

**Table S3. Gene functions**

| Function       | Group                            | Genes   |
|----------------|----------------------------------|---|
| Cell Cycle     | Trophoblast stem cell-associated | BMP4, PIAS2, MAPK3, NOLC1, CCNB2, DSN1, BAZ1A, HRAS, HES1, GPSM2, RECQL, CHAF1A, CD2AP, BMI1, CSE1L, SMARCB1, CDKN3, POLR3D, TP53, CALM3, CDCA8, ESPL1, PCGF6, CKS2 (includes EG:1164), ZC3HC1, HIRA, HMGA1, FGFR2, CKAP2 (includes EG:26586), FOXG1, RAE1, SKP2, CCDC5, PCNA, CCND3, HELLS, TARDBP, H2AFX, EHMT2, ANAPC5, TFRC, EBNA1BP2, SGOL1, BRE, XRCC5, UBE2C, KIF20A, NCAPD3, CD320, AATF, AKAP8, CDT1, SUV39H2, KPNA2, DKC1, GAPDH (includes EG:2597), DTD1, NUF2, CDX1, CHEK1, PTMA, ID1, PSMG2, PROS1, DAP3, TOP2A, E2F5, MCM10, KIF2C, EGFR, CDC45L, MYCN, CCNB1, DBI, NAE1, CDK2AP1, PSMD13, SPC25, TIAL1, PLK1, NCAPD2, POLD1, ID3, FZR1, CEACAM1, KPNB1, KIF22, BUB1 (includes EG:699), MAD2L1, GPI, CCNE1, MCM2, TLK1, MSH2, CUL2, NDE1, NOL1, MPHOSPH1, CHFR, CCT7, EDG1, PRMT5, NHP2L1, PSAP, PIN1, SFN, LIG1, KIF23, DLG7, SFRS2, SRPK1, CCNI, MLLT6, PTTG1, PARP2, SMC4, UBE2V2, NUDC, TAF10, KNTC1, PCBP4, AURKB, SCYE1, BIRC5, GSPT1, MAP2K2, MYBL2, CAST, ECT2, NUCKS1, KIFC1, MCM5, SMC3, MIF, PSMB5, EWSR1, HDAC2, NUBP1, MTA2, ORC6L, LMNA, PAXIP1, ZRF1, BUB1B, SSRP1, NCOA3, ERCC6L, PCAF, NASP, SMC2, CDK4, HIRIP3, CAPN2, GNL3, DIABLO, TMPO, POLE3, BUB3, ID2, PA2G4, CDC20, DTYMK, PTPRF, SHC1, CCNA2, ASPM, GMNN, DR1, BLM, STAT1, TERF1, TACC3, NUSAP1, UHRF1, KLHL2, RACGAP1, PRC1, CKAP5, TBRG4, PPM1G, NCAPH2, JOSD3, CKS1B, PNPT1, PPAP2C, MCM7, DDX11         |
|                | Differentiation-associated       | MAGED1, CAMK1, CREM, HBP1, SOD2, TCEB3, TSC2, FOSL1, VCIPI1, IRS3, SNAI1, JUNB, STAT3, IER3, CSH1, ATF2, DAXX, HELLS, JDP2, FOXN3, BTG2, CDC2L6, MORC3, ADM, FN1, DDIT3, ILK, ZNF655, CRK, DMTF1, NOTCH2, JUN, HK2, GADD45A, PCTK2, PDGFRA, RB1CC1, CITED2, ITGB1, GRB2, EGR1, XBP1, PPP1R15A (includes EG:23645), CEACAM1, GRN, FIS1, GNAI3, LYN, APBB2, PLAU, NCOR2, CSH2, PSEN1, HSPA1A, CUL4A, KLF6, C13ORF15, PIP5K3, GATA2, PPM1D, MYC, USP8, TOP1, CAMK2D, PLAC1, RHOB, EZH2, ITGAV, CDKN1C, ZMYM2, FGFR1, PAWR, BCAR3, KLF4, SEL1L, BCL2L1, IGF2, CCNG2, MDM4, MNT, DUSP1, CEBPD, CASP2, MDK, SOCS5, VHL, JARID1B, ATF5, RBBP8, HIF1A, ING4, NFKBIA, CLK1, SP1, FLNA (includes EG:2316), PLK2, ANXA1, SPHK1, ARID3A, PBEF1, PPARD, PLAUR, CEBPB, IVNS1ABP, GNAI2, PIK3CB, CDKN1B, ING1, MMP9, LGALS1  |
|                | Positively regulated by PI3K     | AKAP12, CUL5, CREM, DDIT3, BAZ1A, CDC123, SCIN, AURKA, CSH1, MYC, BCL2L1, DAXX, HMOX1, IGF2, SREBF1, GATA3, CSH2, MMP9  |
|                | Negatively regulated by PI3K     | AMACR, TPM1, ATF3, ING5, HSPA1A, EGR1, TAF10, LATS2, CYP26B1, CD2AP, H2AFX, SPRY2, PRMT5, SPHK1, UBE2D3, PRKCH, CAST, TCF7L2, ID4, PPP3CA   |
| Cell Survival  | Trophoblast stem cell-associated | LIG1, NPM1 (includes EG:18148), PRPF19, PIAS2, BMP4, DNMT3A, MSX1, TRAP1, HRAS, HES1, BIRC5, BMI1, TP53, TNFRSF21, PRKRA, HDAC2, RRM2, HMGA1, PAXIP1, LMNA, BUB1B, PCNA, CCND3, DIABLO, XRCC5, PRDX2, S100A6, ID2, NME1, SMN1, EMILIN2, CDC20, NUF2, PTMA, CHEK1, ID1, SHC1, MT1E, HMGB1 (includes EG:25459), MCM10, PDK1, BLM, EGFR, DHX9, MYCN, RBM17, TACC3, CCNB1, UCP2, UHRF1, SPC25, PLK1, MAD2L1, CCNE1, TPM3, MSH2, CHFR, COX5A, EDG1, SFN, TXNDC17   |
|                | Differentiation-associated       | MAGED1, TGFB1, CREM, MAP3K7IP2, GCLC, TEGT, ODC1, C16ORF5, MAML1, POR, PKN2, NSF, SOD2, FHL2, TSC2, VAMP3, ADA, ATF4, FOSL1, SERPINE1, DNMT2, DDIT4, CSH1, STAT3, ATF2, DAXX, CDH5, JDP2, HELLS, BTG2, CTSB, ZYX, SQSTM1, HTATIP2, ARMC10, HSPA1B, DDIT3, ILK, HSPB8, GLIPR1, TGM2, CASP6, APPL1, NOTCH2, CD47, GADD45A, BBC3, ZFAND5, RNF19A, NFE2L2, B4GALT5, TMSB4X, OPTN, GRB2, TNFRSF1A, ABCG2, TRIB3, SLC25A24, GRN, LDLR, BFAR, LYN, HAP1, PSEN1, PINK1, DAD1, JAK1, KLF6, BAG3, GATA2, CEBPG, PDCD7, PPM1D, MYC, FDFT1, CTSD, UBE2B, RHOB, SNN, PRR13, CDKN1C, KLF11, STK17B, ATG12, STXBP1, IL2RG, ZMYM2, FEM1B, RDX, BTG1, KLF4, BCL2L1, IGF2, MDM4, SERINC3, GCNT1, DUSP1, SGPP1, MDK, IRF8, HFE, VHL, HSPB1, B2M, KLF10, MAP2K1IP1, NFAT5, PBEF1, CD24, PXN, SLC12A2, G6PD, NSD1, HERPUD1, PLAUR, ALS2, NFE2L1, IVNS1ABP, PRKCI, NRTN, CDKN1B, ING1, CTSL2, A4GALT, BCL2L2, SMG1, IRS3, FASLG, PEG3 (includes EG:5178), TNKS, JUNB, IER3, LDOC1, CD9, RTN4, CDC2L6, ADM, CA2, TCF4, FN1, ZFP36, CRK, PSENE1, NFIL3, JUN, HK2, TFAP2A, RB1CC1, PDGFRA, ACSL4, MAP1LC3B, CITED2, ITGB1, EGR1, ELL, XBP1, ANXA4, PPP1R15A (includes EG:23645), F3, RABGEF1, CEACAM1, ZNF148, ITGB2, FIS1, KRT8, DHCR24, APBB2, PLAU, NCOR2, SLC31A1, NCOA6, CLN8, HSPA1A, TICAM2, CUL4A, MAP1B, TCF7, TOP1, CAMK2D, SCARB1, DPP3, ITGAV, JUP, DSP, PTPRE, FGFR1, PAWR, RALBP1, STAMBP, EIF2AK4, ARRB2, MNT |
|                | Positively regulated by PI3K     | ADM, CA2, HTATIP2, TCF4, CUL5, CREM, DDIT3, ATF5, GADD45G, HSPB8, GCLC, GLIPR1, MYC, CTSD, HMOX1, HSP90B1, GCLM, FASLG, PLSR1, DDIT4, SLC2A1, HSPA9, HERPUD1, NSD1, TRIB3, SCIN, AURKA, CSH1, HCLS1, LDOC1, CEACAM1, BCL2L1, DAXX, IGF2, YARS, RIPK3, CYB5A, DNAJB6, SQSTM1, MMP9, HSPB1  |
|                | Negatively regulated by PI3K     | TPM1, S100A6, HSPA1B, ING5, SGK1, HSPA1A, DUSP22, TAF10, LATS2, TNFRSF12A, NCK2, FDFT1, CYP26B1, CD2AP, PPP3CB, CLDN4, STUB1, A4GALT, SPHK1, CYB5R3, PRR13, DAG1, CAST, DNAJB1, DUSP14, SERPINE1, PPM2C, KLF2, PPP3CA, S100A10, PRNP, STXBP1, ATF3, EGR1, PERP (includes EG:64065), ITGA6, PSIP1, AKAP13, MBTPS1, BNIP3L, PRKCH, ZFP36L2, HFE, CLDN3, ID4   |
| Cell Signaling | Trophoblast stem cell-associated |   |

**Table S3. Gene functions**

| Function                               | Group                            | Genes   |
|--|----------------------------------|---|
| Cell Signaling (cont)                  | Differentiation-associated       | LITAF, JAK1, ZFP36, TICAM2, CRK, AKAP11, TGM2, GNB4, MAP2K1IP1, NLK, JUN, GADD45A, FLNA (includes EG:2316), TNIP2, PLK2, ITGAV, RB1CC1, MAPKAPK2, CD24, TMEM9B, HGS, GNG12, STK17B, ITGB1, GRB2, FGFR1, DAPK3, MKNK2, STAT3, STAMBIP, ATF2, GNAI2, DAXX, STK38, NRTN, NDFIP1, WNK1, PIK3CB, STAT2, DOK1, MAP4K5, SQSTM1, SOCS5, ECM1, PINK1, IRAK2, LGALS1  |
|  | Positively regulated by PI3K     |   |
|  | Negatively regulated by PI3K     | CD2AP, SLC9A3R1, DAG1, PARD3, HFE   |
| Cell-To-Cell Signaling and Interaction | Trophoblast stem cell-associated | LAMA5, PHB2, TFRC, L1CAM, HES1, S100A10   |
|  | Differentiation-associated       | NCOA6, MYC, PKN2, CTSL2, ESAM, FHL2, SOD2, RHOB, SCARB1, TSC2, ITGAV, JUP, MGAT1, SERPINE1, LCP1, IL2RG, FERMT2, STAT3, IGF2, CD9, CDH5, ITGA1, IRF8, TFPI, C1GALT1, VHL, SPN, FN1, PVRL3, PTPN14, ILK, UGCG, CRK, PTPN12, TGM2, CD47, ANXA1, STX4, CD24, ITGB1, CD59, EGR1, PLAUR, ITGA3, F3, ITGB2, ADAM10, LYN, CALD1, PIK3CB, PLAU, ITGAX   |
|  | Positively regulated by PI3K     | ADM, CEACAM1, MYC, HMOX1, BCL2L1, IGF2, HSP90B1, PBX3, ENTPD2, PRL4A1, GATA3, MMP9, FASLG   |
|  | Negatively regulated by PI3K     | NCK2, F11R, STXBP1, HSPA1A, PIP5K1C, SPRY2, EGR1, ITGA6, TACSTD1, CAST, SERPINE1  |
| Cellular Assembly and Organization     | Trophoblast stem cell-associated | KIF23, DLG7, SRPK1, PTTG1, PARP2, SMC4, TXNL4A, CCNB2, DSN1, BAZ1A, GPSM2, AURKB, BIRC5, CHAF1A, CKB, SNRPD1, ECT2, KIFC1, TP53, PPID, ESPL1, NUBP1, MTA2, CKAP2 (includes EG:26586), BUB1B, ERCC6L, SKP2, RAE1, PRDX3, TFAM, SMC2, HELLS, H2AFX, EHMT2, HMGN2, EBNA1BP2, CAPN2, HIRIP3, SGOL1, XRCC5, BUB3, POLE3, SMN1, NCAPD3, CDT1, UBE2N, SUV39H2, CKMT1B, NUF2, SLC25A5, USP39, ID1, CCNA2, GMNN, DR1, TOP2A, KIF2C, BLM, TERF1, MYCN, NUSAP1, TACC3, CCNB1, SLC25A4, UHRF1, MRPL15, PRC1, SPC25, CKAP5, PLK1, MRPL17, NCAPD2, NCAPH2, KIF22, KPNB1, BUB1 (includes EG:699), MAD2L1, CCNE1, B4GALT1, TLK1, NDE1, NHP2L1, PIN1, SFN, KIF18A, DDX11   |
|  | Differentiation-associated       | EPS15, TOM1, RABEP1, MAP1B, PIP5K3, LIMK2, MYC, NSF, SOD2, RHOB, BAIAP2, ITGAV, FASLG, DSP, PTP4A3, RDX, CD9, CDH5, SQSTM1, ELMO1, CTTN, VHL, ENAH, FN1, PICALM, PTPN14, UGCG, CRK, REPS1, PTPN12, FLNA (includes EG:2316), TINAGL1, ARHGEF2, GOSR1, CD24, HGS, ITGB1, STX12, PXN, LOC290704, RAB5A, GRB2, DDEF1, STX5, PLAUR, ALS2, RABGEF1, ITGB2, EPB41, WIPF1, PRKCI, SYNJ1, STX7, HAP1, CALD1, PLAU, CDKN1B, MSN   |
|  | Positively regulated by PI3K     | ADM, MYC, BCL2L1, IGF2, GCLC, BAZ1A, AURKA, GCLM, GATA3, FASLG, PLSCR1  |
|  | Negatively regulated by PI3K     | FLNB, TPM1, MYH10, HSPA1B, HSPA1A, CSRP1, TNFRSF12A, NCK2, DHCR7, CD2AP, A4GALT, STMN4, BAIAP2, CYB5R3, SPHK1, PLDN, CAST, DAG1, SERPINE1, KLF2, PPP3CA, LASP1, STXBP1, ATF3, ARHGEF12, DDEF1, ITGA6, AKAP13, CORO1C, CHRAC1, PIP5K1C, H2AFX, SPRY2, HMGN2, PARD3   |
| Cellular Growth and Proliferation      | Trophoblast stem cell-associated | NPM1 (includes EG:18148), DBN1, PIAS2, HMMR, PLK4, ELF3, SMARCB1, TRAF4, RUVBL2, MYBBP1A, AHY, SART3, TNFRSF21, TP53, ESPL1, CDCA8, HMGA1, GFM1, RRM2, FGFR2, ANP32A, SKP2, NDNL2, ANAPC5, TFRC, DHFR, HNRPA, XRCC5, UBE2C, KIF20A, NME1, AATF, CD320, PHLDA2, GADD45GIP1, TMEFF1, CLDN4, BCCIP, HNRNPU, THG1L, UCP2, CDK2AP1, LASS1, WNK2, CDCA7, HNRPD, ID3, MCM3, MAD2L1, CCNE1, ENO1, CCT7, PSAP, SHMT1, PIN1, SFN, CXADR, DLG7, SFRS2, ILF3, MLLT6, PTTG1, SF3B2, GNPAT, CCT2, NME2, SCYE1, GGA2, SAE1, MAP2K2, MYBL2, CAST, EIF5A2, PGK1, SMC3, HNRPF, LAPTM4B, EWSR1, HDAC2, CDX2, BAMB1, PFDN5, ZRF1, NCOA3, TACSTD1, DIABLO, PPAT, TMEPAI, ID2, HDGF, SHC1, CCNA2, STUB1, STAT1, TERF1, LAMA5, SLC9A3R1, ADAM15, HSPD1 (includes EG:3329), MTHFD1, PPM1G, ATIC, JOSD3, PSMD2, CKS1B, EIF3I, BMP4, MAPK3, TRAP1, HRAS, HES1, GSS, SET, EEF1D, OCLN, ACIN1, BNIP3 (includes EG:664), BMI1, NFKBIB, NOL8, ITGB5, CALM3, METTL3, TNK2, FOXG1, CCND3, PSMB2, CCT3, SPINT2, LDHA, EMILIN2, CDT1, DUSP6, GPX1, RUVBL1, SYMPK, EIF4G1, CDX1, SF3B3, EIF2B2, CHEK1, BYSL, PTMA, ID1, MT1E, TCOF1 (includes EG:6949), DAP3, EGFR, MYCN, CCNB1, TRIM28, DDX56, TIAL1, RRM1, FOLR1, CEACAM1, MCM2, NDE1, MPHOSPH1, CHFR, RSL1D1, EDG1, FKBP4, C6ORF108, PRPF19, CCNI, PCBP4, PBK, CD63, PSMC5, BIRC5, USP7, SIVA1, AKT1S1, MCM5, MIF, ATP5A1, MTA2, PAXIP1, LMNA, HNRPM, EI24, SFRS3, PCAF, CDK4, AK2, |

**Table S3. Gene functions**

| Function                                 | Group                            | Genes  |
|--|----------------------------------|--|
| Cellular Growth and Proliferation (cont) | Differentiation-associated       | MAGED1, TGFBR1, CREM, RAB2A, MAP3K7IP2, ODC1, MAML1, LAMC1, POR, SOD2, FHL2, TSC2, ADA, ATF4, FOSL1, SERPINE1, MGAT1, DNMT2, LCP1, FLOT1, STAT3, CSH1, ATF2, CDC73, DAXX, CDH5, BTG2, CTSB, ZYX, ITGA1, DOK1, ECM1, ARMC10, PIM3, DDIT3, PTPN14, SEMA6A, ILK, HSPB8, TGM2, APPL1, DMTF1, HADHB, CD47, NOTCH2, GADD45A, BBC3, TMSB4X, OPTN, ENTPD1, TNFRSF1A, GRB2, GRN, WIPF1, TMEM49, LYN, NRIP1, RNF14, CSH2, PSEN1, JAK1, ARL6IP5, KLF6, GATA2, PPM1D, GPNMB, HDAC6, MYC, CTNNBIP1, CTSD, FDFT1, USP8, UBE2B, ANXA11, RHOB, CDKN1C, STK17B, KLF11, TOP3B, IL2RG, ZMYM2, BTG1, KLF4, PRL7A2, SLC3A2, BCL2L1, MDM4, IGF2, SERINC3, DUSP1, GCNT1, IRF8, MDK, TFPI, S100A11 (includes EG:6282), VHL, LITAF, YPEL3, KLF10, DHCR7, NFAT5, ARID3A, PBEF1, CD24, G6PD, ERO1L, PLAUR, IVNS1ABP, SHB, PRKCI, ING1, CDKN1B, ITGAX, TCIRG1, HBP1, CTSL2, TCEB3, BCL2L2, FASLG, TNKS, PTP4A3, USP9X, JUNB, IER3, BMYC, LDOC1, CD9, CDC2L6, RAP1B, ADM, TCF4, RALA, FN1, B3GNT2, CRK, DNAJA1, HK2, JUN, TFAP2A, PDGFRA, RB1CC1, HGS, CITED2, BMP1, GLMN, ITGB1, RGS2, EGR1, ELL, XBP1, PFN2, PPP1R15A (includes EG:23645), NAP1L1, ITGA3, RABGEF1, ZNF148, CEACAM1, CUX1, FIS1, ITGB2, NUB1, KRT8, DHCR24, SREBF1, ADAM10, APBB2, NCOR2, PLAUI, EPS15, NCOA6, INSIG1, CUL4A, CDA, TCF7, TOP1, PLAC1, SCARB1, EZH2, ITGAV, UBE2E3, JUP, DSP, SOX4, PTPRE, FGFR1, TSNAX, PAWR, BCAR3, RALBP1, STAMPB, DDX17, ELF1 |
|  | Positively regulated by PI3K     | AKAP12, ADM, CREM, DDIT3, GADD45G, HSPB8, DNAJC3, MYC, CTSD, HMOX1, FASLG, PLSCR1, LCP1, TSNAX, CSH1, AURKA, ATIC, SLC3A2, CEACAM1, BCL2L1, IGF2, FABP5, SREBF1, DNAJB6, CSH2, MMP9  |
|  | Negatively regulated by PI3K     | GBX2, FLNB, MYH10, S100A6, ING5, HSPA1A, DUSP22, IGBP1, TNFRSF12A, NCK2, FDFT1, DHCR7, CLDN4, STUB1, SPHK1, UBE2D3, SERPINE1, IRX3 (includes EG:79191), KLF2, PPP3CA, S100A10, PRNP, AMACR, ATF3, EGR1, ITGA6, F11R, AKAP13, SPRY2, PRMT5, BNIP3L, TACSTD1, ZFP36L2, HMGCR, ID4  |
| Cellular Movement                        | Trophoblast stem cell-associated | KIF23, TP53, KIF20A, NUSAP1, CCNB1, CDC20, RACGAP1, PRC1, HRAS, PLK1, AURKB, ID3, ID1, CD2AP, ELF3, MAP2K2, MPHOSPH1, CHFR, TOP2A, ECT2, EGFR  |
|  | Differentiation-associated       | TGFBR1, TCIRG1, HBP1, ODC1, LAMC1, CTSL2, LGMN, SOD2, FHL2, A4GALT, TSC2, CBLL1, FOSL1, SERPINE1, GNG12, DNMT2, FASLG, LCP1, PTP4A3, CREB3, FERMT2, SNAI1, JUNB, STAT3, CSH1, ARHGDI1, CDH5, CD9, RTN4, CTSB, ZYX, ITGA1, DOK1, ADM, ENAH, FLNB, RALA, FN1, PTPN14, ILK, TPM4, CRK, DNAJA1, PTPN12, TGM2, PRKX, CD47, ACTR3, JUN, GADD45A, PPAP2B, PDGFRA, SARS, NFE2L2, B4GALT5, TMSB4X, ITGB1, TNFRSF1A, EGR1, ITGA3, F3, GRN, CEACAM1, GNAI3, ITGB2, PEX5, LDLR, SREBF1, ADAM10, LYN, APBB2, PLAUI, PSEN1, JAK1, EPS15, MAP1B, HEBP1, HDAC6, MYC, CTSD, ESAM, RHOB, PLAC1, EZH2, ITGAV, JUP, FXYD5, FGFR1, BCAR3, TMOD3, RALBP1, KLF4, SLC3A2, SEL1L, IGF2, ARRB2, PREX1, GCNT1, CXCR7, DUSP1, SEMA6D, SGPP1, MDK, TFPI, CTTN, ELMO1, VHL, HSPB1, PAFAH1B2, SPN, PICALM, ING4, HIF1A, DNMBP, PDCD4, NFKBIA, NFAT5, SP1, FLNA (includes EG:2316), ANXA1, SPHK1, CCRL1, MAPKAPK2, CD24, PRNP, CD59, PXN, DDEF1, PPARD, DAPK3, G6PD, PLAUR, GNAI2, PRKCI, NRTN, SYNJ1, MYLIP, CALD1, PIK3CB, CDKN1B, HMGCR, MMP9, MSN, LGALS1, ITGAX   |
|  | Positively regulated by PI3K     | ADM, LCP1, CUL5, AURKA, CSH1, SLC3A2, CEACAM1, MYC, CTSD, ESAM, NARS, WARS, IGF2, FABP5, YARS, SEMA6D, PPAP2B, GATA3, SARS, ELMO1, FASLG, MMP9   |
|  | Negatively regulated by PI3K     | GBX2, MYH10, FLNB, TPM1, S100A6, IGBP1, LATS2, TNFRSF12A, NCK2, CD2AP, CLDN4, A4GALT, SPHK1, CAST, SERPINE1, KLF2, LASP1, S100A10, PRNP, ATF3, SLC9A3R1, DDEF1, EGR1, APLP2, ITGA6, F11R, PIP5K1C, MRLC2, SPRY2, HMGCR, CLDN3  |
| Gene Expression                          | Trophoblast stem cell-associated | POLR2F, PRIM1, PIAS2, BMP4, MAPK3, MSX1, SMARCD2, MED21, BAZ1A, HRAS, SFPQ, HES1, PPP4C, SET, EEF1D, CHAF1A, ELF3, BMI1, GATAD2A, SMARCB1, TCERG1, MYBBP1A, NFKBIB, APEX1, TARBP2, HMX1, TP53, BCOR, PCGF6, NUFIP1, HIRA, HMGA1, MAPK8IP1, ANP32A, NDNL2, ZNF238, CCND3, SUPT16H, TARDBP, EHMT2, HMGN2, SLC44A2, POLR2I, HNRPAB, XRCC5, HMGB2, DEK, NME1, PRDX1, KPNA2, PSMD9, RUVBL1, MED28, CDX1, PTMA, VRK1, NARG1, ID1, RNPS1, TRIM27, TCOF1 (includes EG:6949), CTBP2, E2F5, TOP2A, POLR3G, PSMD14, HMGB1 (includes EG:25459), ABT1, EGFR, ORC1L, MYCN, CCNB1, NAE1, PPP1R8, PRIM2, TRIM28, MRPL12, TIAL1, PLK1, ID3, CCNE1, ZNF593, ENO1, EDG1, PIN1, MED4, GTF3A, TRAF3, ILF3, GTF3C6, MLLT6, DNMT3A, PTTG1, HSF2, NME2, CBX3, PSMC5, RDBP, TCEB2, PTGES2, PPIE, ECT2, MIF, EWSR1, HDAC2, PHF5A, CDX2, MTA2, PHB2, PFDN5, LMNA, BRD8, TBL1X, PUS1, SSRP1, NCOA3, IFRD1, PCAF, TFAM, TADA2L, NSEP1, PABPN1, TMPO, PEBP1, POU3F1, SNF8, ID2, PA2G4, GTF2F2, PDGFA, BCLAF1, CCNA2, POLR1C, SHC1, POLR2C, DNMTIP1, STUB1, NEDD8, DR1, SUDS3, STAT1, TCF20, SLC20A1, TRIP13, CCNH, VEZF1, UHRF1, CSDA, PSMC3IP, STRAP, CENPK, POLR2G, NOC2L, ZNHIT3, KLF5, SATB1, PNPT1, SMARCC1, MCM7   |

**Table S3. Gene functions**

| Function                        | Group                            | Genes   |
|---------------------------------|----------------------------------|---|
| Gene Expression (cont)          | Differentiation-associated       | MED13, MAGED1, CREM, TGFBR1, MAP3K7IP2, GCLC, GTF2E2, HBP1, ATP8B1, PKN2, MAML1, MYCBP2, FHL2, SOD2, TSC2, TCEB3, ATF4, FOSL1, SERPINE1, FASLG, JUNB, CSH1, STAT3, ZNF496, ATF2, DAXX, JDP2, CCNDBP1, FOXN3, BTG2, SQSTM1, ECM1, ADM, TCF4, HTATIP2, SCAP, FN1, DDIT3, ZFP36, ZNF143, ILK, CRK, AFF4, SMURF1, ARID4B, APPL1, DMTF1, NFIL3, NOTCH2, JUN, ACTR3, GADD45A, TFAP2A, HGS, NFE2L2, CITED2, GLMN, ITGB1, GRB2, TNFRSF1A, EGR1, ELL, XBP1, TRIB3, NAP1L1, NOSTRIN, GRN, ZNF148, CUX1, WIPF1, GPBP1, SREBF2, SREBF1, ATF7IP, LYN, UBN1, AEBP2, APBB2, NCOR2, NRIP1, RNF14, STAG2, PSEN1, JAK1, NCOA6, TICAM2, JMJD1C, CUL4A, KLF6, HAND1, UIMC1, LRRFIP2, GATA2, TCF7, CEBPG, PPM1D, MYC, CTNNBIP1, TOP1, TCF25, CAMK2D, RHOB, EZH2, ITGAV, JUP, CDKN1C, KLF11, EID1, FGFR1, BTG1, PAWR, RALBP1, STAMPB, DDX17, ELF1, EPN2, BCL2L1, MDM4, IGF2, MNT, DUSP1, CEBPD, GMCL1, TLE3, PDLIM1, STAT2, LCOR, IRF8, VHL, JARID1B, LITAF, DYNL3, ATF5, KLF10, RBBP8, MEIS2, HIF1A, ING4, HIC1, PDCD4, NFX1, MAP2K1IP1, NFKBIA, NFAT5, SP1, MED15, FLNA (includes EG:2316), PLK2, ARID3A, MAPKAPK2, BLZF1, ARID5B, PXN, TAF6, MSL3L1, PPARD, NSD1, CIR (includes EG:9541), CEBPB, BIRC4, NFE2L1, IVNS1ABP, HTATSF1, RCOR1, ERBB2IP, PRKCI, WNK1, CDKN1B, ING1, LGALS1 |
|                                 | Positively regulated by PI3K     | ADM, AKAP12, HTATIP2, TCF4, CREM, DDIT3, GADD45G, ATF5, BAZ1A, GCLC, ATP8B1, MYC, HSP90B1, GRINL1A, ATF4, FASLG, MED20, PCGF6, NSD1, TRIB3, CSH1, HCLS1, DAXX, BCL2L1, IGF2, FABP5, SREBF1, CYB5A, DNAJB6, SQSTM1, GATA3, ELF5  |
|                                 | Negatively regulated by PI3K     | AKAP13, ARHGEF12, ATF3, EGR1, ITGA6, PRKCH, DNAJB1, PARD3, KLF2, TCF7L2, PRNP   |
| Lipid Metabolism                | Trophoblast stem cell-associated | PRDX3, GPX1, APEX1  |
|                                 | Differentiation-associated       | HSD3B1, SCAP, CLN8, IDI1, INSIG1, CYP17A1, FDFT1, DHCR7, CD47, SCARB1, SMG1, PBEF1, CD24, CYP51A1, PLSCR1, CYP11A1, ITGB1, APOB48R, ABHD5, RAB5A, PPARD, STARD3, CEBPB, FDPS, LDLR, SYNJ1, DHCR24, SREBF2, SREBF1, PIK3CB, SLC27A1, DGAT1, HMGCR, LGALS1  |
|                                 | Positively regulated by PI3K     | ADM, CYP17A1, BCL2L1, FABP5, CYB5A, CSH1, CSH2, HSD17B2, FASLG, PLSCR1  |
|                                 | Negatively regulated by PI3K     | AMACR, SQLE, ACAT2, DGAT2, FDFT1, CYP26B1, DHCR7, A4GALT, MBTPS1, PCYT2, SPHK1, SERPINE1, HMGCR, MOGAT2, CYP51A1, PRNP  |
| Post-Translational Modification | Trophoblast stem cell-associated | HSPBP1, DNAJA4, SCO1, SF3B3, OCLN, CHAF1A, CD2AP, TCEB2, STUB1, TCP1, RUVBL2, DAG1, VAPB, TBCD, FKBP5, PPID, TP53, BCS1L, MKKS, TBCA, SLC9A3R1, HMGA1, CCT6A, ERP29, FKBP4, CCT7, CCT3, HFE   |
|                                 | Differentiation-associated       | RNF139, TGFBR1, JAK1, DPM1, PIP5K3, PPM1D, MYC, HDAC6, SOD2, CAMK2D, SCARB1, EZH2, TSC2, CBLL1, ITGAV, SMG1, ATG12, PTPRE, TNKS, FGFR1, ELF1, SLC3A2, BCL2L1, ARRB2, WHSC1L1, CD9, DUSP1, RNF25, UBE2G1, BACE2, TLK2 (includes EG:11011), VHL, ADM, PIM3, SPN, FN1, PTPN14, ILK, PSENEN, CRK, ING4, DNAJA1, BAG2, USP2, PTPN12, UBE4A, SMURF1, HK1, CD47, NLK, CLK1, PPP3CB, RB1CC1, CD24, PLOD3, MTMR3, ITGB1, PPARD, ERO1L, NSD1, CLPX, USP33, BIRC4, SHB, ITGB2, STK38, CMAS, MYLIP, LYN, PSEN1, IRAK2, LGALS1   |
|                                 | Positively regulated by PI3K     |   |
|                                 | Negatively regulated by PI3K     | SLC9A3R1, APLP2, ITGA6, DUSP22, NCK2, CD2AP, PPP3CB, STUB1, PCMT1, SPHK1, UBE2D3, DAG1, DNAJB1, PPM2C, PARD3, PPP3CA, HFE   |







