)	10.3 (3.34)		9.7 (3.70)	10.7 (3.01)		9.3 (4.00)	10.3 (3.30)	
	IMMEDIATE Recall: Picture Memory			0.35			0.41			0.008			0.12
	N	129	80		23	186		93	116		16	193	
	Min-Max	0.0-16.0	3.0-15.0		0.0-14.0	0.0-16.0		0.0-14.0	3.0-16.0		0.0-13.0	0.0-16.0	
	Mean (SD)	8.3 (3.23)	8.8 (2.77)		7.8 (3.45)	8.6 (3.01)		7.8 (3.13)	9.0 (2.91)		7.4 (3.65)	8.6 (3.00)	
	DELAYED Recall: Story Memory Recall			0.11			0.53			0.08			0.17
	N	132	85		25	192		95	122		16	201	
	Min-Max	0.0-18.0	1.0-19.0		0.0-16.0	0.0-19.0		0.0-16.0	1.0-19.0		0.0-15.0	0.0-19.0	
	Mean (SD)	9.9 (3.50)	10.8 (3.01)		10.0 (3.77)	10.3 (3.28)		9.8 (3.77)	10.6 (2.92)		9.3 (4.30)	10.3 (3.25)	

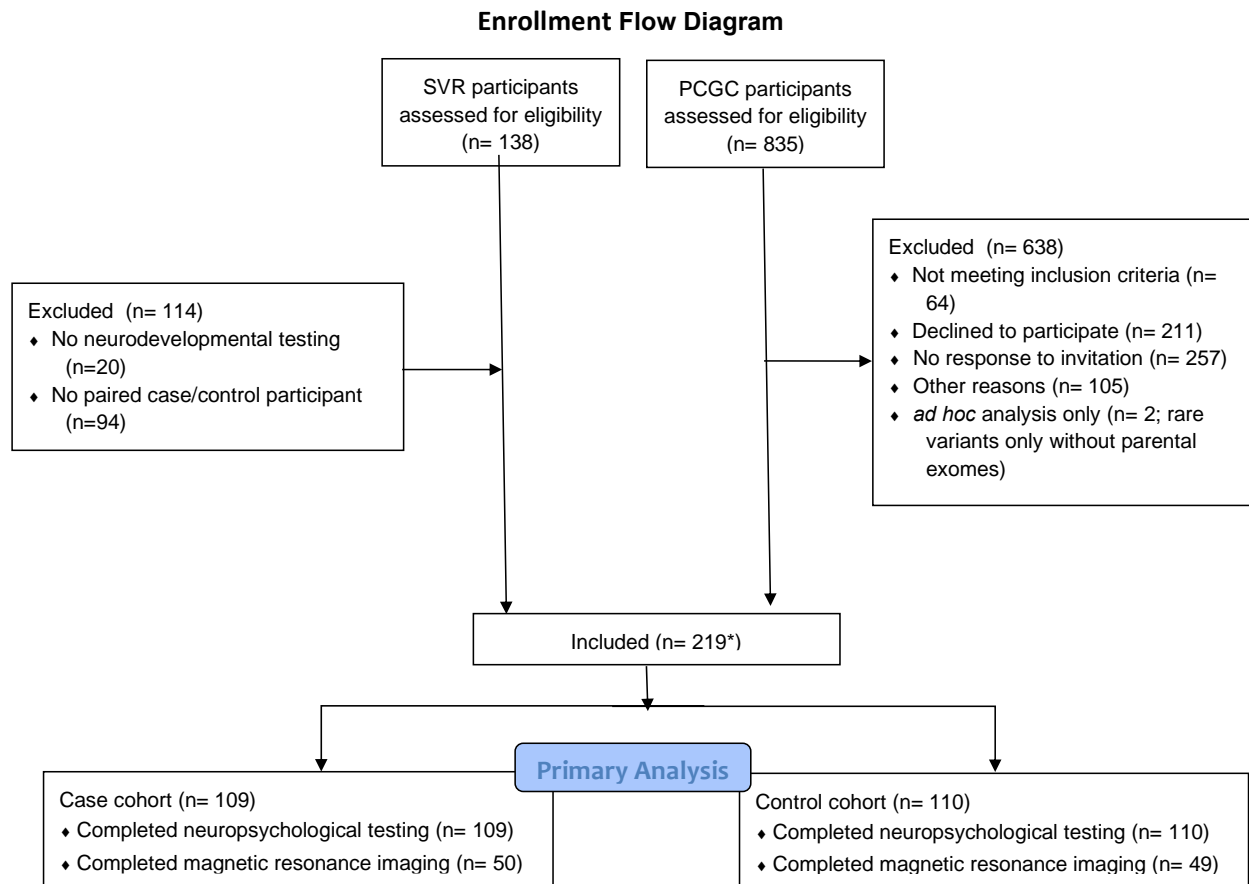
	DELAYED Recall: Picture Memory Recognition		0.89				0.34			0.93			0.70
	N	129	80		23	186		93	116		16	193	
	Min-Max	0.0-19.0	5.0-14.0		0.0-16.0	0.0-19.0		0.0-19.0	1.0-18.0		0.0-19.0	0.0-18.0	
	Mean (SD)	9.3 (3.74)	9.5 (2.12)		8.8 (3.37)	9.4 (3.19)		9.4 (3.59)	9.4 (2.89)		9.2 (5.08)	9.4 (3.02)	
ADOS and SRS													
Screening classification	Composite outcome defined by ADOS-2 and SRS-2 Total Score <sup>1</sup>			-			0.88			0.21			0.01
	Non Spectrum	96 (88.9%)	61 (100%)		18 (90.0%)	139 (93.3%)		73 (91.3%)	84 (94.4%)		10 (71.4%)	147 (94.8%)	
	Autism/Autism Spectrum	12 (11.1%)			2 (10.0%)	10 (6.7%)		7 (8.8%)	5 (5.6%)		4 (28.6%)	8 (5.2%)	
Social Responsiveness Scale (SRS) (>= 8 yrs)	SRS-2 Total Score			0.08			0.86			0.94			0.03
	N	123	75		22	176		86	112		15	183	
	Min-Max	11.0-99.0	36.0-67.0		36.0-83.0	11.0-99.0		11.0-99.0	26.0-87.0		38.0-99.0	11.0-99.0	
	Mean (SD)	51.6 (13.43)	47.4 (8.10)		50.9 (10.84)	49.9 (12.00)		49.8 (12.91)	50.1 (11.03)		57.3 (17.22)	49.4 (11.16)	
Language Deficits													
WIAT-III (>= 8 yrs)	Listening Comprehension			0.10			0.64			0.05			0.10
	N	116	73		23	166		88	101		14	175	

	Min-Max	39.0-133.0	61.0-139.0		39.0-128.0	39.0-139.0		39.0-133.0	65.0-139.0		39.0-126.0	39.0-139.0	
	Mean (SD)	102.0 (18.10)	106.3 (15.22)		100.7 (22.07)	104.1 (16.38)		100.7 (19.68)	106.2 (14.16)		96.6 (24.80)	104.2 (16.34)	
Adaptive Functioning													
Vineland-3 (>= 8 yrs)	Adaptive Behavior Composite			0.67			0.87			0.77			0.23
	N	102	59		19	142		75	86		11	150	
	Min-Max	56.0-125.0	69.0-124.0		75.0-125.0	56.0-124.0		56.0-125.0	60.0-124.0		56.0-118.0	58.0-125.0	
	Mean (SD)	99.8 (14.17)	102.7 (11.83)		99.8 (13.63)	101.0 (13.40)		100.6 (13.32)	101.1 (13.53)		94.0 (16.24)	101.4 (13.09)	
	Motor Skills			0.57			0.90			0.08			0.52
	N	26	10		2	34		14	22		4	32	
	Min-Max	62.0-118.0	81.0-105.0		89.0-105.0	62.0-118.0		85.0-118.0	62.0-111.0		81.0-111.0	62.0-118.0	
	Mean (SD)	97.5 (13.00)	95.7 (10.88)		97.0 (11.31)	97.0 (12.54)		101.2 (9.18)	94.4 (13.49)		102.8 (14.57)	96.3 (12.09)	
Anxiety and Depression													
CDI-2 (< 18 yrs)	Total T-Score			0.19			0.82			0.10			0.53
	N	74	38		14	98		48	64		10	102	
	Min-Max	35.0-79.0	36.0-74.0		35.0-79.0	35.0-74.0		35.0-74.0	35.0-79.0		39.0-71.0	35.0-79.0	
	Mean (SD)	49.7 (10.23)	50.3 (9.86)		51.0 (12.32)	49.8 (9.77)		48.4 (8.62)	51.1 (10.95)		52.5 (10.00)	49.7 (10.09)	

Beck Anxiety Inventory (>= 18 yrs)	BAI Total Raw Score			0.17			0.19			>0.99			0.09
	N	41	32		8	65		37	36		4	69	
	Min-Max	0.0-64.0	0.0-56.0		0.0-64.0	0.0-64.0		0.0-64.0	0.0-56.0		5.0-64.0	0.0-64.0	
	Mean (SD)	13.4 (14.41)	8.8 (11.66)		17.8 (19.59)	10.6 (12.42)		11.9 (14.97)	10.8 (11.74)		21.3 (28.58)	10.8 (12.16)	
Beck Depression Inventory (>= 18 yrs)	BDI-2 Total Raw Score			0.18			0.13			0.61			0.07
	N	41	32		8	65		36	73		4	69	
	Min-Max	0.0-64.0	0.0-41.0		2.0-64.0	0.0-64.0		0.0-41.0	0.0-64.0		5.0-64.0	0.0-64.0	
	Mean (SD)	12.2 (14.46)	7.9 (9.05)		17.4 (20.83)	9.4 (11.01)		9.2 (10.67)	10.3 (12.50)		20.0 (29.34)	9.7 (11.02)	
ADHD/Attention													
Conners-3 Parent (< 18 yrs)	DSM-5 ADHD Hyperactive-Impulsive			0.44			0.28			0.11			0.72
	N	76	39		14	101		51	64		11	104	
	Min-Max	0.0-99.0	40.0-86.0		41.0-71.0	0.0-99.0		0.0-99.0	40.0-90.0		40.0-86.0	0.0-99.0	
	Mean (SD)	55.2 (16.71)	54.7 (13.54)		50.9 (8.46)	55.6 (16.34)		53.3 (16.32)	56.5 (15.07)		55.7 (15.25)	55.0 (15.76)	
Conners-3 Teacher (< 18 yrs)	DSM-5 ADHD Hyperactive-Impulsive			0.48			0.17			0.11			0.46
	N	51	23		66	74		33	41		9	65	

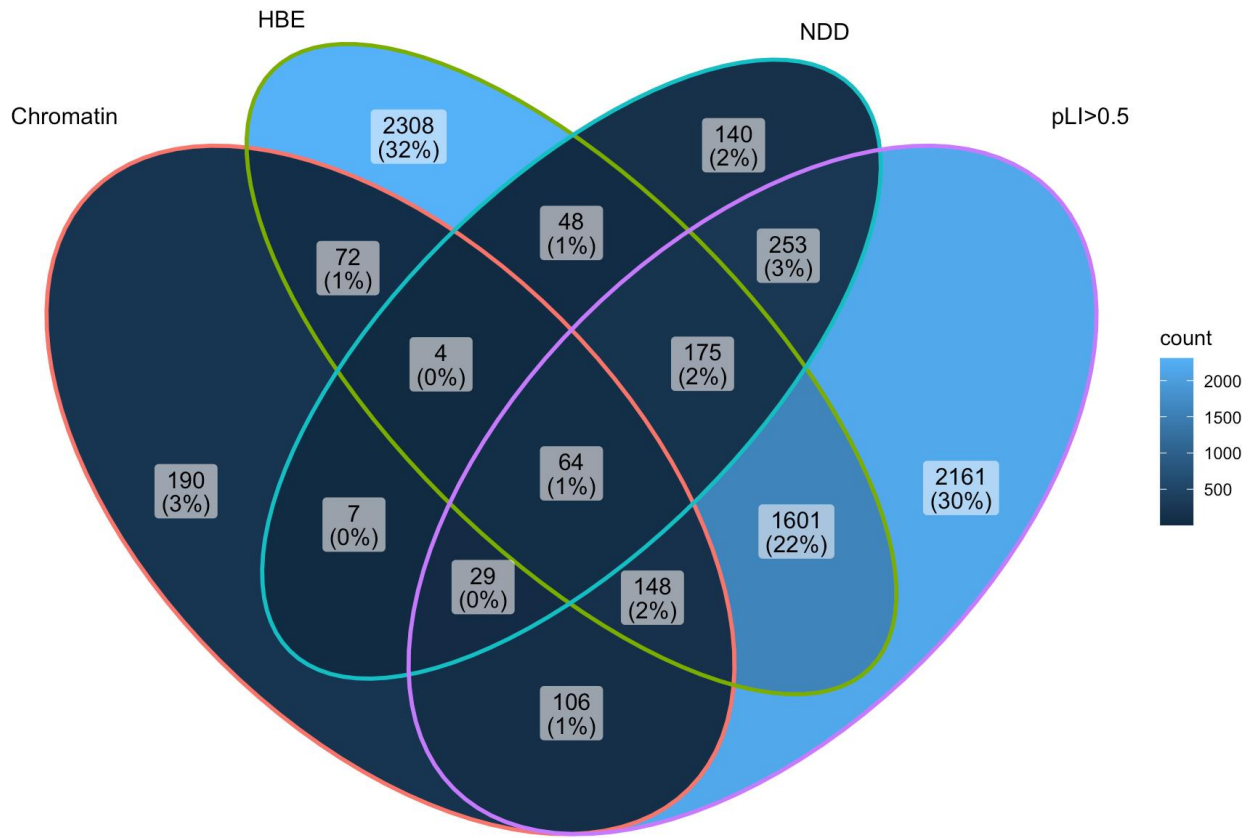
	Min-Max	42.0-91.0	43.0-89.0		42.0-91.0	42.0-91.0		42.0-87.0	42.0-91.0		43.0-77.0	42.0-91.0	
	Mean (SD)	57.1 (15.58)	52.6 (11.85)		55.9 (14.78)	55.7 (14.59)		52.5 (11.71)	58.2 (16.26)		53.6 (11.67)	56.0 (15.00)	
Conners' Adult ADHD Rating Scales (>= 18 yrs)	DSM-IV ADHD Symptoms Total			0.007			0.45			0.59			0.43
	N	42	33		9	66		37	38		4	71	
	Min-Max	32.0-91.0	31.0-85.0		35.0-91.0	31.0-91.0		32.0-91.0	31.0-85.0		41.0-91.0	31.0-91.0	
	Mean (SD)	55.5 (15.36)	46.6 (12.29)		54.9 (20.13)	51.2 (13.93)		52.8 (15.12)	50.5 (14.38)		55.5 (23.74)	51.4 (14.25)	
<p>*Normative values: The normative mean score is 100 and standard deviation (SD) is 15 for all tests with these exceptions: Behavior Rating Inventory of Executive Function, Second Edition (BRIEF-2)<sup>26</sup>, Children's Depression Index, Second Edition (CDI-2), Conners' Scales, Multidimensional Anxiety Scale for Children, Second Edition (MASC-2) has mean 50, SD 10); Delis-Kaplan Executive Function System (D-KEFS) has mean 10, SD 3)<sup>27</sup>; Social Responsiveness Scale, Second Edition (SRS-2) reports T-score ≥ 76 for severe symptoms, 66-75 for moderate, 60-65 for mild, and &lt; 60 typical<sup>28</sup>; Beck Anxiety Inventory (BAI) and Beck Depression Inventory, Second Edition (BDI-II) score 30-63 for severe symptoms, 17-29 for moderate, 10-16 for mild, and 0-9 for minimal<sup>29,30</sup>.</p>													

eFigure 1. Patient enrollment flow diagram.



\*All 211 included in *ad hoc* analysis based on rare *de novo* or inherited predicted loss-of-function variants

eFigure 2. Venn diagram of shared genes between the four gene lists used in the *ad hoc* analysis.





## eMethods

### *Study Population*

Among 613 eligible PCGC participants, 197 consented to the study (97 cases, 98 controls, and 2 controls with singleton ES included only in the rare variant analysis; Supplemental Figure 1, Supplemental Table 1). SVR subjects had undergone neurodevelopmental testing and trio exome sequencing (ES) in the parent study; our analysis included 12 with dDNVs and 12 SVR controls without such variants.

### *Determination of Heterozygous Status*

Genomic results for the PCGC participants included ES (n=188), genome sequencing (GS; n=67 who also had ES), and molecular inversion probe sequencing (MIPS; 9 participants). A dDNV-NA was defined as a *de novo* coding variant in a gene not associated with risk of NDD<sup>1</sup> that was predicted to be damaging based on a MetaSVM rankscore > 0.83 on available genomic analysis<sup>2,3</sup> (Supplemental Table 2). Case participants were selected based on the absence of dDNV-NAs. Analysis of dDNV-NAs in GS data did not change the case/control status of any participants. The nine PCGC participants classified as cases by MIPS were also studied by singleton (participant-only) exome sequencing to ensure the absence of other pathogenic variants. Two control PCGC participants had singleton exome sequencing and therefore were only included in rare variant analyses.

In *post-hoc* analysis, dDNV or rare pLOF variants from cases and controls were identified in ES data as previously described<sup>3,4</sup>. Each participant (case or control) was re-categorized based on presence or absence of a rare (allele frequency <  $1 \times 10^{-5}$  in gnomAD) pLOF variant in a chromatin gene (620 genes), high brain-expressed (HBE) gene (upper quartile of mouse brain expression at E14.5<sup>2</sup>, 4420 genes), constrained gene with probability of intolerance to loss (pLI) > 0.5 in gnomAD 2.0 cohort (high pLI, 4543 genes), or gene known to be associated with risk of NDD (based on literature review through April 2017; 720 genes, Supplemental Tables 3-4). The number of participants with pLOF heterozygous status in genes from four non-mutually exclusive categories were: chromatin modifying (n = 16), HBE (n = 132), high pLI (n = 95) or NDD (n = 25). The other participants were not heterozygous in each category. As participants with a dDNV-NA in a gene known to be associated with risk of NDD at the time of the study launch were excluded from enrollment, the only NDD gene variants present in the cohort were 1) transmitted from parents, 2) single variants in genes with recessive disease mechanisms, and/or 3) not known to be associated with NDD at the time of enrollment. Twenty pLOF variants in NDD risk genes were inherited from a parent (five were single variants in NDD risk genes with recessive disease mechanism, while 15 were in genes with autosomal dominant mechanism); three were pLOF dDNV-NAs in genes with an autosomal recessive mechanism of disease (CAD, MYO5A, and SBF1); and two were pLOF dDNV-NAs in genes newly associated with NDD risk after study enrollment began (COL6A1 and TBX18).

### *Neuropsychological Testing*

**Academic Achievement:** All participants completed the Wide Range Achievement Test 4 (WRAT4), a norm-referenced, examiner-administered test that measures the basic academic skills of word reading, sentence comprehension, spelling, and math computation<sup>5</sup>. The WRAT4 was standardized on a representative national sample of over 3,000 individuals ranging in age from 5 to 94 years. Scores have a mean of 100 and standard deviation of 15.

**Intelligence:** Participants under 16 years of age completed the norm-referenced, examiner-administered Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V)<sup>6</sup>. Scores were calculated for the Full Scale Intelligent Quotient (FSIQ), Verbal Comprehension Index, Fluid Reasoning Index, and Processing Speed Index. For participants 16 years or older, the norm-referenced, examiner-administered Wechsler Adult Intelligent Scale, Fourth Edition (WAIS-IV)<sup>7</sup> was used. The WAIS-IV generates an FSIQ as well as Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed Index scores. The mean of the WISC-V and WAIS-IV is 100, and the standard deviation is 15.

**Learning and Attention:** Participants, parents and teachers of all participants < 18 years old completed a Conners-3 multi-informant questionnaire measure of Attention-Deficit/Hyperactivity Disorder (ADHD) and its most common associated conditions in children and adolescents<sup>8</sup>. Symptom scales measure domains including, but not limited to: learning problems, DSM-V inattentive symptoms, DSM-V hyperactive-impulsive symptoms. Participants over the age of 18 years completed the Conners' Adult ADHD Rating Scales (CAARS), a self-report questionnaire. The CAARS yields scores including DSM-IV Total ADHD symptoms. Scores on the Conners-3 and CAARS domains are presented as T-scores with a mean of 50 and a standard deviation of 10.

Executive Function: Parents and teachers of all participants < 18 years old completed the Behavior Rating Inventory of Executive Function, Second Edition (BRIEF-2)<sup>9</sup>, which measures executive skills functioning. The Global Executive Composite score was used in the current study. Executive function was also assessed with the Conners-3 questionnaires completed by parents and teachers for participants < 18 years old<sup>8</sup>. BRIEF-2 and Conners-3 scores are presented as T-scores, which have a mean of 50 and a standard deviation of 10. All participants completed selected subtests of the norm-referenced, examiner-administered Delis-Kaplan Executive Function System (D-KEFS)<sup>10</sup>, which measures overall executive functioning. The specific subtests used were the Tower test (planning and inhibition of impulsive behavior; Total Achievement Score) and Verbal Fluence-Category Switching (cognitive flexibility, set-shifting; Total Accuracy score). The mean is 10, and the standard deviation is 3.

Memory: All participants completed selected subtests of the norm-referenced, examiner-administered Wide Range Assessment of Memory and Learning, Second Edition (WRAML2)<sup>11</sup>. The Story Memory subtest measures the ability to remember contextual verbal information both immediately (independent recall) and after a brief (approx. 15 minute) delay (independent recall and cued recognition). The Picture Memory subtest assesses the ability to remember visual stimuli, both immediately and with delay. The mean is 100, and the standard deviation is 15.

Social Cognition: Parents administered the Social Responsiveness Scale, Second Edition (SRS-2)<sup>12</sup>, a questionnaire. The SRS-2 measures social awareness and cognition, social communication, social motivation, and repetitive/stereotypic behavior that are characteristic of an autism spectrum disorder. The SRS-2 scale is measured via T-score, with a T score of 76 or higher indicating severe symptom presence associated with an autism spectrum disorder, T scores of 66-75 indicate a moderate symptom presence, T scores of 60-65 reflect a mild symptom presence, and a T score of 59 or lower indicates functioning that is age typical. Participants who obtained a T score at or above 60 went on to be evaluated with the examiner-administered Autism Diagnostic Observation Schedule, Second Edition (ADOS-2)<sup>13</sup>, a test that allows for the assessment and diagnosis of autism spectrum disorders across age, developmental level, and language skills. There are four primary modules used for the age group included in the current study. Across the four modules, there is no mean or standard deviation; thus, cutoff scores are utilized to determine the potential for an autism spectrum disorder. Peer relations were also assessed with Conners-3 questionnaires completed by parents and teachers of participants < 18 years old.

Language: All participants completed the norm-referenced, examiner-administered Wechsler Individual Achievement Test, Third Edition (WIAT-III)<sup>14</sup>, Oral Language Component; included subtests were listening comprehension, oral expression and oral language. The mean is 100, and the standard deviation is 15.

Fine Motor: All participants completed the examiner-administered Beery-Buktenica Developmental Test of Visual Motor Integration Test, Sixth Edition (BEERYBEERY VMI)<sup>15</sup>, which measures the extent to which individuals can integrate their visual and motor abilities. The mean is 100, and the standard deviation is 15.

Adaptive Functioning: All parents of participants completed the Vineland Adaptive Behavior Scales, Third Edition (Vineland-3)<sup>16</sup>, which measures the adaptive functioning to assess whether subjects perform their activities of daily living at an age appropriate level. Five components were included – Adaptive Behavior Composite, as well as the four indices: Communication, Daily Living, Socialization, and Motor skills. The mean of the Vineland-3 is 100, and the standard deviation is 15.

Anxiety: Parents of participants < 18 years old completed the Multidimensional Anxiety Scale for Children, Second Edition (MASC-2)<sup>17</sup>, which measures children's level of overall anxiety as well as subscale scores. MASC-2 scores have a mean of 50 and a standard deviation of 10. For participants 18 years or older, the Beck Anxiety Inventory (BAI)<sup>18</sup>, a self-report inventory, was administered. The BAI is measured via a cut off score. There is no mean and standard deviation, but cut-off scores are used to determine the severity of anxiety symptoms: minimal, 0-9; mild, 10-16; moderate, 17-29; severe 30-63.

Depression: Parents of participants < 18 years old completed the Children's Depression Index, Second Edition (CDI-2)<sup>19</sup> to measure depressive symptoms in children. The CDI-2 assesses for both emotional problems and functional problems related to depressive symptomology. The CDI-2 is reported in T-scores, with a mean of 50 and a standard deviation of 10. Participants 18 years or older completed the Beck Depression Inventory, Second Edition

(BDI-II)<sup>20</sup>, a self-report measure of depression. Scores on the BDI-II are tallied and compared to cut-off scores that indicate the level of severity of depression: minimal, 0-13; mild, 14-19; moderate, 20-28; severe, 29-63.

### MRI Acquisition

The following is a brief description of those methods, as detailed previously. A small number of changes to the processing pipeline as described previously are indicated with footnotes. Magnetic resonance imaging was performed on either Siemens Prisma (two sites) or Prisma Fit (three sites), or General Electric MR750 (two sites). 32 channel head coils were used on all but one Prisma fit scanner, which used a 64 channel head coil. A standard scan session included sMRI series (T<sub>1</sub>w and T<sub>2</sub>w), one dMRI series, and four rs-fMRI series, in the following order: localizer, 3D T<sub>1</sub>-weighted images, 2 runs of resting state fMRI, diffusion weighted images, 3D T<sub>2</sub>-weighted images, and 2 runs of resting state fMRI. Scan sessions typically required ~50 minutes to complete. The T<sub>1</sub>w acquisition (1 mm isotropic) is a 3D T<sub>1</sub>w inversion prepared RF-spoiled gradient echo scan using prospective motion correction (Tisdall, et al., 2012; White, et al., 2010). The T<sub>2</sub>w acquisition (1 mm isotropic) is a 3D T<sub>2</sub>w variable flip angle fast spin echo scan, also using prospective motion correction. Prospective motion correction has not been implemented for the dMRI or fMRI acquisition. The dMRI acquisition (1.7 mm isotropic) uses multiband EPI (Moeller, et al., 2010; Setsompop, et al., 2012) with slice acceleration factor 3 and includes 96 diffusion directions, seven b=0 frames, and four b-values (6 directions with b=500 s/mm<sup>2</sup>, 15 directions with b=1000 s/mm<sup>2</sup>, 15 directions with b=2000 s/mm<sup>2</sup>, and 60 directions with b=3000 s/mm<sup>2</sup>). The fMRI acquisitions (2.4 mm isotropic, TR=800 ms) also use multiband EPI with slice acceleration factor 6. Each of the dMRI and fMRI acquisition blocks include spin-echo EPI fieldmap scans for B<sub>0</sub> distortion correction. The imaging protocol was developed in collaboration with each scanner manufacturer using commercially available system upgrades, and where possible, product sequences. Imaging parameters were made as similar as possible across scanner manufacturers, although some hardware and software constraints were unavoidable (for details, see Image acquisition parameters).

Siemens	Matrix	Slices	FOV	% FOV phase	Resolution (mm)	TR (ms)	TE (ms)	TI (ms)	Flip Angle (deg)	Parallel Imaging	MultiBand Acceleration	Phase partial Fourier	Diffusion Directions	b-values	Acquisition Time
	T1	256 x 256	176	256 x 256	100%	1.0 x 1.0 x 1.0	2500	2.88	1060	8	2x	Off	Off	N/A	N/A
T2	256 x 256	176	256 x 256	100%	1.0 x 1.0 x 1.0	3200	565	N/A	Variable	2x	Off	Off	N/A	N/A	6:35
Diffusion	140 x 140	81	240 x 240	100%	1.7 x 1.7 x 1.7	4100	88	N/A	90	Off	3	6/8	96	500, 1000, 2000, 3000	7:31
fMRI	90 x 90	60	216 x 216	100%	2.4 x 2.4 x 2.4	800	30	N/A	52	Off	6	Off	N/A	N/A	5:00

GE	Matrix	Slices	FOV	% FOV phase	Resolution (mm)	TR (ms)	TE (ms)	TI (ms)	Flip Angle (deg)	Parallel Imaging	MultiBand Acceleration	Phase partial Fourier	Diffusion Directions	b-values	Acquisition Time
	T1	256 x 256	208	256 x 256	100%	1.0 x 1.0 x 1.0	2500	2	1060	8	2x	Off	Off	N/A	N/A
T2	256 x 256	208	256 x 256	100%	1.0 x 1.0 x 1.0	3200	60	N/A	Variable	2x	Off	Off	N/A	N/A	5:50
Diffusion	140 x 140	81	240 x 240	100%	1.7 x 1.7 x 1.7	4100	81.9	N/A	90	Off	3	5.5/8	96	500, 1000, 2000, 3000	7:30
fMRI	90 x 90	60	216 x 216	100%	2.4 x 2.4 x 2.4	800	30	N/A	52	Off	6	Off	N/A	N/A	5:00

**Image acquisition parameters.** Scanner models: Siemens Prisma VE11B-C. GE MR759 DV25-26. For dMRI acquisition, number of diffusion directions for each b-value: 500 (6-dirs), 1000 (15-dirs) 2000 (15-dirs), 3000 (60-dirs).

### Data Transfer and Initial Quality Control

Imaging data in DICOM format were packaged as tgz files, sent electronically from participating sites to the MRI Core, and automatically categorized into the different types of imaging series: T<sub>1</sub>w, T<sub>2</sub>w, dMRI, and rs-fMRI. Using web-based REDCap reports, MRI Core staff identified participants with missing data, and worked with sites to facilitate data transfer if needed. DICOM files were extracted from the tgz files received at the MRI Core<sup>1</sup> and then reviewed for problems such as incorrect acquisition parameters, imaging artifacts, or corrupted data files, using a combination of automated and manual methods. Automated protocol compliance checks providing information about the completeness of the imaging series and the adherence to the intended imaging parameters. Automated quality control procedures include the calculation of metrics such as signal-to-noise ratio (SNR) and head motion statistics. Trained technicians visually reviewed image series for poor image quality, noting various imaging artifacts and flagging unacceptable data, typically those with the most severe artifacts or irregularities. All

<sup>1</sup> Offline reconstruction of multiband EPI data from raw k-space files into DICOM files was performed for dMRI and fMRI data collected on a GE scanner with software version DV25, using software supplied by GE. In late 2018, GE scanners were upgraded to software version DV26, supporting online reconstruction of multiband data and providing DICOM files.

series were consensus rated by two or more reviewers. Series rejected based on data quality criteria were excluded from subsequent processing and analysis. T1w and T2w images for each participant were reviewed by a neuroradiologist who recorded the number, approximate size, and general location of focal infarcts, number and location of foci of low or high T2w signal, and other abnormalities.

### *sMRI Processing and Analysis*

T<sub>1</sub>w and T<sub>2</sub>w structural images were corrected for gradient nonlinearity distortions, and T<sub>2</sub>w images were registered to T<sub>1</sub>w images using mutual information (Jovicich, et al., 2006; Wald, et al., 2001). Intensity inhomogeneity correction was performed by applying smoothly varying bias fields estimated using sparse spatial smoothing and white matter segmentation, with the assumption of uniform T<sub>1</sub>w (or T<sub>2</sub>w) intensity values within white matter (Hagler, et al., 2019). Images were rigidly registered and resampled into alignment with an averaged reference brain in standard space. Manual quality control (QC) performed prior to full image processing was used to exclude poor-quality structural scans or select one for processing in the case of multiple acceptable scans of a given type.

Cortical surface reconstruction and subcortical segmentation were performed using FreeSurfer (Fischl, 2012) (version 5.3), a software package validated for use in children (Ghosh, et al., 2010) and used successfully in large pediatric studies (Jernigan, et al., 2016; Levman, et al., 2017). The T<sub>2</sub>w MRI volumes were not used in the cortical surface reconstruction and subcortical segmentation. Subcortical structures were labeled using automated, atlas-based, volumetric segmentation procedure (Fischl, et al., 2002). Labels for cortical gray matter and underlying white matter voxels were assigned based on cortical folding patterns and Bayesian classification rules for two standard parcellation schemes (Desikan, et al., 2006; Destrieux, et al., 2010). Fuzzy-cluster parcellations based on genetic correlation of surface area were used to calculate averages of cortical surface measures for each parcel (Chen, et al., 2012). Functionally-defined parcels based on resting-state correlations in fMRI (Gordon, et al., 2016) were resampled from atlas-space to individual subject-space and used for resting-state fMRI analysis. Morphometric measures include cortical thickness (Fischl and Dale, 2000; Rimol, et al., 2010), area (Chen, et al., 2012; Joyner, et al., 2009), volume, and sulcal depth (Fischl, et al., 1999). Image intensity measures include T<sub>1</sub>w, T<sub>2</sub>w, and T<sub>1</sub>w and T<sub>2</sub>w cortical contrast (Westlye, et al., 2009). Cortical contrast was calculated as the normalized difference of gray versus white matter, sampled at a distance of  $\pm 0.2$  mm relative to the gray-white boundary.

To ensure the quality of derived measures trained technicians reviewed the accuracy of cortical surface reconstruction. For each cortical surface reconstruction reviewers gauged the severity of five categories of image artifact or reconstruction inaccuracy: motion, intensity inhomogeneity, white matter underestimation, pial overestimation, and magnetic susceptibility artifact. The reviewers assigned an overall QC score indicating whether the cortical surface reconstruction is recommended for use (1) or recommended for exclusion (0). Exclusion was recommended if any of the five categories were rated as severe.

### *dMRI Processing and Analysis*

Preprocessing of dMRI series included corrections for eddy current distortions, head motion, B<sub>0</sub> distortion, and gradient nonlinearity distortion. A model-based approach based on diffusion gradient orientations and amplitudes was used to correct for eddy current distortions (Zhuang, et al., 2006), with corrections limited to displacement along the phase-encode direction (Andersson and Sotiropoulos, 2016; Barnett, et al., 2014; Rohde, et al., 2004; Zhuang, et al., 2006). To correct images for head motion, we rigid-body-registered each frame to the corresponding volume synthesized from a robust tensor fit, accounting for image contrast variation between frames. Dark slices caused by abrupt head motion were replaced with values synthesized from the robust tensor fit, and the diffusion gradient matrix was adjusted for head rotation. Spatial and intensity distortions caused by B<sub>0</sub> field inhomogeneity were minimized using FSL's TOPUP<sup>2</sup>, a robust and accurate tool for reducing spatial and intensity distortions in EPI images that relies on reversing phase-encode polarities (Andersson, et al., 2003; Chang and Fitzpatrick, 1992; Holland, et al., 2010; Morgan, et al., 2004). Gradient nonlinearity distortions were then corrected for each frame (Jovicich, et al., 2006). The b=0 dMRI images were registered to T<sub>1</sub>w structural images using mutual information (Wells, et al., 1996), after coarse pre-alignment via within-modality registration to atlas brains. dMRI images were then resampled in a standard orientation (relative to the T<sub>1</sub>w image rigidly registered to an atlas) with 1.7 mm isotropic resolution (equal to the dMRI acquisition resolution).

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<sup>2</sup> Note that this differs from the description in Hagler et al., 2019. The previous tool for estimation of B<sub>0</sub> distortion was replaced with FSL's TOPUP, which provides more accurate B<sub>0</sub> distortion correction, particularly in the presence of head motion between forward and reverse phase-encode polarity scans. This change is consistent with ABCD Release 3.0.

Several measures related to microstructural tissue properties were calculated using Diffusion Tensor Imaging (DTI) (Basser, et al., 1994; Basser and Pierpaoli, 1996) and Restriction Spectrum Imaging (RSI) (White, et al., 2013a; White, et al., 2014; White, et al., 2013b). The DTI full shell model (DTI<sub>FS</sub>) was calculated using all gradient strengths/shells (6 directions at  $b=500$  s/mm<sup>2</sup>, 15 directions at  $b=1000$  s/mm<sup>2</sup>, 15 directions at  $b=2000$  s/mm<sup>2</sup>, and 60 directions at  $b=3000$  s/mm<sup>2</sup>). The DTI inner shell (DTI<sub>IS</sub>) model fit was calculated with high b-value frames excluded (leaving 6 directions at  $b=500$  s/mm<sup>2</sup> and 15 directions at  $b=1000$  s/mm<sup>2</sup>) so that derived diffusivity measures better correspond to traditional single-b-value acquisitions. Measures derived from each DTI model included fractional anisotropy (FA), mean diffusivity (MD), longitudinal diffusivity (LD), and transverse diffusivity (TD). We use RSI to model mixtures of “restricted”, “hindered”, and “free” diffusion within individual voxels<sup>3</sup>. The signal fractions representing restricted (e.g., intracellular) and hindered (e.g., extracellular) diffusion were modeled as fourth order spherical harmonic, fiber orientation density (FOD) functions. For both fractions, the LD is modeled as  $1 \times 10^{-3}$  mm<sup>2</sup>/s. For the restricted fraction, TD is modelled as 0. For the hindered fraction, TD is modelled as  $0.9 \times 10^{-3}$  mm<sup>2</sup>/s. The free water fraction was modeled as isotropic diffusion with an apparent diffusion coefficient (ADC) of  $3.0 \times 10^{-3}$  mm<sup>2</sup>/s. Measures derived from this RSI model fit included restricted normalized isotropic (RNI), restricted normalized directional (RND), restricted normalized total (RNT), hindered normalized isotropic (HNI), hindered normalized directional (HND), and hindered normalized total (HNT), and free normalized isotropic (FNI)<sup>4</sup>. These normalized RSI measures are unitless and range from 0 to 1.

Mean DTI and RSI measures were calculated for white matter fiber tract ROIs created with AtlasTrack (Hagler, et al., 2009; Hagler, et al., 2019), ROIs derived from FreeSurfer’s automated subcortical segmentation (Fischl, et al., 2002), and cortical surface parcellations (Desikan, et al., 2006; Destrieux, et al., 2010), for cortical gray matter and white matter adjacent to the cortex (Elman, et al., 2017). Visual inspection of dMRI data after processing involved the comparison of RSI-derived RND images to corresponding co-registered T<sub>1</sub>w images. Two reviewers rated each dMRI series based on residual B<sub>0</sub> distortion, registration to the T<sub>1</sub>w image, image quality, segmentation integrity, and field of view (FOV) cutoff, and gave an overall pass-fail QC rating. Exclusion was recommended if any of the four categories were rated as severe.

### *fMRI Processing and Analysis*

Preprocessing of fMRI series included corrections for head motion using AFNI’s 3dvolreg (Cox, 1996), B<sub>0</sub> distortion correction using FSL’s TOPUP2 (Andersson, et al., 2003), and gradient nonlinearity distortion correction (Jovicich, et al., 2006). The displacement field for B<sub>0</sub> distortion correction was estimated from spin-echo calibration scans with reversing phase-encode polarities and applied to each gradient-echo fMRI series. Between-scan motion was corrected through image registration to a mid-session reference scan and resampling with cubic interpolation. Processed fMRI images remained in “native-space”, with 2.4 mm isotropic resolution. Registration between the spin-echo B<sub>0</sub> calibration scans and T<sub>1</sub>w structural images was performed using mutual information (Wells, et al., 1996), with coarse pre-alignment based on within-modality registration to atlas brains.

Measures of functional connectivity were computed using a seed-based correlational approach (Van Dijk, et al., 2010), adapted for cortical surface-based analysis (Seibert and Brewer, 2011). Additional processing steps included the removal of initial frames and normalization by the mean across time. Linear regression to remove quadratic trends, signals correlated with estimated motion time courses, and the mean time courses of cerebral white matter, ventricles, and whole brain, as well as their first derivatives (Power, et al., 2014; Satterthwaite, et al., 2012). Estimated motion time courses were temporally filtered to attenuate signals linked to respiration (Fair, et al., 2018). Frames with displacement (FD) greater than 0.3 mm were excluded from the regression (Power, et al., 2014). After regression and residualization, values for censored frames were replaced through linear interpolation<sup>5</sup>, and time courses were band-pass filtered between 0.009 and 0.08 Hz (Hallquist, et al., 2013).

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<sup>3</sup> Note that this differs from the RSI model described in Hagler et al., 2019, which included only restricted and hindered fractions. The addition of a free water fraction is consistent with the upcoming ABCD Release 4.0.

<sup>4</sup> Note that these abbreviations differ from those used in Hagler et al., 2019. RNI and HNI were previously called N0 and N0\_s2, respectively. RND and HND were previously called ND and ND\_s2. RNT and HNT were previously called NT and NT\_s2. FNI was not previously included.

<sup>5</sup> Note that this differs from the rs-fMRI preprocessing described in Hagler et al., 2019. Specifically, the linear interpolation step, which prevents motion contamination in the subsequent band-pass filtering, was previously omitted. The inclusion of this step is consistent with the upcoming ABCD Release 4.0.

Preprocessed time courses were projected onto the cortical surface for each individual subject by sampling cortical gray matter voxels 1 mm from the gray/white boundary. Average time courses were calculated for cortical surface-based ROIs using FreeSurfer's anatomically-defined parcellations (Desikan, et al., 2006; Destrieux, et al., 2010) and a functionally-defined parcellation based on resting-state functional connectivity patterns (Gordon, et al., 2016), resampled from atlas-space to individual subject-space. Average time courses were also calculated for subcortical ROIs (Fischl, et al., 2002).

Variance across time was calculated for each ROI, a measure that reflects the magnitude of low frequency oscillations. Correlation values were calculated for each pair of ROIs, Fisher transformed to z-statistics, and averaged within or between networks to provide summary measures of network correlation strength (Van Dijk, et al., 2010). Average correlations within and between networks defined in the Gordon parcellation were calculated as the average of the Fisher-transformed correlations for each unique pairwise combination of ROIs belonging to each network. Average correlations were also calculated for correlation between each network and each subcortical gray matter ROI.

Motion censoring was used to reduce residual effects of head motion (Power, et al., 2012; Power, et al., 2014). Time points with FD greater than 0.2 mm were excluded from the variance and correlation calculations. Time periods with fewer than five contiguous sub-threshold time points were also excluded, and an additional round of censoring was applied based on outliers with respect to spatial variation across the brain. ROI variance and network correlation values were averaged across rs-fMRI runs, weighted by the number of frames per run remaining after motion censoring. Runs with fewer than 100 usable time points (out of 375 acquired) were excluded from the average.

Visual inspection of fMRI data after processing involved the comparison to corresponding co-registered T<sub>1</sub>w images. Two reviewers rated each participant's fMRI images, averaged across all series, based on residual B<sub>0</sub> distortion, registration to the T<sub>1</sub>w image, image quality, and field of view (FOV) cutoff, and gave an overall pass-fail QC rating. Exclusion was recommended if any of the four categories were rated as severe.

## REFERENCES

1. McKusick-Nathans Institute of Genetic Medicine JHU. Online Mendelian Inheritance in Man, OMIM®. <https://omim.org/>
2. Homsy J, Zaidi S, Shen Y, et al. De novo mutations in congenital heart disease with neurodevelopmental and other congenital anomalies. *Science* (80- ). 2015;350(6265):1262-1266. doi:10.1126/science.aac9396
3. Jin SC, Homsy J, Zaidi S, et al. Contribution of rare inherited and de novo variants in 2,871 congenital heart disease probands. *Nat Genet.* 2017;49(11):1593-1601. doi:10.1038/ng.3970
4. Morton SU, Shimamura A, Newburger PE, et al. Association of Damaging Variants in Genes with Increased Cancer Risk among Patients with Congenital Heart Disease. *JAMA Cardiol.* Published online October 21, 2020. doi:10.1001/jamacardio.2020.4947
5. Wilkinson G, Robertson G. *Wide Range Achievement Test 4 Professional Manual.* Psychological Assessment Resources; 2006.
6. Wechsler D. *WISC-V Wechsler Intelligence Scale for Children - Fifth Ed.* 5th ed. Psychological Corporation; 2014.
7. Wechsler D. *Wechsler Adult Intelligence Scale--Fourth Edition (WAIS-IV).* Pearson; 2008.
8. Conners C. *Conners 3rd Edition (Conners 3).* 3rd ed. Pearson Clinical; 2008.
9. Gioia G, Isquith P, Guy S, Kenworthy L. Behavior Rating Inventory of Executive Function Second Edition. In: 2nd ed. Psychological Assessment Resources; 2015.
10. Baron IS. *Delis-Kaplan Executive Function System.* Vol 10. (Kaplan E, Kramer JH, Corporation P, eds.). Psychological Assessment Resources Inc; 2004.
11. Sheslow D, Adams W. *WRAML2 Wide Range Assessment of Memory & Learning Second Edition.* Wide Range; 2003.
12. Constantino J. *Social Responsiveness Scale, Second Edition.* Western Psychological Services; 2012.
13. Lord C, Rutter M, Dilavore P, Risi S, Gotham K, Bishop S. *Autism Diagnostic Observation Schedule, Second Edition.* Western Psychological Services; 2012.
14. Wechsler D. *Wechsler Individual Achievement Test.* Second Edi. The Psychological Corporation; 2009.
15. Beery K, Buktenica N, Beery N. *Beery-Buktenica Visual-Motor Integration Sixth Edition.* Pearson; 2010.
16. Sparrow S, Cicchetti D, Saulnier C. *Vineland Adaptive Behavior Scales Third Edition.* 3rd ed. Pearson; 2016.

17. March JS. *Multidimensional Anxiety Scale for Children: Third Edition*. 3rd ed. Multi-Health Systems; 2013.
18. Beck A. *Beck Anxiety Inventory*. Psychological Corporation; 1993.
19. Kovacs M. *Children's Depression Inventory Second Edition*. 2nd ed. Multi-Health Systems; 2011.
20. Beck A, Steer R, Brown G. *Beck Depression Inventory Second Edition*. 2nd ed. Harcourt; 1996.