

Table S1 Phenotypes of 11 fetuses

Case no.	Ultrasound diagnostic phenotype
#1	The shape of the fetal head is "strawberry"; the posterior horn of both lateral ventricles is about 1.0 cm wide; and the cisterna magna is about 1.2 cm wide
#2	The fetal head circumference is enlarged; there is forehead protuberance; the intracranial frontal lobe is full and disordered; and the midline, thalamus, and cerebellum are visible
#3	Fetus shows a single ventricle of approximately 0.5 cm wide
#4	Fetal head circumference ultrasound value is lower than M-2SD line
#5	The intracranial left cerebellar hemisphere of the fetus has a visible range of about 3.3 cm×1.4 cm without echo. The lower margin is immediately above the cerebellar curtain; the medial margin is near the midline of the brain; and the upper margin is near the thalamus. The shape is irregular, and there is no obvious communication with the left ventricle
#6	The fetal head circumference ultrasound value is lower than the M-2SD line
#7	The fetal head circumference ultrasound value is lower than the M-2SD line
#8	The midline of the fetus' brain is not continuous, and the anterior horns of the lateral ventricles communicate with each other
#9	The fetal biparietal diameter and head circumference ultrasound measurements are lower than the M-2SD line
#10	The posterior horns of the bilateral ventricles of the fetus are about 1.2 cm wide, and the anterior horns are abducted. The bilateral ventricles showed water drop-like appearance.. The transparent compartment is not shown. The third ventricle is raised and about 0.4 cm wide. The cisterna magna is about 1.2 cm wide. The cerebellar vermis is not shown. The cisterna magna is connected to the 4 th ventricle, which measures about 0.6 cm wide
#11	The left lateral ventricle of the fetus is about 1.15 cm wide, and the right lateral ventricle is about 1.09 cm wide

M-2SD, Mean-2 Standard Deviation; cm, Centimeter

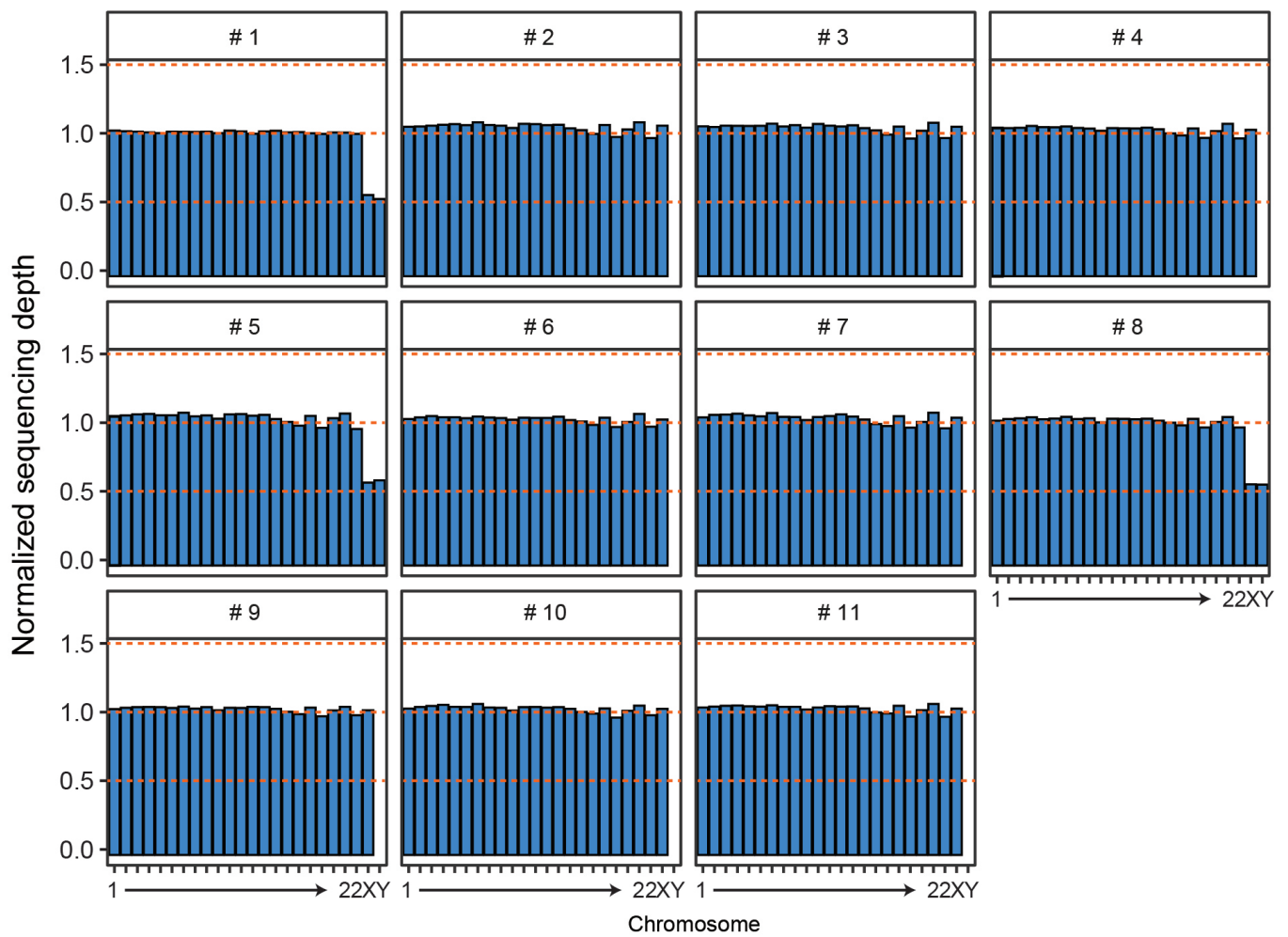


Figure S1 The average normalized sequencing depth of each chromosome for 11 fetuses. The sequencing coverage of each 10-kb genomic region is normalized by the median coverage of all 10-kb regions.

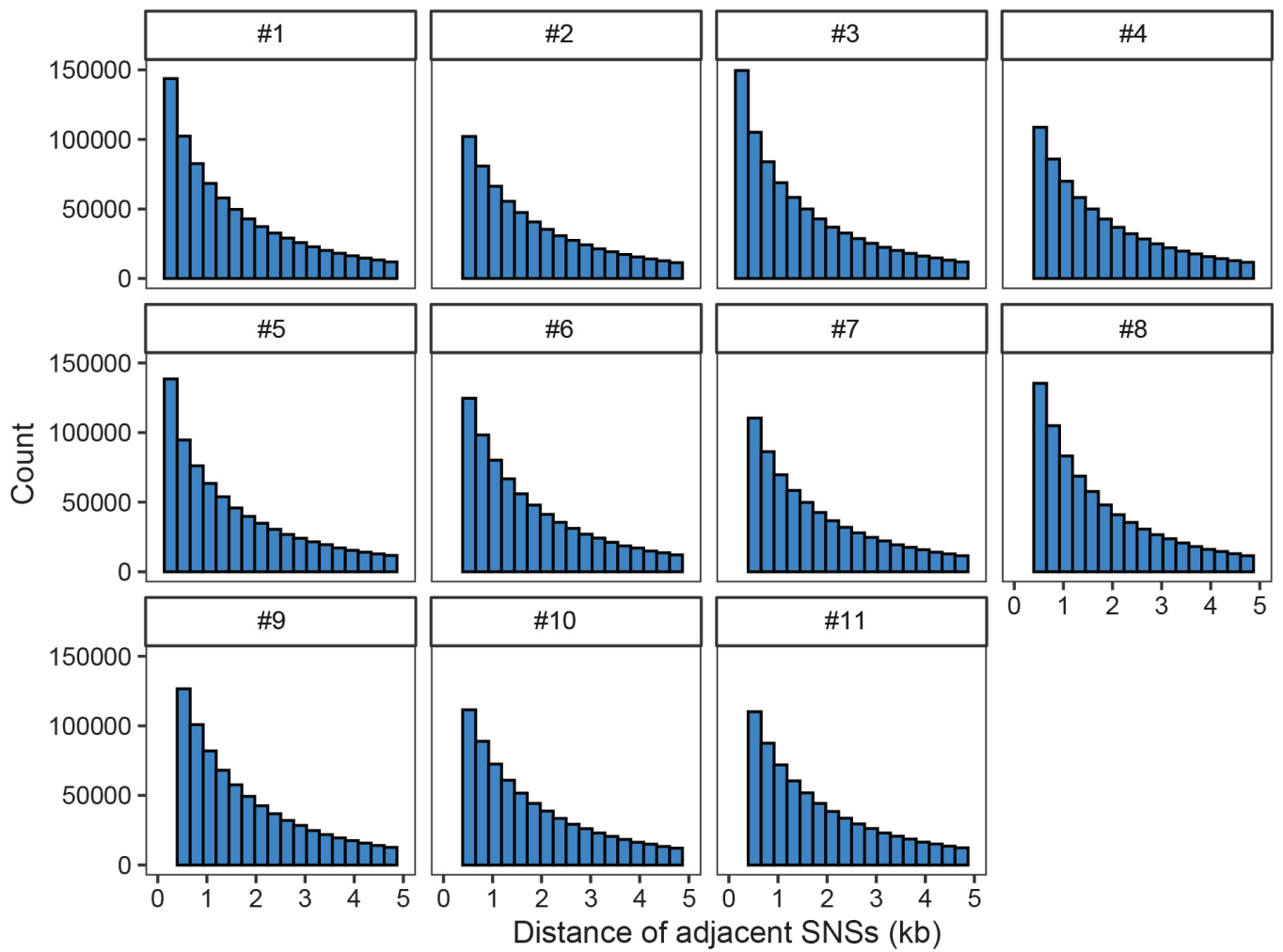


Figure S2 The distribution of the distance between adjacent single nucleotide substitutions (SNSs).

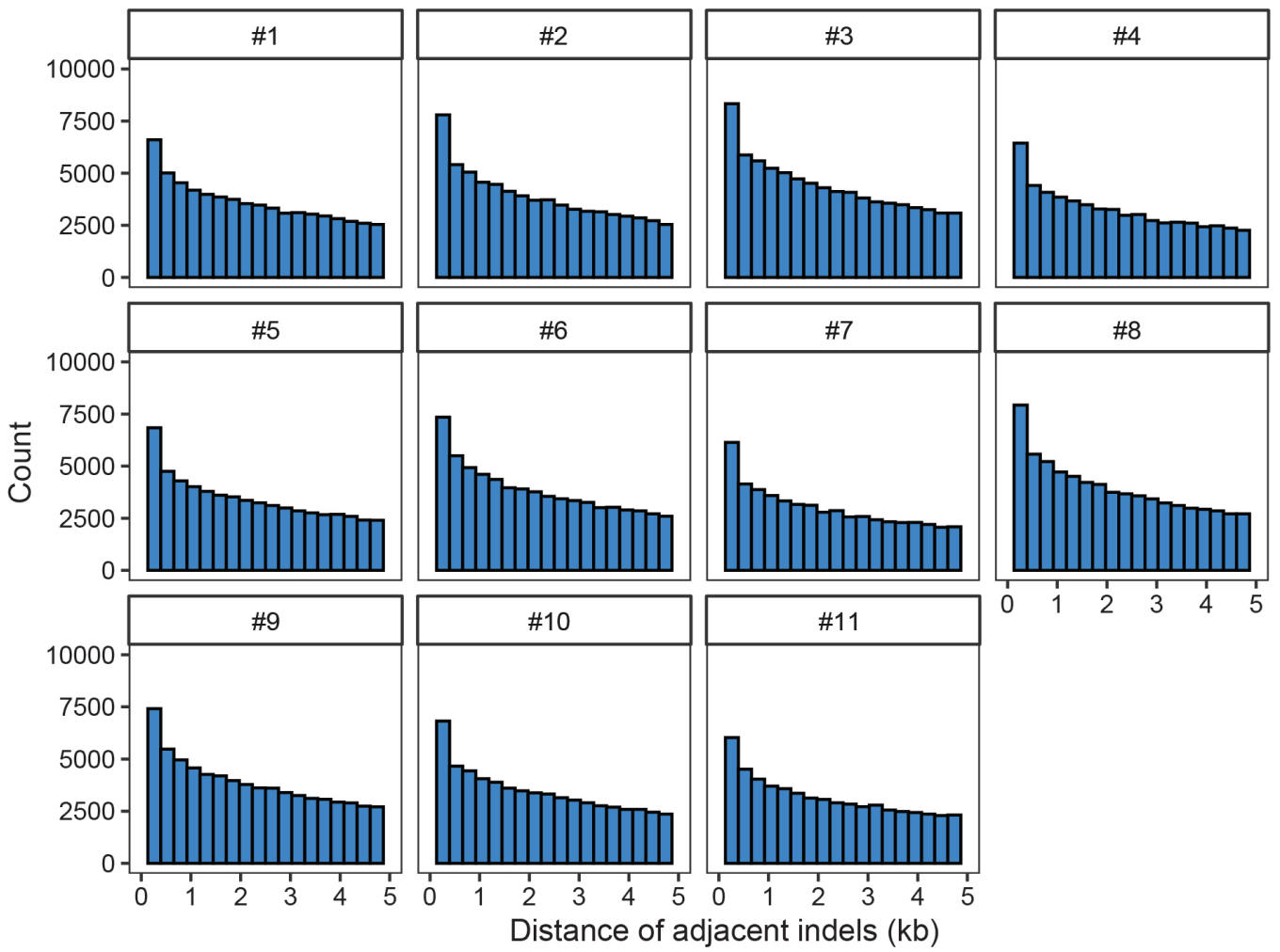


Figure S3 The distribution of the distance between adjacent insertions and deletions (inDels).

Table S2 Genes listed in each enriched GO term

Term	Genes
Negative regulation of chondrocyte differentiation	ADAMTS7, TGFBF1, GDF5, ADAMTS12, GLI2, SNAI2
Regulation of Rho protein signal transduction	DLC1, MURC, OBSCN, ARHGEF33, PLEKHG6, ARHGEF28, ARHGEF5, TRIO, ARHGEF9, SPATA13, ARHGEF10L, ARHGEF10
Detection of bacterium	NLRC4, NOD1, PGLYRP4, HLA-DRB1, HLA-DRB5
Liver development	ACADM, XBP1, GATA6, IGF2R, RB1CC1, NKX2-8, PKD1, PCSK9, CAD, AACS, LSR
Collagen catabolic process	COL4A4, COL4A1, COL19A1, COL6A6, COL7A1, COL13A1, MMP27, CTSS, COL5A2, MMP12
Chromatin organization	SMARCA1, HMGB2, CDAN1, SOX2, PADI2, ZNF462, PADI4, CHD4
Cell migration	FGFR4, TMEM18, PLXNB1, CD248, ELMO3, GAS6, EPHA3, FAM83D, NCK2, PLCG1, PSTPIP1, DGKZ, JAK2, IL12B, ADAMTS12, USP24, SPATA13, ADAM9
Gastrulation with mouth forming second	RNF2, UGDH, AMOT, CHRD, LRP5
O-glycan processing	GALNT10, B3GNT5, MUC5AC, MUC19, MUC6, MUC17, MUC12, MUC4, MUC16
Cell differentiation	ETV7, TMEM189-UBE2V1, FOXA3, CREM, ARHGEF28, NAA15, ANPEP, MYBL2, CFAP54, MUSK, FLI1, OSR2, SMOC1, ZC3H12A, ROS1, C9ORF24, BCL7B, KIF2A, INA, COL13A1, CENPF, MORC1, ABCB5, CEL, MURC, SPAG8, COL19A1, TEX15, HUWE1, TXNRD3, MYCBPAP, JAK2, ADAM18, TNK1, APAF1, NHLH1, DUSP6
Lipoprotein metabolic process	APOB, APOA1, LRP1, HSPG2, NPC1L1, PCSK9, ABCA1
Response to cortisol	CAD, SLIT2, SLIT3
Protein phosphorylation	CDK19, FASTKD1, FASTKD2, PRPF4B, NEK2, BRSK1, CAMKK2, CSNK2A1, PRKRA, ROS1, AATK, PRKCA, OBSCN, BRAF, TGFBF1, NEK10, TRIO, BIRC6, NEK11, GAS6, CDC25B, FNIP2, DAPK1, MAPK1, HUNK, CDC42BPG, RPS6KA3, TEX14, CAMK4, ULK1, RSR1, NEK8, BUB1B, JAK2, CPNE3, TNK1
Protein sumoylation	TOP1, NUP98, HNRNPK, SP100, BLM, INCENP, RNF2, TDG, PIAS2, UBE2I, HERC2, NUPL2, RNF212
Positive regulation of stress fiber assembly	APOA1, BRAF, TGFBF1, ARHGEF5, AMOT, ARHGEF10L, ARHGEF10
Synapsis	TEX15, FANCD2, MEIOB, SYCP1, RNF212
Negative regulation of chemokine-Mediated signaling pathway	PADI2, SLIT2, SLIT3
Protein localization to synapse	DLG4, NLGN2, SHANK1, PCLO
Forebrain development	NOTCH3, DLC1, SOX2, VAX2, APAF1, SETD2, CHRD
Cardiac muscle cell apoptotic process	HSP90AA1, GNB1, APAF1
Chiasma assembly	MSH5, SYCP1, RNF212
Regulation of DNA-templated Transcription in response to stress	RPS6KA3, BCLAF1, RGS14
Intracellular signal transduction	ADCY4, ARHGEF28, BRSK1, STAC3, NOD1, DGKB, PIKFYVE, ANP32A, PRKCA, MAGI3, PLXNB1, ZP4, TGFBF1, ARHGEF5, SPHK1, DGKK, RGS14, NEK11, DAPK1, MAST4, HUNK, PDZD8, RPS6KA3, CDC42BPG, PLCG1, DUSP1, CAMK4, RASSF1, DGKZ, JAK2, UNC13C
Transcription, DNA-templated	HKR1, THRA, TMEM18, NAA15, ASCC1, ZNF250, CNOT1, FOXO6, MAMSTR, CSNK2A1, SMARCD3, ZNF302, ZNF578, ZNF391, ZNF595, RBL2, NKX2-8, VAX2, TOX2, TRIM37, MAPK1, KDM2A, BAZ1B, RFC1, MCIDAS, ZNF239, HOXD4, MNX1, ZNF384, PIAS2, ASCL5, HMGB2, ZNF517, HOXA13, SETD1A, CXXC1, MED12L, TAL1, TCF20, ZNF429, LYL1, ZNF697, MN1, ASXL2, KCTD1, SKI, TEAD2, ZSCAN4, MYPO, DPPA4, ZFH4, ZNF311, RNF2, TDG, DNMT1, RFX2, ZFH2, PHF6, HDAC6, TAF1B, TCEANC, POU6F1, E2F4, ZNF81, FOXA3, ZKSCAN1, ZKSCAN4, ZNF726, ANP32A, HSF5, LRRFIP1, INO80D, SP100, CTBP2, ZNF544, ZNF142, NCOA7, IRF2BP2, PADI4, ZNF335, MURC, NAB2, ZNF717, PERM1, ZNF710, ZFPM2, CUX2, COMMD6, BCLAF1, ABLIM3, CREM, WTIP, CIC, MYCBP2, ZNF512B, NPAS3, TCEA3, RB1CC1, PRDM10, ZC3H12A, GATAD2B, PER3, ZSCAN23, KDM3B, BCAS3, CHD6, FOXD2, CHD4, FOXD4, TXNIP, TBX6, TRNP1, ZNF454, POLR3A, SNAI2, SNAI3, ATXN3, ZNF860, SFPQ, ZBTB5, ZNF462, ZNF573
Telomere maintenance	RAD51D, SP100, ACD, POLD2, SMG1, CTC1
Lysosome organization	GNPTAB, TPP1, LYST, ABCA1, VPS11, ZKSCAN4
Adipose tissue development	LEP, AMER1, XBP1, AACS, LRP5
Regulation of ERK1 and ERK2 cascade	FAM83D, ARHGEF5, NEK10, RRAS, ROS1
Golgi organization	ARHGAP21, SYNE1, CUL7, SPTBN5, GORASP1, HTT, ATP8B2, BCAS3, KIFC3
Actin cytoskeleton organization	DLC1, WASF3, SPTBN5, FOXJ1, WASF1, ABLIM3, ARHGEF5, ATXN3, NISCH, XIRP2, AMOT, PDE4DIP, IQSEC1
Positive regulation of filopodium assembly	DNM3, CCR7, TGFBF1, DPYSL3, BCAS3
Regulation of autophagy	XBP1, SOGA3, ULK1, USP13, DAPK1, PIK3R2, HDAC6
Regulation of bone remodeling	LEP, LRP5, SUCO
Response to growth factor	GATA6, SOX2, DUSP6, HDAC6
Negative regulation of phosphatase activity	SH2D4A, PPP1R37, CEP192, MYO1D, SFI1, WDR81, RBM26
Cytoplasm	RAD51D, DLC1, ADCY4, NAF1, HNRN, TMEM18, FAM110C, NAA15, KPRP, NAA16, CDC16, CD2AP, DUDP1, APOB, CUL7, AFDN, DHX35, LRRC4, SH3GL3, KRR1, CEP295, DBNL, PTPRM, BRAF, UBR3, HCFC1R1, MYH8, VASH1, PCF11, MAPK1, SPAG8, HUWE1, RFC1, CAMK4, ZWINT, BHMT, NEK8, PDEADIP, PIDD1, UNC13C, AHCY, NEK2, DNAH17, PABPC4, ARF5, KRT27, ACD, UBASH3B, RCCD1, MYO15B, PABPC3, PABPC1, ARHGEF10L, IQSEC1, SGIP1, PTGR1, TRPC6, LGALS3, PCNT, SPHK1, EPM2A, SKI, CDC27, LARP4B, FNIP1, GAS6, GART, FNIP2, NOTCH3, CAPN15, CEL, PLA2G4A, SYNE1, CDC42BPG, SYNE2, KIAA0922, TNK1, MUC5AC, UTP20, BACH1, CRNKL1, CPEB2, WASF3, HIP1R, TCOF1, TTC28, ZNF346, CAMKK2, CKB, MSRA, SMAP1, NOD1, ANP32A, TSEN2, CATIP, ASTL, ACO1, CLMN, INPPL1, ARHGEF5, MICAL3, RPH3AL, HERC3, CCT6A, ARHGEF9, HERC2, DECR1, ELMO3, SLIT2, NAPRT, ANKRD27, CARD11, TAF10, MAST4, NCK2, EFHC1, DNPH1, FANCD2, PLA2G6, IL12B, THOC5, USP24, SSU72, PPIA2, RAB3B, CREM, USPA, FKBP1A, CEP128, FEM1A, STAU1, NECAB1, CFAP54, CYP27B1, DGKB, ATXN2L, C19ORF68, XBP1, PLEKHG6, RB1CC1, FASN, PKD1, PCSK9, PER3, BCAS3, DTNA, ATRN, CAPN9, RTN4R, DGKB, FZD2, ITPR3, SNAI2, RAPH1, SAMD1, CABYR, RPS6KA3, TEX14, TEX15, LRP1, DUSP1, RPL21, RASSF1, SFPQ, AOX1, BLVRB, MEX3C, MYCBPAP, USP47, AMOT, DGKZ, SLFN11, DUSP6, ASPN, KAT14, TMEM189-UBE2V1, TBK1, TBP, CNOT1, ALDH1L2, UBQLN1, FOXO6, CTNBL1, CHAD, CRYGD, KRT80, SMARCD3, DNAJC9, ZNF578, DND1, ACIN1, IFNL4, ASPM, CASKIN1, CFAP126, RBL2, DARS, NUDT3, SLC34A1, LRTOMT, VAX2, SOCS5, NUPL2, TRIM37, RALGAP2, SGSM1, LYST, MNX1, SPATA13, DST, FILIP1L, CRACR2B, FBXO10, FGFR4, HMGB2, PODN, BLM, SOX2, GIPC2, MROH2B, CXXC1, WAPL, HNRNPK, OSBP1A, GMPPA, PRKRA, THAP12, SLC30A3, ERCC6L, ZMYM1, SPTBN5, MYO1C, HNT, RPS6A, SPTBN4, FANK1, SMG1, ABHD14B, SHANK1, TRIM62, GCN1, ARID3C, MPRIP, TRIM56, CASS4, PLCG1, NEDD4, ARMCT7, ULK1, BEX5, CPNE3, THNSL2, RFX2, TMPO, PLEKHA1, HDAC6, IER2, OSBP, TLN2, ESD, GABBR2, SH2D4A, FAM83D, ALS2CR12, DLG4, SNTB2, LRRFIP1, ZCCHC7, CDK13, PRKCA, SP100, HSP90AA1, G3BP1, MEIOB, NEK10, PADI2, UBE2I, IRF2BP2, PADI4, EML5, DAPK1, HAGH, ACADVL, UBE2O, HUNK, MURC, UMPS, EVPL, PRDX6, IGF2R, ADGRV1, PERM1, BTG3, BUB1B, ZFPM2, COMMD6, DNAH9, BCLAF1, CD248, ABLIM3, EGLN1, BRSK1, DNAH5, DNAH6, NPAS3, CCDC125, THYN1, ZC3H12A, KLHL42, CHD4, RTCB, TXNIP, GEMIN2, CEP192, MAP1A, DTX3, CENPF, RGS18, DPYSL3, RGS14, CDC25B, SMC4, LEP, CYP4A11, ATXN3, ITPA, CCDC116, CDAN1, RSR1, KCNN3, JAK2, SH3BP1
Endosome lumen	APOB, PRLR, JAK2, AP4M1, AP4S1
Endocytic vesicle	APOA1, RAB5B, RAB5C, IGF2R, AMOT, ABCA1, VPS11, CD2AP, DPP4
Synapse	PPFIA2, ACHE, CPEB2, GABBR3, TLN2, WASF1, SDK1, NLGN2, PCLO, CEL, NCK2, DMD, ADGRV1, SYN2, DOK7, DLG4, SNTB2, SLC5A7, DTNA
Cytoplasmic stress granule	ATXN2L, PABPC4, G3BP1, PUM1, PABPC1, LARP4B, STAU1
Spindle pole	NEK2, FAM110C, BIRC6, CENPF, TTC28, CEP128, RGS14, FBF1, FRY, CDC25B, RASSF1, PLEKHG6, KIF2A
Proteinaceous extracellular matrix	COL4A4, ASPN, LTBP1, ADAMTSL1, PODN, ZP4, ADAMTS16, CD248, VIT, COL5A2, MMP12, SLIT2, MUC4, SLIT3, CHAD, ADAMTS7, ADAMTS6, WISP2, ADAMTS8, COL19A1, COL6A6, SMOC1, FBN3, ADAMTS12
Centrosome	RAD51D, NEK2, BRSK1, CDC16, TTC28, WDR81, FBF1, KIFC3, CUL7, CEP250, TSEN2, CHD4, KIF2A, ERCC6L, CEP295, CEP192, PCNT, CENPF, NEK10, PDE4D, SKI, SFI1, CEP152, CENPJ, CDC27, ARHGEF10, RGS14, CDC25B, EFHC1, CCDC116, HSPB11, PDE4DIP, SPATC1L, WDR43
Lamellipodium	DBNL, PTPRM, HAX1, WASF3, INPPL1, WASF1, ABLIM3, KCNA2, DPYSL3, RAPH1, PLCG1, PSTPIP1, DGKZ, AMOT, SPATA13, DPP4
Extracellular exosome	HRNR, TMEM189-UBE2V1, SLC22A13, MASP2, KPRP, KIAA1324, NAA16, PDLIM2, TTN, ALDH1L2, UXS1, CD2AP, KIFC3, APOB, APOA1, VPS13D, AKR7A2, RRAS, PLA1A, SLC4A4, KRT84, IDUA, ADAM9, SH3GL3, DBNL, DARS, RBL2, PTPRG, NUDT3, ATPRS, HLA-C, COLEC12, AP4M1, PPP1CB, PCLO, SIRPA, MAPK1, CAMK4, RFC1, HUWE1, BHMT, MGAM, DST, TPST2, AHCY, HLA-DRB1, GIPC2, ARF5, AGMAT, NAGK, KRT27, HNRNPK, MTCH2, FOLR1, OSBP1A, MYO1C, HNT, PABPC4, PABPC3, PABPC1, ANGPTL2, DNAJA2, PTGR1, B4GAT1, LGALS3, SPTBN5, GMPPA, TLC-DR10A, MYO1D, SPTBN4, AK2, ABHD14B, RBMX, GAS6, MUC4, GART, LAMA2, CEL, LAMA3, SYNE2, HSPB11, FAM151A, NEDD4, BEX5, CPNE3, MUC5AC, PLEKHA1, TAF1B, STEAP4, WASF3, RAB5B, RAB5C, SLC15A2, DUOX2, ESD, ANPEP, CAD, CDSN, LSR, CKB, WISP2, MSRA, CEP250, TPP1, DNAJC14, TKFC, CHST14, KLK11, SNTB2, SEMA3B, DPP4, SCN10A, PRKCA, HSP90AA1, ACADM, SLC25A5, ACO1, SDK1, PADI2, DECR1, CCT6A, EML5, SLIT2, NAPRT, HAGH, C8B, CARD11, EVPL, DNPH1, GNB1, PRDX6, IGF2R, ADGRV1, CUX2, WIZ, HIST1H2AB, PPFIA2, MEGF8, RAB3B, CD248, UGDH, BTN2A2, FKBP1A, STAU1, CBR1, PRSS3, FASN, PKD1, ZSCAN23, APMAP, QSOX1, THBS4, DNM3, SI, TMC4, ATRN, HSPG2, RTN4R, FRMPD1, A2ML1, CYP4A11, SDHB, TEX14, NEB, BLVRB, AOX1, SLC5A8, TCEB2, APAF1, MUC19, MUC16
Synaptonemal complex	WAPL, MSH5, UBE2I, SYCP1, RNF212
Early endosome membrane	SH3GL3, RAB5B, RCC2, EPHA8, RAB5C, ZFYVE9, PIKFYVE, INPP5F, HLA-C, CLIP3, SNX13, HLA-G
ATP binding	RAD51D, ADCY4, PRPF4B, TBK1, TTN, MTHFD1L, KIFC3, NLRC4, CSNK2A1, DHX35, ROS1, NMNAT3, MAGI3, DARS, BRAF, MYH8, CARNS1, MAPK1, BAZ1B, RFC1, CAMK4, NEK8, EP400, FGFR4, BLM, NEK2, DNAH17, ABCA1, NAGK, MUSK, MYO15B, ENTDP3, DDX43, DNAJA2, ERCC6L, CSF1R, OBSCN, NADK2, SHPRH, MYO1C, TGFBF1, MYO1D, MET, SPHK1, TRIO, SMG1, AK2, ATR, ABCB5, EPHA3, GART, CDC42BPG, EPHA8, ULK1, TNK1, CLCN5, CDK19, ATP10B, CAD, CAMKK2, CKB, FANCM, NOD1, TKFC, ACOT12, ATP8B2, CDK13, KIF2A, PRKCA, NLRP7, HSP90AA1, G3BP1, NEK10, UBE2I, CCT6A, NEK11, DAPK1, UBE2O, HUNK, MAST4, BUB1B, SLC27A5, SMARCA1, DNAH9, BRSK1, BMS1, DNAH5, DNAH6, DGKB, MCMDC2, PIKFYVE, SYN2, CHD6, RTCA, CHD4, RTCB, AATK, ABCA10, MSH5, DGKK, SMC4, TEX14, RPS6KA3, ABC33, SLFN12, DGKZ, JAK2, SLFN11, APAF1, ZRANB3, AACS
Poly(A) RNA binding	NAF1, TRMT1L, PCBP4, URB1, ANP32A, PUM1, SNTB2, PUM3, RBM14, ACIN1, DHX35, RBM10, ZCCHC7, CDK13, MTERF1, KRR1, HSP90AA1, DARS, SLC25A5, G3BP1, UBE2I, CCT6A, NUPL2, UBE2O, NOP2, RCC2, HUWE1, FAM120C, CPSF4, CCDC9, WDR43, BCLAF1, HMGB2, PABPC4, FCF1, BMS1, STAU1, DROSHA, PPAN, TCF20, ATXN2L, HNRNPK, PRKRA, FASN, PCSK9, DMGDH, PABPC1, RBM28, RTCA, MOPCE, RBM26, RTCB, ZC3H13, LGALS3, SMG1, LRRC47, LARP4B, GCN1, RBMX, TRIM56, SON, SYNE1, MRPL21, LRP1, PTCO3, RPL21, SFPQ, MEX3C, CPNE3, UTP20, PHF6
Calcium ion binding	ASPN, EFCC1, HNRN, LTBP1, CLSTN2, MASP2, DUOX2, MMP27, FSTL4, TTN, CAMKK2, PCDH1, CD93, VWDE, PCDHGA10, BRAF, LRP1B, RPH3AL, STIM2, PADI2, CDHR4, PADI4, PCLO, SLIT2, MMP12, SLIT3, EFHC1, GRM7, ADGRV1, C2CD4A, DST, CRACR2B, DCHS2, MEGF8, CD248, NECA1, DGKB, GNPTAB, FAT3, SMOC1, PRSS3, FBN3, PCDHA13, THBS4, CAPN9, HSPG2, ITPR3, GAS6, CABYR, NOTCH3, PLA2G4A, LRP1, PLCG1, EFHB, FLG
Microtubule binding	CAPN6, DNM3, MAP1A, WDR81, BCL2L11, RGS14, KIFC3, FAM83D, CFAP44, SPAG8, RCC2, CCSEF2, CLIP3, MAP6, WDR43, JAKMIP3, CHD4, HDAC6, KIF2A, SGIP1
Rho guanyl-nucleotide exchange factor activity	OBSCN, ARHGEF33, PLEKHG6, ARHGEF28, ARHGEF5, TRIO, ARHGEF9, SPATA13, ARHGEF10L, ARHGEF10
SH3 domain binding	CTTNBP2, CASP9, INPPL1, DPYSL3, ADAM19, SH3BP1, SHANK1, SIRPA, ELMO3, CD2AP, CABYR, ADAM9, SGIP1
Calmodulin binding	OBSCN, MYO1C, PCNT, SPHK1, MYO1D, RRAD, TTN, MYH8, CAMKK2, DAPK1, IQCF2, KCNQ3, CAMK4, KCNN3, SNTB2, PLA2G6, MAP6, ASPM
Zinc ion binding	PNMA3, THRA, MMP27, PDLIM2, CAD, ANPEP, ZNF346, GLI2, RNF212, PGLYRP4, GATA6, RBCK1, RBM10, VPS11, ZCCHC7, USP13, PRKCA, PHRF1, SP100, ASTL, CIZ1, MTA2, MICAL3, UBR3, HAZ2, MORC1, MNX1, ZSWIM5, TRIM37, ADAMTS7, ADAMTS6, ZDHHC16, ADAMTS18, KDM1A, BERC1B, BHMT, CPXM1, RNF2, ZFPM2, PIAS2, CPMF5, TRIM64C, ADAMTSL1, ADAMTS6, ABPC4, USP5, WTIP, CXXC1, TRIM73, MYCBP2, TCF20, TCEA3, C19ORF68, DMD, PIKFYVE, GATAD2B, ADAMTS12, CHD4, DTNA, CPA5, PTGR1, SHPRH, ZMYM1, DTX3, SKI, TRIM62, TRIM60, CAPN15, TRIM56, ZFH4, RASSF1, RNF2, MEX3C, DNMT1, ZNF385B, ZRANB3, ZFNH2, PHF6, HDAC6
Protein kinase activity	CDK19, FASTKD1, FASTKD2, PRPF4B, TBK1, TTN, MTHFD1L, KIFC3, NLRC4, CSNK2A1, DHX35, ROS1, NMNAT3, MAGI3, DARS, BRAF, MYH8, CARNS1, MAPK1, BAZ1B, RFC1, CAMK4, NEK8, EP400, FGFR4, BLM, NEK2, DNAH17, ABCA1, NAGK, MUSK, MYO15B, ENTDP3, DDX43, DNAJA2, ERCC6L, CSF1R, OBSCN, NADK2, SHPRH, MYO1C, TGFBF1, MYO1D, MET, SPHK1, TRIO, SMG1, AK2, ATR, ABCB5, EPHA3, GART, CDC42BPG, EPHA8, ULK1, TNK1, CLCN5, CDK19, ATP10B, CAD, CAMKK2, CKB, FANCM, NOD1, TKFC, ACOT12, ATP8B2, CDK13, KIF2A, PRKCA, NLRP7, HSP90AA1, G3BP1, NEK10, UBE2I, CCT6A, NEK11, DAPK1, UBE2O, HUNK, MAST4, BUB1B, SLC27A5, SMARCA1, DNAH9, BRSK1, BMS1, DNAH5, DNAH6, DGKB, MCMDC2, PIKFYVE, SYN2, CHD6, RTCA, CHD4, RTCB, AATK, ABCA10, MSH5, DGKK, SMC4, TEX14, RPS6KA3, ABC33, SLFN12, DGKZ, JAK2, SLFN11, APAF1, ZRANB3, AACS
Protein domain specific binding	DBNL, PHRF1, HMGB2, OSBP, THRA, SP100, E2F4, FOXA3, MYO1D, CNOT1, SKI, CENPJ, CEP250, RFC1, RCC2, NEDD4, TDG, PKD1, VPS11
Extracellular matrix constituent, lubricant activity	MUC5AC, MUC17, MUC4
Actin binding	DBNL, SPTBN5, TRPC6, MYO1C, WASF3, TLN2, CLMN, INPPL1, WASF1, ABLIM3, SPTBN4, MICAL3, MPRIP, SYNE1, SNEB, XIRP2, DMD, FHOD3, SNTB2, DST, BCL7B, HDAC6

Table S3 Genomic variants in genes with high-impact mutations in at least 3 fetuses

Case no.	Name	Genomic variant
#1	<i>CTBP2</i>	chr10:g.126691552T>G
#4	<i>CTBP2</i>	chr10:g.126727724C>16inserts
#5	<i>CTBP2</i>	chr10:g.126692019G>A
#9	<i>CTBP2</i>	chr10:g.126714705C>56inserts
#10	<i>CTBP2</i>	chr10: g.126691552T>G
#1	<i>CTDSP2</i>	chr12:g.58217422T>C
#4	<i>CTDSP2</i>	chr12:g.58220819A>G
#8	<i>CTDSP2</i>	chr12:g.58220801G>T
#9	<i>CTDSP2</i>	chr12:g.58220827G>C
#10	<i>CTDSP2</i>	chr12:g.58220801G>T
#2	<i>HLA-DRB5</i>	chr6:g.32489755GT>G, chr6:g.32497957C>3inserts
#5	<i>HLA-DRB5</i>	chr6:g.32489937G>5inserts
#6	<i>HLA-DRB5</i>	chr6:g.32497905G>A
#10	<i>HLA-DRB5</i>	chr6:g.32489755G>3inserts
#6	<i>LZTFL1</i>	chr3:g.45877274A>15inserts
#9	<i>LZTFL1</i>	chr3:g.45877262G>6inserts, chr3:g.45877263T>24inserts
#11	<i>LZTFL1</i>	chr3:g.45877273C>9inserts
#1	<i>MUC19</i>	chr12:g.40880335A>G
#4	<i>MUC19</i>	chr12:g.40879082A>T, chr12:g.40881226T>29inserts
#7	<i>MUC19</i>	chr12:g.40882872A>G, chr12:g.40882796G>3inserts, chr12:g.40884241A>122inserts
#8	<i>MUC19</i>	chr12:g.40881235A>G
#2	<i>MUC4</i>	chr3:g.195507082G>3inserts
#3	<i>MUC4</i>	chr3:g.195518092G>6inserts
#9	<i>MUC4</i>	chr3:g.195510225A>3inserts, chr3:195510228C>47inserts, chr3:195518368C>23inserts
#1	<i>MUC6</i>	chr11:g.1018239G>5inserts, chr11:g.1018241T>14inserts
#5	<i>MUC6</i>	chr11:g.1017466T>A
#6	<i>MUC6</i>	chr11:g.1017466T>A

Gene expression for CTBP2 (ENSG00000175029.16)

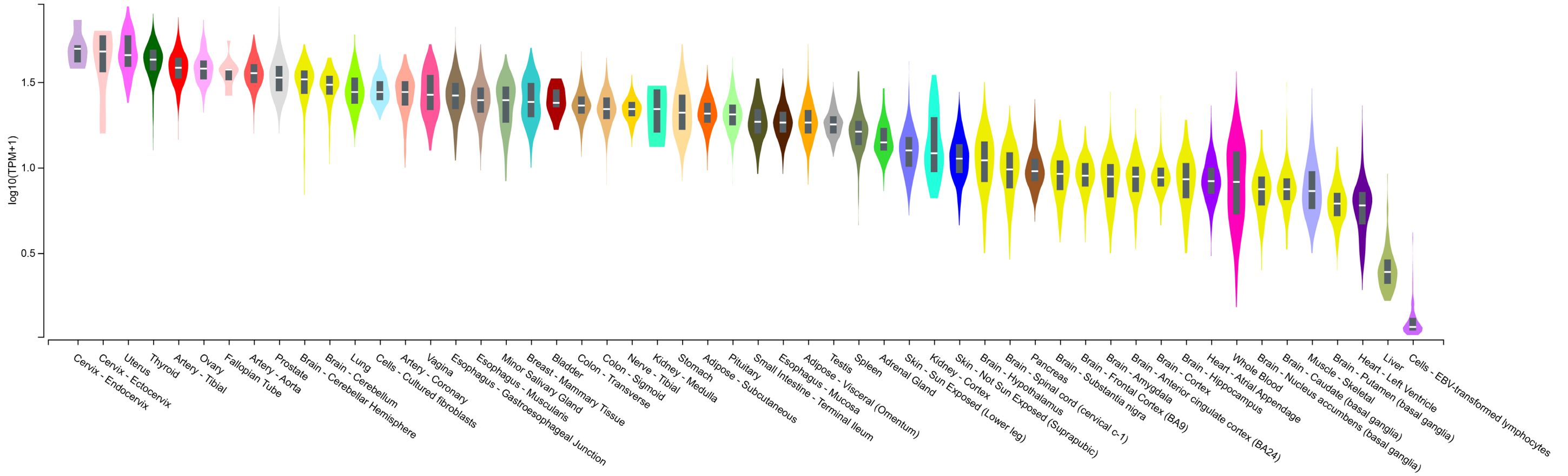


Figure S4 Gene expression levels of *CTDSP2* in different human tissues. The plot was generated by GTEx (<https://www.gtexportal.org/home/>).

Gene expression for CTDSP2 (ENSG00000175215.10)

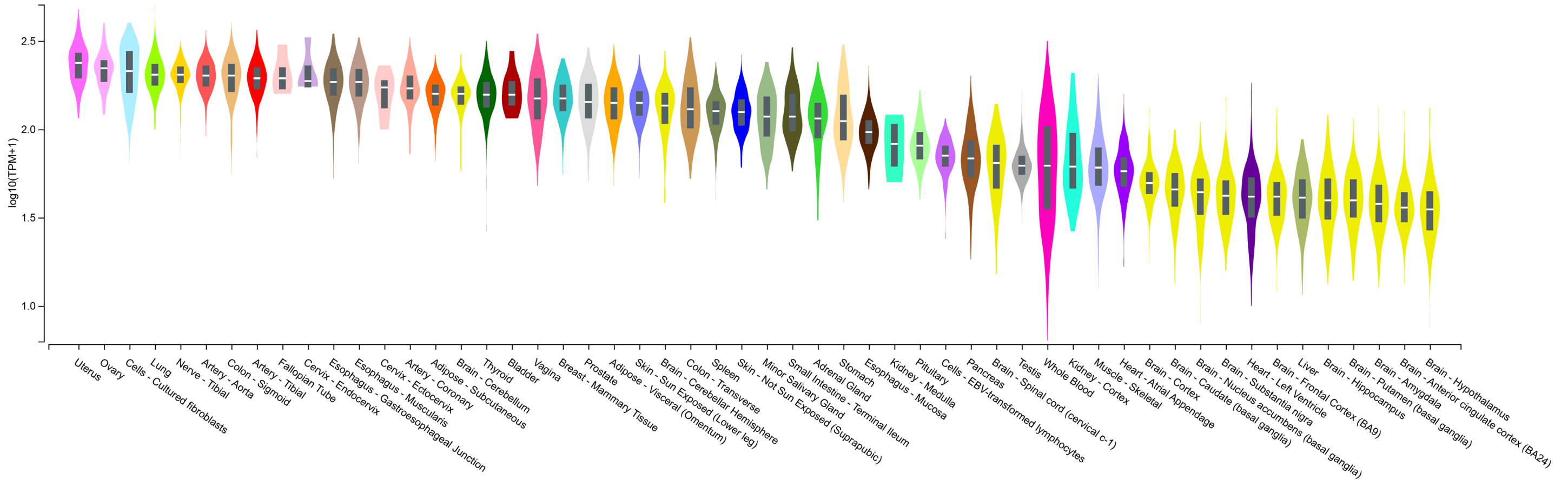


Figure S5 Gene expression levels of *CTBP2* in different human tissues. The plot was generated by GTEx (<https://www.gtexportal.org/home/>).