Date: 2025-12-11

1 Methods

To identify biological pathways overrepresented among the SNPs, pathway enrichment analysis was performed using the Gene Ontology Biological Process (GO BP) and Kyoto Encyclopedia of Genes and Genomes (KEGG) database. Gene annotations from VEP output were used, and Ensembl gene identifiers were extracted. For KEGG analysis, Ensembl IDs were mapped to Entrez gene identifiers using the org.Gg.eg.db (version 3.20.0) package in R (version 4.4.1, 2024-06-14).

GO BP and KEGG over-representation analysis was carried out with the clusterProfiler package (version 4.14.6) using the enrichGO and enrichKEGG functions respectively. The entire set of annotated chicken genes was used as the background. Statistical significance of enriched pathways was determined based on a hypergeometric test, and multiple testing correction was performed using the Benjamini-Hochberg method. Pathways with an adjusted p-value < 0.05 were considered significantly enriched.

2 Enrichment Analysis

Table 1 GO Biological Process enrichment of SNPs

35 significantly enriched GO BP pathways found.

GO ID	Biological Process	Fold Enrichment	Adjusted p-value	Gene IDs
GO:0034764	**positive regulation of transmembrane transport**	1.534	0.03781	AKAP9, ARC, AZIN1, C2CD5, FAM132A, FAM173A, FAM173B, NPSR1, PIRT, RNF207, STAC, LOC107050760, STIM1, STIM2, LOC121106612, WNK1, WNK2, WNK4
GO:0048167	**regulation of synaptic plasticity**	1.468	0.04557	CALB1, CALB2, CRHR2, ERC1, ERC2, GRIN2A, GRIN2B, GRIN2C, JPH3, LZTS1, NCDN, NSMF, RIMS1, RIMS2, RIMS3, RIMS4, SCGN, SHISA6, SHISA8, SHISA9, SLC24A1, ZZEF1
GO:0042255	**ribosome assembly**	1.439	0.02638	C1QBP, EFL1, EIF6, ERAL1, GLTSCR2, MDN1, MPV17L2, MRPL20, MRPL22, MRPS11, MRPS7, MRTO4, MTERF3, NIP7, LOC107051197, PWP2, RPF2, RPL23A, RPL3, RPL3L, RPLP0, RPS14, RPS15, RPS27, RPS27L, RPS28, RPSA2, RRP7A, SBDS, TRAF7
GO:0031667	**response to nutrient levels**	1.368	0.02661	ATG5, ATG7, BCAS3, BCKDHB, BGLAP, LOC100859819, DAP, DEPDC5, GABARAPL1, GABARAPL2, GCN1, GH, GHRL, GIP, HTR4, KICS2, KPTN, MAP1LC3A, MAP1LC3B, MAP1LC3C, MIOS, NPRL3, OC3, PCK1, PCK2, PRL, PRLL, RNF152, RPTOR, RRAGA, RRAGC, RRAGD, SEH1L, SESN1, SESN2, SESN3, SESN4, SLC27A4, UCN3, VPS41, NPRL2
GO:0032006	**regulation of TOR signaling**	1.356	0.03879	BMT2, DEPDC5, DEPTOR, FAM83D, FLCN, GATSL2, GATSL3, GPR137B, ITFG2, KICS2, KLHL22, KPTN, LAMTOR1, LAMTOR2, LAMTOR3, LAMTOR5, MAPKAPK5, MINAR1, MIOS, NPRL3, RNF152, ROS1, RRAGA, RRAGC, RRAGD, SEC13, SEH1L, SESN1, SESN2, SESN3, SESN4, TBC1D7, TNFAIP8L1, TSC1, TSC2, WAC, WDR24, NPRL2
GO:0031929	**TOR signaling**	1.328	0.03781	BMT2, DEPDC5, DEPTOR, FAM83D, FLCN, GATSL2, GATSL3, GPR137B, ITFG2, KICS2, KLHL22, KPTN, LAMTOR1, LAMTOR2, LAMTOR3, LAMTOR5, MAPKAP1, MAPKAPK5, MINAR1, MIOS, MLST8, MTOR, NPRL3, PRR5, RNF152, ROS1, RPTOR, RRAGA, RRAGC, RRAGD, SEC13, SEH1L, SESN1, SESN2, SESN3, SESN4, TBC1D7, TIPRL, TLDC1, TNFAIP8L1, TSC1, TSC2, WAC, WDR24, NPRL2
GO:0022618	**protein-RNA complex assembly**	1.270	0.02661	AAR2, C12orf45, CELF2, CELF3, CELF5, CELF6, CLNS1A, COIL, CRNKL1, DDX20, DENR, EIF2D, EIF2S2, EIF2S3, EIF6, ERAL1, GEMIN4, GEMIN7, GEMIN8, GLTSCR2, ISY1, LSM4, LUC7L, LUC7L2, LUC7L3, MCTS1, MDN1, MRPL20, MRPS11, MRPS7, MRTO4, NAF1, NUFIP1, PIH1D2, LOC107051197, PRPF18, PRPF6, PRPF8, PTGES3, PUF60, PWP2, RPF2, RPL23A, RPL3, RPL38, RPL3L, RPLP0, RPS14, RPS15, RPS27, RPS27L, RPS28, RPSA2, RRP7A, RUVBL1, SCAF11, SF3A2, SFSWAP, SHQ1, SNRPC, SNRPD1, SNRPD3, SNRPE, SNRPF, SNRPGP15, SRPK1, SRPK2, SRSF4, SRSF6, STRAP, TRAF7, ZNHIT3
GO:0071826	**protein-RNA complex organization**	1.268	0.02638	AAR2, C12orf45, CELF2, CELF3, CELF5, CELF6, CLNS1A, COIL, CRNKL1, DDX20, DENR, DHX8, DYRK3, EIF2D, EIF2S2, EIF2S3, EIF6, ERAL1, GEMIN4, GEMIN7, GEMIN8, GLTSCR2, ISY1, LSM4, LUC7L, LUC7L2, LUC7L3, MCTS1, MDN1, MRPL20, MRPS11, MRPS7, MRTO4, NAF1, NUFIP1, PIH1D2, LOC107051197, PRPF18, PRPF6, PRPF8, PTGES3, PUF60, PWP2, RPF2, RPL23A, RPL3, RPL38, RPL3L, RPLP0, RPS14, RPS15, RPS27, RPS27L, RPS28, RPSA2, RRP7A, RUVBL1, SCAF11, SF3A2, SFSWAP, SHQ1, SNRPC, SNRPD1, SNRPD3, SNRPE, SNRPF, SNRPGP15, SRPK1, SRPK2, SRSF4, SRSF6, STRAP, TFIP11, TRAF7, ZFAND1, ZNHIT3
GO:0032956	**regulation of actin cytoskeleton organization**	1.222	0.04594	ADD1, ADD2, AP1AR, ARFIP1, ARFIP2, ARHGAP17, ARHGAP18, ARHGAP28, ARHGAP40, ARHGAP44, ARHGEF10, ARHGEF10L, ARPC3, ARPC5L, ASB12, BAIAP2, BAIAP2L1, BAIAP2L2, CAPG, CAPZA1, CAPZA2, CAPZA3, CAPZB, CARMIL1, COTL1, CRACD, CYFIP1, CYFIP2, DBN1, DBNL, FAM107A, FAM206A, FAM49A, FAM49B, FCHSD1, FCHSD2, FLII, GSN, HAX1, HCLS1, IQGAP1, IQGAP3, KANK3, LIMCH1, LIMK1, LMOD1, LMOD2, LMOD3, MLST8, MTPN, MTSS1, PAK1, PAK3, PFN3, PICK1, PLEKHH2, RAC1, RAC3, RHOG, RHOG2, RHPN1, RHPN2, RLTPR, ROCK2, SCIN, SSH1, SSH2, SVIL, SYNPO2, TMOD2, TMOD3, TMOD4, TMSB15B, TMSB4X, TMSB4B, TP53I3, TWF1, TWF2, VASP, VILL, WASF1, WASF2, WASF3, WASF3L, WASHC5, WDR1
GO:0032970	**regulation of actin filament-based process**	1.216	0.04931	ABRACL, ADD1, ADD2, AP1AR, ARFIP1, ARFIP2, ARHGAP17, ARHGAP18, ARHGAP28, ARHGAP40, ARHGAP44, ARHGEF10, ARHGEF10L, ARPC3, ARPC5L, ASB12, BAIAP2, BAIAP2L1, BAIAP2L2, CAPG, CAPZA1, CAPZA2, CAPZA3, CAPZB, CARMIL1, COTL1, CRACD, CYFIP1, CYFIP2, DBN1, DBNL, FAM107A, FAM206A, FAM49A, FAM49B, FCHSD1, FCHSD2, FLII, GSN, HAX1, HCLS1, IQGAP1, IQGAP3, KANK3, LIMCH1, LIMK1, LMOD1, LMOD2, LMOD3, MLST8, MTPN, MTSS1, PAK1, PAK3, PDPN, PFN3, PICK1, PLEKHH2, RAC1, RAC3, RHOG, RHOG2, RHPN1, RHPN2, RLTPR, ROCK2, SCIN, SSH1, SSH2, SVIL, SYNPO2, TMOD2, TMOD3, TMOD4, TMSB15B, TMSB4X, TMSB4B, TP53I3, TWF1, TWF2, VASP, VILL, WASF1, WASF2, WASF3, WASF3L, WASHC5, WDR1

GO ID	Biological Process	Fold Enrichment	Adjusted p-value	Gene IDs
GO:0044087	**regulation of cellular component biogenesis**	1.210	0.02638	ADD1, ADD2, ARHGAP18, ARHGAP24, ARHGAP28, ARHGAP40, ARHGEF10, ARHGEF10L, ARPC3, ARPC5L, ASB12, ATF7IP, BAIAP2, BAIAP2L1, BAIAP2L2, CAPG, CAPZA1, CAPZA2, CAPZA3, CAPZB, CCSAP, CDK5RAP2, CEP295, CLIP1, CLSTN1, CLSTN3, COTL1, CRACD, CYFIP1, CYFIP2, DBN1, DBNL, DCDC2, DOCK11, EPS8, LOC107050775, EZR, FAM110C, FAM206A, FAM208A, FAM49A, FAM49B, FCHSD1, FCHSD2, FLII, FMR1, GPATCH4, GSN, HAX1, HCLS1, HNRNPU, ITGB1BP1, KANK3, KCNJ4, LIMCH1, LIMK1, LMOD1, LMOD2, LMOD3, LRTM2, MACF1, MALSU1, MDM1, MIEN1, MSN, MTM1, MTPN, MTSS1, NAPA, NAPB, NF2, NF2L, ODF2, ORMDL2, ORMDL3, PFN3, PINX1, PLA2G6, PODXL, PREB, RDX, RESF1, RHPN1, RHPN2, ROCK1, ROCK2, RTEL1, SAR1B, SCIN, SDCCAG3, SENP6, SETDB1, SETDB2, SLAIN1, SLAIN2, SLITRK1, LOC121106448, SLITRK4, SLITRK5, SLITRK6, SPICE1, SSH1, SSH2, SVIL, SYNDIG1, SYNPO2, TAPT1, TMEM39A, TMOD2, TMOD3, TMOD4, TMSB15B, TMSB4X, TMSB4B, TP53I3, TPPP, TPPP3, TRIM37, TWF1, TWF2, VASP, VILL, VSTM5
GO:0022613	**ribonucleoprotein complex biogenesis**	1.199	0.01331	AAR2, ABCE1, BOP1, BYSL, C12orf45, C1D, C1QBP, C8orf59, CELF2, CELF3, CELF5, CELF6, CLNS1A, COIL, CRNKL1, DCAF13, DDX10, DDX20, DDX31, DDX52, DENR, DHX37, DIEXF, DKC1, DROSHA, EFL1, EIF2D, EIF2S2, EIF2S3, EIF6, EMG1, ERAL1, ERI1, ESF1, EXOSC10, EXOSC2, EXOSC7, EXOSC8, EXOSC9, FDXACB1, FTSJ3, GAR1, GEMIN4, GEMIN7, GEMIN8, GLTSCR2, GPATCH4, GTPBP4, HEATR1, HEATR3, IMP3, ISY1, LAS1L, LSM4, LSM6, LTV1, LUC7L, LUC7L2, LUC7L3, LYAR, MAK16, MALSU1, MCTS1, MDN1, METTL16, MPHOSPH10, MPHOSPH6, MPV17L2, MRM1, MRPL20, MRPL22, MRPL36, MRPS11, MRPS7, MRTO4, MTERF3, NAF1, NHP2, NIP7, NOB1, NOC2L, NOC4L, NOL10, NOL11, NOL9, NOM1, NOP14, NOP16, NOP2, RRP36, NPM1, NSUN3, NSUN5, NUFIP1, NUP88, NVL, PES1, PIH1D2, PIN4, PINX1, POP4, LOC107051197, PRPF18, PRPF6, PRPF8, PTGES3, PUF60, PWP1, PWP2, RAN, RBFA, REXO4, RIOK1, RIOK3, RPF2, RPL14, RPL23A, RPL26L1, RPL3, RPL35, RPL38, RPL3L, RPL7, RPL7A, RPL7L1, RPLP0, RPP40, RPS14, RPS15, RPS16, RPS21, RPS27, RPS27L, RPS28, RPS7, RPSA2, RRNAD1, RRP15, RRP1B, RRP7A, RRS1, RSL24D1, RUVBL1, SBDS, SCAF11, SDAD1, SF3A2, SFSWAP, SHQ1, TSR1, SNRPC, SNRPD1, SNRPD3, SNRPE, SNRPF, SNRPGP15, SRPK1, SRPK2, SRSF4, SRSF6, STRAP, SURF6, TBL3, TFB1M, TFB2M, TRAF7, TSR3, URB1, URB2, UTP11, UTP14A, UTP18, UTP4, UTP6, WBSCR22, WDR18, WDR3, WDR43, XPO1, ZCCHC4, ZNF622, ZNHIT3
GO:0009894	**regulation of catabolic process**	1.194	0.02638	ABHD4, ANGEL2, ANKIB1, APC2, ARIH1, ARIH2, ASB11, ASB13, ASB5, ASB9, AZIN1, BANP, C18orf8, CALCOCO2, CARHSP1, CISD2, CLEC16A, CNOT1, CNOT2, CNOT6, CNOT6L, COMMD1, CSDC2, CSNK1D, DAP, DCP1A, DCP1B, DCPS, DDA1, DEPDC5, DET1, DNAJB6, DND1, DRAM1, DRAM2, ECSCR, EXOSC7, EXOSC8, EXOSC9, FAM46A, FAM46B, FAM46C, FAM46D, FASTK, FASTKD3, FBXO22, FBXO7, FHIT, FMR1, FYCO1, FZR1, GFAP, GPR137B, HACE1, HNRNPU, KLHL40, LARP1, LARP1B, LSM1, MEIOC, MTCL1, MTM1, MTMR3, MTMR4, MTMR8, MTMR9, MTMR9LP, MTOR, MYEF2, N4BP1, NPRL3, NUB1, OAZ1, OAZ2, PAN2, PAN3, PARK2, PARN, PATL2, PDE12, PDIK1L, PLEKHN1, PNLDC1, PNPLA3, PSMD3, PSME1, PUM1, PUM2, RARRES2, RNF14, RNF144A, RNF144B, RNF152, RNF19A, RNF19AL, RNF19B, RNF217, RNFT1, RNFT2, RPTOR, RRAGA, RRAGC, RRAGD, SESN1, SESN2, SESN3, SESN4, SH3RF2, SOCS5, SOGA1, SOGA3, STK35, SYNCRIP, TBRG4, TIA1, TIGAR, TIMP2, TIMP3, TIMP4, TMEM173, TMEM259, TMEM39A, TNFRSF1B, TNRC6A, TNRC6B, TNRC6C, TRIB1, TRIB2, TRIM13, TRIM65, UFL1, ULK1, ULK2, USP10, USP14, VIP, WAC, YTHDF1, YTHDF2, YTHDF3, ZC3H12A, ZC3H12D, ZCCHC17, NPRL2
GO:0042254	**ribosome biogenesis**	1.194	0.02638	ABCE1, BOP1, BYSL, C1D, C1QBP, C8orf59, DCAF13, DDX10, DDX31, DDX52, DHX37, DIEXF, DKC1, DROSHA, EFL1, EIF6, EMG1, ERAL1, ERI1, ESF1, EXOSC10, EXOSC2, EXOSC7, EXOSC8, EXOSC9, FDXACB1, FTSJ3, GAR1, GEMIN4, GLTSCR2, GPATCH4, GTPBP4, HEATR1, HEATR3, IMP3, LAS1L, LSM6, LTV1, LYAR, MAK16, MALSU1, MDN1, METTL16, MPHOSPH10, MPHOSPH6, MPV17L2, MRM1, MRPL20, MRPL22, MRPL36, MRPS11, MRPS7, MRTO4, MTERF3, NAF1, NHP2, NIP7, NOB1, NOC2L, NOC4L, NOL10, NOL11, NOL9, NOM1, NOP14, NOP16, NOP2, RRP36, NPM1, NSUN3, NSUN5, NUP88, NVL, PES1, PIH1D2, PIN4, PINX1, POP4, LOC107051197, PWP1, PWP2, RAN, RBFA, REXO4, RIOK1, RIOK3, RPF2, RPL14, RPL23A, RPL26L1, RPL3, RPL35, RPL3L, RPL7, RPL7A, RPL7L1, RPLP0, RPP40, RPS14, RPS15, RPS16, RPS21, RPS27, RPS27L, RPS28, RPS7, RPSA2, RRNAD1, RRP15, RRP1B, RRP7A, RRS1, RSL24D1, SBDS, SDAD1, TSR1, SURF6, TBL3, TFB1M, TFB2M, TRAF7, TSR3, URB1, URB2, UTP11, UTP14A, UTP18, UTP4, UTP6, WBSCR22, WDR18, WDR3, WDR43, XPO1, ZCCHC4, ZNF622, ZNHIT3
GO:0007015	**actin filament organization**	1.193	0.02079	ACTR2, ADD1, ADD2, AP1AR, ARFIP1, ARFIP2, ARHGAP18, ARHGAP28, ARHGAP40, ARHGEF10, ARHGEF10L, ARHGEF2, ARPC1A, ARPC1B, ARPC3, ARPC4, ARPC5L, ASB12, BAIAP2, BAIAP2L1, BAIAP2L2, C9ORF58, CALD1, CAPG, CAPZA1, CAPZA2, CAPZA3, CAPZB, CARMIL1, CCDC53, COBL, CORO1C, CORO2B, CORO6, COTL1, CRACD, CYFIP1, CYFIP2, DBN1, DBNL, DIAPH2, DIAPH3, DMTN, DPYSL3, DSTN, ELMO1, ELMO2, ELMO3, ENAH, ESPN, FAM107A, FAM171A1, FAM206A, FAM49A, FAM49B, FCHSD1, FCHSD2, FHOD1, FHOD3, FLII, FSCN1, FSCN2, GAS2L2, GAS2L3, GAS7, GSN, HAX1, HCLS1, HIP1, HIP1R, KANK3, KPTN, LCP1, LIMA1, LIMCH1, LIMD2, LIMK1, LMOD1, LMOD2, LMOD3, MARCKS, MARCKSL1, MPRIP, MTPN, MTSS1, MYO19, MYO1A, MYO1C, MYO1D, MYO1E, MYO1F, MYO1G, MYO1H, MYO5A, MYO5B, MYO5C, MYO6,

GO ID	Biological Process	Fold Enrichment	Adjusted p-value	Gene IDs
				NEBL, PACSIN1, PFN3, PHACTR1, PICK1, PLEKHH2, PLS3, POF1B, PPP1R19B, PPP1R9A, PSTPIP1, RAC1, RAC3, RFLNA, RFLNB, RHOA, RHOG, RHOG2, RHPN1, RHPN2, RLTPR, SAMD14, SCIN, SHROOM1, SHROOM2, SHROOM3, SPIRE1, SPIRE1L, SPIRE2, SSH1, SSH2, SVIL, SYNPO2, TCAP, TMOD2, TMOD3, TMOD4, TMSB15B, TMSB4X, TMSB4B, TP53I3, TPM1, TPM3, TPM4, TRIOBP, TRPV4, TWF1, TWF2, VASP, VILL, WASF1, WASF2, WASF3, WASF3L, WASHC1, WASHC5, WASL, WDR1, WHAMM, XIRP1
GO:0051493	**regulation of cytoskeleton organization**	1.193	0.03781	ADD1, ADD2, AP1AR, APC2, ARFIP1, ARFIP2, ARHGAP17, ARHGAP18, ARHGAP28, ARHGAP40, ARHGAP44, ARHGEF10, ARHGEF10L, ARPC3, ARPC5L, ASB12, BAIAP2, BAIAP2L1, BAIAP2L2, BICD1, BICD2, BMERB1, BORA, CAMSAP1, CAPG, CAPZA1, CAPZA2, CAPZA3, CAPZB, CARMIL1, CCSAP, CDK5RAP2, CKAP2, CLIP1, COTL1, CRACD, CYFIP1, CYFIP2, DBN1, DBNL, FAM107A, FAM206A, FAM49A, FAM49B, FCHSD1, FCHSD2, FLII, GAS2L2, GSK3A, GSN, HAX1, HCLS1, HNRNPU, IQGAP1, IQGAP3, KANK3, LIMCH1, LIMK1, LMOD1, LMOD2, LMOD3, MAP1A, MAP1S, MAP6, MAPRE1, MAPRE2, MAPRE3, MDM1, MLST8, MTPN, MTSS1, NES, PAK1, PAK3, PFN3, PHLDB1, PHLDB2, PICK1, PLEKHH2, RAC1, RAC3, RHOG, RHOG2, RHPN1, RHPN2, RLTPR, ROCK2, SCIN, SENP6, SLAIN1, SLAIN2, SPATA4, SSH1, SSH2, STMN1, STMN2, STMN3, STMN4, SVIL, SYNPO2, TMOD2, TMOD3, TMOD4, TMSB15B, TMSB4X, TMSB4B, TP53I3, TPX2, TRIM37, TWF1, TWF2, VASP, VILL, WASF1, WASF2, WASF3, WASF3L, WASHC5, WDR1
GO:0033043	**regulation of organelle organization**	1.186	0.01658	ADD1, ADD2, AKAP9, ANAPC1, ANAPC4, ANAPC5, AP1AR, APC2, AREG, ARFIP1, ARFIP2, ARHGAP17, ARHGAP18, ARHGAP28, ARHGAP40, ARHGAP44, ARHGEF10, ARHGEF10L, ARPC3, ARPC5L, ASB12, ATF7IP, ATP13A2, BAIAP2, BAIAP2L1, BAIAP2L2, BICD1, BICD2, BID, BMERB1, BORA, BTC, BUB1, C2CD5, CALCOCO2, CAMSAP1, CAPG, CAPZA1, CAPZA2, CAPZA3, CAPZB, CARMIL1, CCSAP, CDK5RAP2, CEP295, CKAP2, CLEC16A, CLIP1, COTL1, CRACD, CYFIP1, CYFIP2, DBN1, DBNL, DCDC2, ELAPOR1, EPGN, EREG, EZR, FAM107A, FAM162A, FAM162BL, FAM206A, FAM208A, FAM49A, FAM49B, FBXO43, FBXO5, FCHSD1, FCHSD2, FLII, FYCO1, GAS2L2, GSK3A, GSN, HAX1, HCLS1, HNRNPU, IQGAP1, IQGAP3, KANK3, KCNJ4, KNTC1, LIMCH1, LIMK1, LMOD1, LMOD2, LMOD3, MAD1L1, MAD2L1, MAP1A, MAP1S, MAP6, MAPRE1, MAPRE2, MAPRE3, MCM2, MDM1, MIEF1, MIEF2, MLLT11, MLST8, MSN, MTM1, MTPN, MTSS1, NEDD8, NES, NF2, NF2L, ODF2, PAK1, PAK3, PARK2, PFN3, PGAM5, PHLDB1, PHLDB2, PICK1, PINK1, PLEKHH2, POT1, PREB, RAB3A, RAC1, RAC3, RDX, RESF1, RHOG, RHOG2, RHOT1, RHOT2, RHPN1, RHPN2, RLTPR, RMI2, ROCK2, RTEL1, SAR1B, SCIN, SDCCAG3, SENP6, SETDB1, SETDB2, SLAIN1, SLAIN2, SPATA4, SPDL1, SPICE1, SSH1, SSH2, STMN1, STMN2, STMN3, STMN4, SVIL, SYNPO2, TAPT1, TEN1, TERF2, TEX14, TGFA, TMEM39A, TMOD2, TMOD3, TMOD4, TMSB15B, TMSB4X, TMSB4B, TP53I3, TPX2, TRIM37, TRIP13, TTK, TWF1, TWF2, VASP, VILL, WASF1, WASF2, WASF3, WASF3L, WASHC5, WDR1, WEE2, ZW10, ZWILCH
GO:0045944	**positive regulation of transcription by RNA polymerase II**	1.182	0.03781	ABRA, ADCYAP1, AKIRIN2, ALX1, ASCL1, ASXL1, ASXL2, ASXL3, ATAD2, ATAD2B, BCL9, BCL9L, BCLAF1, BRCA1, BRD4, CASZ1, CCNC, CD40, CDK12, CDK13, CHCHD2, CIITA, CREBBP, CRTC1, CTNNB1, CXorf23, CYTL1, DCAF6, ELL, EP300, FHL5, GABPB1, GABPB2, GATA2, GATA3, GATA4, GATA5, GATA6, GMEB1, GMEB2, HIPK2, HNF4A, HNF4beta, HNRNPU, IKBKB, ISL2, JUP, KANSL3, KAT2A, KAT2B, KMT2C, KMT2D, LDB2, LEO1, LMO3, LPIN1, LPIN2, MAML1, MAML2, MAML3, MCRS1, MED10, MEF2A, MEF2B, MEF2D, MEIS1, MEOX1, MEOX2, MTF1, MYOG, NCOA1, NCOA2, NCOA3, NCOA6, NPM1, NR1D1, NR1D2, NR1H4, NR1I3, NR2C2, NR2E3, OCLN, PAXBP1, PAXIP1, PCBP2, PLAC8L1, PLACL2, POU2AF1, PPARA, PPARD, PPARG, PPARGC1A, PPARGC1B, PTMS, RAX2, RNF10, RNF4, RXRA, SAMD11, SETD4, SLC30A9, SMARCA4, SOX11, SOX12, SOX17, SOX18, SOX21, SOX3, SREBF2, SRF, SS18, SS18L1, SS18L2, SSBP4, STOX2, SUPT6H, TCEA1, TEAD3, TET2, TET3, TFCP2, THRA, THRAP3, THRB, TP53BP1, VDR, YAP1, ZFPM1, ZFPM2, ZNF750, LOC121109895
GO:0045935	**positive regulation of nucleobase-containing compound metabolic process**	1.171	0.01331	ABRA, ADCYAP1, AKIRIN2, ALX1, ARID1A, ARID1B, ASCL1, ASXL1, ASXL2, ASXL3, ATAD2, ATAD2B, BABAM1, BCL9, BCL9L, BCLAF1, BICRA, BRCA1, BRD4, CASZ1, CCNC, CCNT1, CD40, CDK12, CDK13, CDK5RAP2, CHCHD2, CIITA, CNOT1, CNOT2, CNOT6, CNOT6L, CREBBP, CRTC1, CTC1, CTNNB1, CXorf23, CYTL1, DBF4, DBF4B, DCAF6, DCP1A, DCP1B, DCPS, DHX33, DYRK1A, EAF1, ELL, ENY2, EOMES, EP300, EXOSC7, EXOSC8, EXOSC9, EYA1, EYA2, EYA3, EYA4, FAM168A, FANCB, FGF7, FHL5, GABPB1, GABPB2, GATA2, GATA3, GATA4, GATA5, GATA6, GLTSCR1L, GMEB1, GMEB2, GPATCH3, GUCA1A, HEATR1, HIPK2, HMBOX1, HNF1A, HNF1B, HNF4A, HNF4beta, HNRNPU, ICE2, IKBKB, ING1, ING2, ISL2, JUP, KANSL3, KAT2A, KAT2B, KMT2A, KMT2C, KMT2D, LBH, LDB2, LEO1, LMO3, LPIN1, LPIN2, LSM1, MAML1, MAML2, MAML3, MCRS1, MED10, MED16, MED30, MEF2A, MEF2B, MEF2D, MEIS1, MEOX1, MEOX2, MLLT11, MSANTD1, MTF1, MYOG, MYRFL, NCOA1, NCOA2, NCOA3, NCOA6, NPM1, NPM2, NR1D1, NR1D2, NR1H4, NR1I3, NR2C2, NR2E3, NUP85, OCLN, PAN2, PAN3, PARN, PATL2, PAXBP1, PAXIP1, PCBP2, PDE12, PLAC8L1, PLACL2, PLEKHN1, PML, PMLL, PNLDC1, POU2AF1, PPARA, PPARD, PPARG, PPARGC1A, PPARGC1B, PTMS, RAX2, RBM3, RBMXL1, RNF10, RNF111, RNF4, RNF6, RPS6KA1, RXRA, RYBP, SAMD11, SETD4, SF3B4, SLC30A9, SMARCA4, SMARCC1, SMARCC2, SOX11, SOX12, SOX17, SOX18, SOX21, SOX3, SREBF2, SRF, SS18, SS18L1, SS18L2, SSBP4, STOX2, SUPT4H1, SUPT6H, TBX1, TBX15, TBX18, TBX19, TBX2, TBX20, TBX21, TBX22, TBX4, TBX5, TBX6,

GO ID	Biological Process	Fold Enrichment	Adjusted p-value	Gene IDs
				TBXT, TCEA1, TEAD3, TET2, TET3, TFCP2, TFEB, THOC5, THRA, THRAP3, THRB, TIGAR, TNRC6A, TNRC6B, TNRC6C, TP53BP1, TP53INP1, TP53INP2, TRA2A, TRIM28, TRIM45, TRIP4, UIMC1, VDR, WBP2, WBP2NL, YAF2, YAP1, YTHDF1, YTHDF2, YTHDF3, ZC3H12A, ZC3H12D, ZFPM1, ZFPM2, ZNF318, ZNF750, LOC121109895
GO:0051254	**positive regulation of RNA metabolic process**	1.165	0.01658	ABRA, ADCYAP1, AKIRIN2, ALX1, ARID1A, ARID1B, ASCL1, ASXL1, ASXL2, ASXL3, ATAD2, ATAD2B, BCL9, BCL9L, BCLAF1, BICRA, BRCA1, BRD4, CASZ1, CCNC, CCNT1, CD40, CDK12, CDK13, CDK5RAP2, CHCHD2, CIITA, CNOT1, CNOT2, CNOT6, CNOT6L, CREBBP, CRTC1, CTNNB1, CXorf23, CYTL1, DCAF6, DCP1A, DCP1B, DCPS, DHX33, DYRK1A, EAF1, ELL, ENY2, EOMES, EP300, EXOSC7, EXOSC8, EXOSC9, FGF7, FHL5, GABPB1, GABPB2, GATA2, GATA3, GATA4, GATA5, GATA6, GLTSCR1L, GMEB1, GMEB2, GPATCH3, HEATR1, HIPK2, HMBOX1, HNF1A, HNF1B, HNF4A, HNF4beta, HNRNPU, ICE2, IKBKB, ING1, ING2, ISL2, JUP, KANSL3, KAT2A, KAT2B, KMT2A, KMT2C, KMT2D, LBH, LDB2, LEO1, LMO3, LPIN1, LPIN2, LSM1, MAML1, MAML2, MAML3, MCRS1, MED10, MED16, MED30, MEF2A, MEF2B, MEF2D, MEIS1, MEOX1, MEOX2, MLLT11, MSANTD1, MTF1, MYOG, MYRFL, NCOA1, NCOA2, NCOA3, NCOA6, NPM1, NR1D1, NR1D2, NR1H4, NR1I3, NR2C2, NR2E3, NUP85, OCLN, PAN2, PAN3, PARN, PATL2, PAXBP1, PAXIP1, PCBP2, PDE12, PLAC8L1, PLACL2, PLEKHN1, PML, PMLL, PNLDC1, POU2AF1, PPARA, PPARD, PPARG, PPARGC1A, PPARGC1B, PTMS, RAX2, RBM3, RBMXL1, RNF10, RNF111, RNF4, RNF6, RPS6KA1, RXRA, RYBP, SAMD11, SETD4, SF3B4, SLC30A9, SMARCA4, SMARCC1, SMARCC2, SOX11, SOX12, SOX17, SOX18, SOX21, SOX3, SREBF2, SRF, SS18, SS18L1, SS18L2, SSBP4, STOX2, SUPT4H1, SUPT6H, TBX1, TBX15, TBX18, TBX19, TBX2, TBX20, TBX21, TBX22, TBX4, TBX5, TBX6, TBXT, TCEA1, TEAD3, TET2, TET3, TFCP2, TFEB, THOC5, THRA, THRAP3, THRB, TNRC6A, TNRC6B, TNRC6C, TP53BP1, TP53INP1, TP53INP2, TRA2A, TRIM28, TRIM45, TRIP4, VDR, WBP2, WBP2NL, YAF2, YAP1, YTHDF1, YTHDF2, YTHDF3, ZC3H12A, ZC3H12D, ZFPM1, ZFPM2, ZNF318, ZNF750, LOC121109895
GO:0045893	**positive regulation of DNA-templated transcription**	1.158	0.02661	ABRA, ADCYAP1, AKIRIN2, ALX1, ARID1A, ARID1B, ASCL1, ASXL1, ASXL2, ASXL3, ATAD2, ATAD2B, BCL9, BCL9L, BCLAF1, BICRA, BRCA1, BRD4, CASZ1, CCNC, CCNT1, CD40, CDK12, CDK13, CDK5RAP2, CHCHD2, CIITA, CREBBP, CRTC1, CTNNB1, CXorf23, CYTL1, DCAF6, DHX33, DYRK1A, EAF1, ELL, ENY2, EOMES, EP300, FGF7, FHL5, GABPB1, GABPB2, GATA2, GATA3, GATA4, GATA5, GATA6, GLTSCR1L, GMEB1, GMEB2, GPATCH3, HEATR1, HIPK2, HMBOX1, HNF1A, HNF1B, HNF4A, HNF4beta, HNRNPU, ICE2, IKBKB, ING1, ING2, ISL2, JUP, KANSL3, KAT2A, KAT2B, KMT2A, KMT2C, KMT2D, LBH, LDB2, LEO1, LMO3, LPIN1, LPIN2, MAML1, MAML2, MAML3, MCRS1, MED10, MED16, MED30, MEF2A, MEF2B, MEF2D, MEIS1, MEOX1, MEOX2, MLLT11, MSANTD1, MTF1, MYOG, MYRFL, NCOA1, NCOA2, NCOA3, NCOA6, NPM1, NR1D1, NR1D2, NR1H4, NR1I3, NR2C2, NR2E3, NUP85, OCLN, PAXBP1, PAXIP1, PCBP2, PLAC8L1, PLACL2, PML, PMLL, POU2AF1, PPARA, PPARD, PPARG, PPARGC1A, PPARGC1B, PTMS, RAX2, RNF10, RNF111, RNF4, RNF6, RPS6KA1, RXRA, RYBP, SAMD11, SETD4, SLC30A9, SMARCA4, SMARCC1, SMARCC2, SOX11, SOX12, SOX17, SOX18, SOX21, SOX3, SREBF2, SRF, SS18, SS18L1, SS18L2, SSBP4, STOX2, SUPT4H1, SUPT6H, TBX1, TBX15, TBX18, TBX19, TBX2, TBX20, TBX21, TBX22, TBX4, TBX5, TBX6, TBXT, TCEA1, TEAD3, TET2, TET3, TFCP2, TFEB, THOC5, THRA, THRAP3, THRB, TP53BP1, TP53INP1, TP53INP2, TRIM28, TRIM45, TRIP4, VDR, WBP2, WBP2NL, YAF2, YAP1, ZFPM1, ZFPM2, ZNF318, ZNF750, LOC121109895
GO:1902680	**positive regulation of RNA biosynthetic process**	1.158	0.02661	ABRA, ADCYAP1, AKIRIN2, ALX1, ARID1A, ARID1B, ASCL1, ASXL1, ASXL2, ASXL3, ATAD2, ATAD2B, BCL9, BCL9L, BCLAF1, BICRA, BRCA1, BRD4, CASZ1, CCNC, CCNT1, CD40, CDK12, CDK13, CDK5RAP2, CHCHD2, CIITA, CREBBP, CRTC1, CTNNB1, CXorf23, CYTL1, DCAF6, DHX33, DYRK1A, EAF1, ELL, ENY2, EOMES, EP300, FGF7, FHL5, GABPB1, GABPB2, GATA2, GATA3, GATA4, GATA5, GATA6, GLTSCR1L, GMEB1, GMEB2, GPATCH3, HEATR1, HIPK2, HMBOX1, HNF1A, HNF1B, HNF4A, HNF4beta, HNRNPU, ICE2, IKBKB, ING1, ING2, ISL2, JUP, KANSL3, KAT2A, KAT2B, KMT2A, KMT2C, KMT2D, LBH, LDB2, LEO1, LMO3, LPIN1, LPIN2, MAML1, MAML2, MAML3, MCRS1, MED10, MED16, MED30, MEF2A, MEF2B, MEF2D, MEIS1, MEOX1, MEOX2, MLLT11, MSANTD1, MTF1, MYOG, MYRFL, NCOA1, NCOA2, NCOA3, NCOA6, NPM1, NR1D1, NR1D2, NR1H4, NR1I3, NR2C2, NR2E3, NUP85, OCLN, PAXBP1, PAXIP1, PCBP2, PLAC8L1, PLACL2, PML, PMLL, POU2AF1, PPARA, PPARD, PPARG, PPARGC1A, PPARGC1B, PTMS, RAX2, RNF10, RNF111, RNF4, RNF6, RPS6KA1, RXRA, RYBP, SAMD11, SETD4, SLC30A9, SMARCA4, SMARCC1, SMARCC2, SOX11, SOX12, SOX17, SOX18, SOX21, SOX3, SREBF2, SRF, SS18, SS18L1, SS18L2, SSBP4, STOX2, SUPT4H1, SUPT6H, TBX1, TBX15, TBX18, TBX19, TBX2, TBX20, TBX21, TBX22, TBX4, TBX5, TBX6, TBXT, TCEA1, TEAD3, TET2, TET3, TFCP2, TFEB, THOC5, THRA, THRAP3, THRB, TP53BP1, TP53INP1, TP53INP2, TRIM28, TRIM45, TRIP4, VDR, WBP2, WBP2NL, YAF2, YAP1, ZFPM1, ZFPM2, ZNF318, ZNF750, LOC121109895
GO:0050793	**regulation of developmental process**	1.155	0.03252	AAMDC, ADD1, ADGRB2, ADGRB3, ALK, APC2, ARHGAP44, ARHGEF2, ASCL1, ATRAID, BCL11A, BEND6, BGLAP, BHLHE40, BHLHE41, BRINP1, BRWD1, BRWD3, CASZ1, CD40, CDH2, CDKL5, CEBPB, CEBPD, CHODL, CLSTN1, CLSTN3, CNOT2, CSF1, CSF3, CSMD3, CST7, DAAM2, DBN1, DBNL, DCT, DUSP6, ECSCR, ENPP1, ERRFI1, EZR, FAM171A1, FANCA, FBXO22, FGFR1, FLOT2, FLT1, FMNL1, FMR1, FNDC5, FTO, GATA2, GATA3, GBX1, GDPD5, GHRH, GPR137B, HECW1, HELT, HES4, HES5A, HES5B, HEY1, HEY2,

GO ID	Biological Process	Fold Enrichment	Adjusted p-value	Gene IDs
				HEYL, HOMER3, IL23A, IL34, ISM1, KDR, KIAA0319, KRIT1, LAMA1, LAMA2, LAMA3, LAMA4, LAMA5, LATS1, LATS2, LECT1, LRTM2, LZTS1, MAFB, MAFF, MAFG, MAP6, METRN, METRNL, MIEF1, MIEF2, MSN, MTDH, MTURN, MYDGF, MYF5, MYF6, MYOG, NEDD4, NF2, NF2L, NGF, NOG, NOG2, NOTCH1, NR2C2, NTF3, PACSIN1, PAK1, PAK3, PALM, PDE3A, PDPN, PGAM5, PHIP, PINK1, PLEKHB1, PLEKHO1, PLXNA1, PLXNA2, PLXNA4, PLXNB2, PLXNB3, PLXNC1, PLXND1, PPP1R16B, PTBP1, PTHLH, RAC1, RAC3, RBPMS2, RDX, RFLNA, RFLNB, RHOG, RHOG2, RNF10, RNF207, RUFY3, RUNX1, RUNX2, RUNX3, SEMA3A, SEMA3B, SEMA3C, SEMA3D, SEMA3DL, SEMA3E, SEMA3F, SEMA3G, SEMA4B, LOC107049953, SEMA5A, SEMA6B, SEMA6C, SEMA6D, SEMA7A, SERPINF1, SEZ6, SLITRK1, LOC121106448, SLITRK4, SLITRK5, SLITRK6, SOX5, SOX9, SRCIN1, SS18L1, SYNDIG1, TANC2, TCP11, THBS2, TIAM1, TIAM2, TMEM119, TNFRSF1B, TNFRSF21, TNMD, UBASH3B, VASH2, VEGFA, VEGFC, VEGFD, VSTM5, WWC1, WWC2, WWC3, ZC4H2, ZFHX3, ZNF335
GO:0000902	**cell morphogenesis**	1.154	0.04224	ACTG1L, ANKRD27, APLP2, APP, ARHGAP44, ARHGEF2, BOC, BRWD1, BRWD3, BSG, BTBD3, CAP1, CAP2, CAPZB, CDH1, CDH10, CDH11, CDH12, CDH13, CDH15, CDH17, CDH18, CDH19, CDH2, CDH20, CDH22, CDH3, CDH4, CDH5, CDH6, CDH7, CDH8, CDH9, CDK5, CDKL5, CDON, CHL1, CHODL, CYFIP1, CYFIP2, DAG1, DBN1, DBNL, DCDC2, DRAXIN, DSCAM, DSCAML1, EFNA2, EFNB1, EFNB2, ENAH, EPHA1, EPHA10, EPHA2, EPHA3, EPHA5, EPHA6, EPHA7, EPHA8, EPHB2, EPHB6, EZR, FAM171A1, FAM206A, FAT3, FMNL1, FMR1, FRY, FRYL, GAP43, GAS7, HECW1, HOMER3, IGDCC3, IGDCC4, ISL2, JAG1, LAMA1, LAMA2, LAMA3, LAMA5, LAMB4, LRTM2, LZTS1, MAP1A, MAP1S, MAP6, METRN, MNX1, MSN, MYO16, MYOT, NCKAP1L, NEDD4, NF2, NF2L, NGF, NPTX1, NRN1, NRN1L, NRP1, NTF3, PACSIN1, PAK1, PAK3, PALM, PDIK1L, PDPN, PHIP, PLXNA1, PLXNA2, PLXNA4, PLXNB2, PLXNB3, PLXNC1, PLXND1, POF1B, PRTG, PTPRO, RAB3A, RAC1, RAC3, RB1, RDX, RHOG, RHOG2, ROBO1, ROBO3, RUFY3, SDK1, SEMA3A, SEMA3B, SEMA3C, SEMA3D, SEMA3DL, SEMA3E, SEMA3F, SEMA3G, SEMA4B, LOC107049953, SEMA5A, SEMA6B, SEMA6C, SEMA6D, SEMA7A, SIPA1, SLIT2, SLIT3, SLITRK1, LOC121106448, SLITRK4, SLITRK5, SLITRK6, SMO, SPAG6, SPG11, SRCIN1, SS18L1, STK35, TANC2, TIAM1, TIAM2, TMEM106B, TMEM108, TP53TG5, TUBB3, ULK1, ULK2, UNC5A, UNK, VASP, VSIG1, WHRN
GO:0016071	**mRNA metabolic process**	1.152	0.02638	AAR2, ALKBH5, ANGEL2, BCAS2, BUD13, BUD31, C9orf78, CACTIN, CARHSP1, CASC3, CCDC94, CDC40, CDC5L, CELF2, CELF3, CELF5, CELF6, CLNS1A, CMTR1, CMTR2, CNOT1, CNOT10, CNOT11, CNOT2, CNOT6, CNOT6L, COIL, CPSF3, CPSF6, CRNKL1, CSDC2, CSTF1, CSTF2, CWC15, CWC25, CWF19L2, DCP1A, DCP1B, DCPS, DDX17, DDX20, DDX41, DDX46, DDX5, DHX34, DHX38, DHX8, DKC1, DND1, EDC3, EDC4, EFTUD2, ERN1, ERN2, EXOSC10, EXOSC5, EXOSC6, EXOSC7, EXOSC8, EXOSC9, FAM46A, FAM46B, FAM46C, FAM46D, FASTK, FASTKD3, FMR1, SMG8, GEMIN4, GEMIN7, GEMIN8, GPATCH1, LOC101749377, HNRNPLL, HNRNPU, HTATSF1, IK, ISY1, KHDRBS1, KHDRBS2, KHDRBS3, LARP1, LARP1B, LSM1, LSM10, LSM11, LSM3, LSM4, LSM5, LSM6, LSM7, LSM8, LUC7L, LUC7L2, LUC7L3, MEIOC, MFAP1, MRTO4, MYEF2, LOC422214, NSRP1, PAN2, PAN3, PARN, PATL2, PAXBP1, PCBP4, PDE12, PHF5A, PLEKHN1, PLRG1, PNLDC1, PNPT1, PNRC1, PNRC2, PRPF18, PRPF3, PRPF4, PRPF4B, PRPF6, PRPF8, PTBP1, PUF60, PUM1, PUM2, PUS1, PUS3, QKI, RBMX2, RBBP6, RBFOX1, RBFOX2, RBFOX3, RBM10, RBM11, RBM14, RBM15, RBM15B, RBM17, RBM23, RBM26, RBM27, RBM3, LOC425562, RBM41, RBM6, RBM7, RBMXL1, RNGTT, RNMT, RNPS1, RPRD1A, RPRD1B, RPRD2, SAFB, SAFB2, SCAF11, SF3A1, SF3A2, SF3A3, SF3B3, SF3B4, SF3B5, SFSWAP, SKIV2L, SLBP, SLTM, SLU7, SMG1, SMG5, SNRNP25, SNRNP35, SNRPA1, SNRPB2, SNRPC, SNRPD1, SNRPD3, SNRPE, SNRPF, SNRPGP15, SNRPN, SON, SRPK1, SRPK2, SRRM1, SRSF3, SRSF4, SRSF6, SRSF7, SRSF7L, STRAP, SUPT4H1, SUPT6H, SYNCRIP, TBRG4, TDRD3, TFIP11, THOC2, THOC7, TIA1, TNRC6A, TNRC6B, TNRC6C, TRA2A, TXNL4A, TXNL4B, U2AF1, UBL5, UPF1, UPF2, UPF3A, UPF3B, WBP11, WBP4, WTAP, XRN2, CCDC130, YTHDC1, YTHDF1, YTHDF2, YTHDF3, ZC3H12A, ZC3H12D, ZCRB1, ZMAT2, ZRSR2
GO:0051128	**regulation of cellular component organization**	1.145	0.01658	ADD1, ADD2, AKAP9, ANAPC1, ANAPC4, ANAPC5, AP1AR, APC2, AREG, ARFGAP1, ARFIP1, ARFIP2, ARHGAP17, ARHGAP18, ARHGAP24, ARHGAP28, ARHGAP40, ARHGAP44, ARHGEF10, ARHGEF10L, ARPC3, ARPC5L, ASB12, ATF7IP, ATP13A2, BAIAP2, BAIAP2L1, BAIAP2L2, BCL11A, BICD1, BICD2, BID, BMERB1, BORA, BTC, BUB1, C2CD5, CALCOCO2, CAMSAP1, CAPG, CAPZA1, CAPZA2, CAPZA3, CAPZB, CARMIL1, CCSAP, CD47, CDH2, CDK5RAP2, CDKL5, CEP131, CEP295, PIFO, CHODL, CKAP2, CLEC16A, CLIP1, CLSTN1, CLSTN3, COTL1, CRACD, CSMD3, CTTNBP2, CYFIP1, CYFIP2, DBN1, DBNL, DCDC2, DOCK11, EFHC2, ELAPOR1, EPGN, EPS8, LOC107050775, EREG, EZR, FAM107A, FAM110C, FAM162A, FAM162BL, FAM206A, FAM208A, FAM49A, FAM49B, FBXO43, FBXO5, FCHSD1, FCHSD2, FLII, FMR1, FYCO1, GAS2L2, GLE1, GSK3A, GSN, HAX1, HCLS1, HECW1, HNRNPU, HOMER3, IGFBP7, IQGAP1, IQGAP3, ITGB1BP1, JMJD4, KANK3, KCNJ4, KIAA0319, KNTC1, LIMCH1, LIMK1, LMOD1, LMOD2, LMOD3, LRPAP1, LRTM2, LZTS1, MACF1, MAD1L1, MAD2L1, MAP1A, MAP1S, MAP6, MAPRE1, MAPRE2, MAPRE3, MCM2, MDM1, METRN, MIEF1, MIEF2, MIEN1, MLLT11, MLST8, MSN, MTM1, MTPN, MTSS1, NAPA, NAPB, NDEL1, NEDD4, NEDD8, NES, NF2, NF2L, NGF, NPM1, ODF2, OGFOD1, PACSIN1, PACSIN2, PAK1, PAK3, PARK2, PDPN, PFN3, PGAM5, PHLDB1, PHLDB2, PICK1, PINK1, PLEKHH2, PLEKHM2, PLEKHO1, PLXNA1, PLXNA2, PLXNA4, PLXNB2, PLXNB3, PLXNC1, PLXND1,

GO ID	Biological Process	Fold Enrichment	Adjusted p-value	Gene IDs
				PODXL, POT1, PREB, RAB3A, RAB4A, RAC1, RAC3, RDX, RESF1, RHOG, RHOG2, RHOT1, RHOT2, RHPN1, RHPN2, RLTPR, RMI2, ROCK1, ROCK2, RPTOR, RTEL1, RUFY1, RUFY3, SAR1B, SCAF4, SCIN, SDCCAG3, SEMA3A, SEMA3B, SEMA3C, SEMA3D, SEMA3DL, SEMA3E, SEMA3F, SEMA3G, SEMA4B, LOC107049953, SEMA5A, SEMA6B, SEMA6C, SEMA6D, SEMA7A, SENP6, SETDB1, SETDB2, SEZ6, SLAIN1, SLAIN2, SLC25A20, SLIT2, SLITRK1, LOC121106448, SLITRK4, SLITRK5, SLITRK6, SMAP1, SPATA4, SPDL1, SPICE1, SRCIN1, SS18L1, SSH1, SSH2, STK11, STMN1, STMN2, STMN3, STMN4, STON1, SVIL, SYNDIG1, SYNPO2, TANC2, TAPT1, TEN1, TERF2, TEX14, TGFA, TIAM1, TIAM2, TMEM39A, TMOD2, TMOD3, TMOD4, TMSB15B, TMSB4X, TMSB4B, TP53I3, TPPP, TPPP3, TPX2, TRIM37, TRIP13, TTK, TWF1, TWF2, UNC119, VASP, VILL, VSTM5, WASF1, WASF2, WASF3, WASF3L, WASHC5, WDR1, WEE2, WFDC1, ZW10, ZWILCH
GO:0048666	**neuron development**	1.145	0.04931	ACTG1L, ADCYAP1, ADGRB3, ANKRD27, APLP2, APP, ARHGAP44, ATP8A2, ATXN10, BCL11A, BOC, BSG, BTBD3, C2orf71, CAMSAP1, CDH2, CDK5, CDKL5, CDON, CHL1, CHODL, CSMD3, CYFIP1, CYFIP2, DAG1, DBN1, DBNL, DCDC2, DCLK1, DCX, DRAXIN, DSCAM, DSCAML1, DTNBP1, DZANK1, EFHC2, EFNA2, EFNB1, EFNB2, ENAH, EPHA1, EPHA10, EPHA2, EPHA3, EPHA5, EPHA6, EPHA7, EPHA8, EPHB2, EPHB6, FAM206A, FMR1, FRY, FRYL, GAP43, GAS7, GPM6A, GPM6B, GPRIN3, GRXCR1, GSK3A, HECW1, HOMER3, IFT88, IGDCC3, IGDCC4, ISL2, JAG1, KIAA0319, KLHL1, LAMA1, LAMA2, LAMA3, LAMA5, LAMB4, LHX6, LRTM2, LZTS1, MAFA, MANF, MAP1A, MAP1S, MAP4, MAP6, MAPT, MCF2, METRN, MNX1, MYO16, MYOT, NCDN, NCKAP1L, NDEL1, NEDD4, NEFH, NGF, NPTX1, NRN1, NRN1L, NRP1, NTF3, OMG, PACSIN1, PAK1, PAK3, PBX3, PBX4, PDIK1L, PLP1, PLXNA1, PLXNA2, PLXNA4, PLXNB2, PLXNB3, PLXNC1, PLXND1, PPP1R19B, PPP1R9A, PRTG, PTPRO, RAB3A, RAC1, RAC3, RB1, ROBO1, ROBO3, RPGRIP1L, RUFY3, SAMD14, SCLT1, SDK1, SEMA3A, SEMA3B, SEMA3C, SEMA3D, SEMA3DL, SEMA3E, SEMA3F, SEMA3G, SEMA4B, LOC107049953, SEMA5A, SEMA6B, SEMA6C, SEMA6D, SEMA7A, SEZ6, SLC25A20, SLIT2, SLIT3, SLITRK1, LOC121106448, SLITRK4, SLITRK5, SLITRK6, SMO, SPAG6, SPG11, SRCIN1, SS18L1, STK35, STMN1, STMN2, STMN3, STMN4, TANC2, TENM1, TENM2, TENM3, TENM4, TIAM1, TIAM2, TMEM106B, TMEM108, TP53TG5, TUBB3, TWF1, TWF2, ULK1, ULK2, UNC5A, UNK, VAPA, VASP, WHRN
GO:0097435	**supramolecular fiber organization**	1.143	0.03252	ACTR2, ADD1, ADD2, AP1AR, APC2, ARFIP1, ARFIP2, ARHGAP18, ARHGAP28, ARHGAP40, ARHGEF10, ARHGEF10L, ARHGEF2, ARPC1A, ARPC1B, ARPC3, ARPC4, ARPC5L, ASB12, BAIAP2, BAIAP2L1, BAIAP2L2, BFSP2, BMERB1, C9ORF58, CALD1, CAMSAP1, CAPG, CAPZA1, CAPZA2, CAPZA3, CAPZB, CARMIL1, CCDC53, CCDC88A, CDK5RAP2, CEP126, CEP192, CKAP2, CLIP1, CLIP2, CLIP4, COBL, CORO1C, CORO2B, CORO6, COTL1, CRACD, CRIPT, CRTAP, CSRP1, CSRP2, CYFIP1, CYFIP2, DBN1, DBNL, DIAPH2, DIAPH3, DMTN, DPT, DPYSL3, DST, DSTN, ELMO1, ELMO2, ELMO3, ENAH, LOC107050437, ESPN, FAM107A, FAM171A1, FAM206A, FAM49A, FAM49B, FCHSD1, FCHSD2, FHOD1, FHOD3, FLII, FSCN1, FSCN2, GAS2L2, GAS2L3, GAS7, GFAP, GSN, HAX1, HCLS1, HIP1, HIP1R, KANK3, KATNB1, KPTN, KRT3, KRT5, KRT6A, KRT7, KRT75, KRT75L1, KRT75L2, KRT75L4, KRT80, LCP1, LIMA1, LIMCH1, LIMD2, LIMK1, LMOD1, LMOD2, LMOD3, MACF1, MAP10, MAP1A, MAP1S, MARCKS, MARCKSL1, MPRIP, MTPN, MTSS1, MYL9, MYO19, MYO1A, MYO1C, MYO1D, MYO1E, MYO1F, MYO1G, MYO1H, MYO5A, MYO5B, MYO5C, MYO6, MZT1, NDE1, NDEL1, NEBL, NEDD1, NEFL, NEFM, P3H4, PACSIN1, PFN3, PHACTR1, PICK1, PKP1, PKP2, PLEKHH2, PLS3, POF1B, PPP1R19B, PPP1R9A, PSTPIP1, RAC1, RAC3, RFLNA, RFLNB, RHOA, RHOG, RHOG2, RHPN1, RHPN2, RLTPR, SAMD14, SCIN, SERPINH1, SHROOM1, SHROOM2, SHROOM3, SLAIN1, SLAIN2, SPIRE1, SPIRE1L, SPIRE2, SSH1, SSH2, STMN1, STMN2, STMN3, STMN4, SVIL, SYNPO2, TBCB, TCAP, TMOD2, TMOD3, TMOD4, TMSB15B, TMSB4X, TMSB4B, TNNT2, TP53I3, TPM1, TPM3, TPM4, TPPP, TPPP3, TRIOBP, TRPV4, TUBG1, TUBGCP3, TUBGCP4, TUBGCP5, TUBGCP6, TWF1, TWF2, VASP, VILL, VIM, WASF1, WASF2, WASF3, WASF3L, WASHC1, WASHC5, WASL, WDR1, WDR73, WHAMM, XIRP1
GO:0009891	**positive regulation of biosynthetic process**	1.131	0.03340	ABRA, ADCYAP1, AKIRIN2, ALX1, ANGEL2, APOA5, ARID1A, ARID1B, ASCL1, ASIP, ASXL1, ASXL2, ASXL3, ATAD2, ATAD2B, BCDIN3D, BCL9, BCL9L, BCLAF1, BICRA, BRCA1, BRD4, CASZ1, CCNC, CCNT1, CD14, CD226, CD40, CD74, CDK12, CDK13, CDK5RAP2, CGA, CGAS, CHCHD2, CIITA, CNBP, CREBBP, CRTC1, CTNNB1, CXorf23, CYTL1, DCAF6, DHX33, DHX58, DND1, DYRK1A, EAF1, EIF2S3, ELL, ENY2, EOMES, EP300, FAM46A, FAM46B, FAM46C, FAM46D, FGF1, FGF13, FGF14, FGF16, FGF18, FGF2, FGF20, FGF22, FGF23, FGF6, FGF7, FGF9, FHL5, FMR1, GABPB1, GABPB2, GATA2, GATA3, GATA4, GATA5, GATA6, GLTSCR1L, GMEB1, GMEB2, GPATCH3, GUCA1A, GUF1, HEATR1, HIPK2, HMBOX1, HNF1A, HNF1B, HNF4A, HNF4beta, HNRNPU, ICE2, IKBKB, IL15, IL18R1, IL1B, IL2, ING1, ING2, ISL2, JMJD4, JUP, KANSL3, KAT2A, KAT2B, KMT2A, KMT2C, KMT2D, LARP1, LARP1B, LARP4, LARP4B, LBH, LDB2, LEO1, LMO3, LPIN1, LPIN2, MAML1, MAML2, MAML3, MCRS1, MED10, MED16, MED23, MED26, MED30, MEF2A, MEF2B, MEF2D, MEIOC, MEIS1, MEOX1, MEOX2, MLLT11, MSANTD1, MTF1, MYOG, MYRFL, NCK1, NCOA1, NCOA2, NCOA3, NCOA6, NPM1, NR1D1, NR1D2, NR1H4, NR1I3, NR2C2, NR2E3, NUP85, OCLN, PANX1, PANX2, PANX3, PAXBP1, PAXIP1, PCBP2, PDCL3, PLA2G6, PLAC8L1, PLACL2, PML, PMLL, POU2AF1, PPARA, PPARD, PPARG, PPARGC1A, PPARGC1B, PTMS, PTPN22, RAX2, RBM3, RBMXL1, RMND1, RNF10, RNF111, RNF4, RNF6, RPS6KA1, RXRA, RYBP, SAMD11, SASH3, SEMA7A, SETD4, SF3B4, SLC30A9, SMARCA4, SMARCC1, SMARCC2,

GO ID	Biological Process	Fold Enrichment	Adjusted p-value	Gene IDs
				SOX11, SOX12, SOX17, SOX18, SOX21, SOX3, SREBF2, SRF, SS18, SS18L1, SS18L2, SSBP4, STOX2, SUPT4H1, SUPT6H, SYNCRIP, TBX1, TBX15, TBX18, TBX19, TBX2, TBX20, TBX21, TBX22, TBX4, TBX5, TBX6, TBXT, TCEA1, TEAD3, TET2, TET3, TFCP2, TFEB, THOC5, THRA, THRAP3, THRB, TICAM1, TMEM173, TP53BP1, TP53INP1, TP53INP2, TRA2A, TRIM28, TRIM45, TRIP4, TRMT10C, UPF3A, UPF3B, VDR, WBP2, WBP2NL, YAF2, YAP1, ZBTB7B, ZFPM1, ZFPM2, ZNF318, ZNF750, LOC121109895
GO:0031328	**positive regulation of cellular biosynthetic process**	1.129	0.03781	ABRA, ADCYAP1, AKIRIN2, ALX1, ANGEL2, ARID1A, ARID1B, ASCL1, ASXL1, ASXL2, ASXL3, ATAD2, ATAD2B, BCDIN3D, BCL9, BCL9L, BCLAF1, BICRA, BRCA1, BRD4, CASZ1, CCNC, CCNT1, CD14, CD226, CD40, CD74, CDK12, CDK13, CDK5RAP2, CGAS, CHCHD2, CIITA, CNBP, CREBBP, CRTC1, CTNNB1, CXorf23, CYTL1, DCAF6, DHX33, DHX58, DND1, DYRK1A, EAF1, EIF2S3, ELL, ENY2, EOMES, EP300, FAM46A, FAM46B, FAM46C, FAM46D, FGF1, FGF13, FGF14, FGF16, FGF18, FGF2, FGF20, FGF22, FGF23, FGF6, FGF7, FGF9, FHL5, FMR1, GABPB1, GABPB2, GATA2, GATA3, GATA4, GATA5, GATA6, GLTSCR1L, GMEB1, GMEB2, GPATCH3, GUF1, HEATR1, HIPK2, HMBOX1, HNF1A, HNF1B, HNF4A, HNF4beta, HNRNPU, ICE2, IKBKB, IL15, IL18R1, IL1B, IL2, ING1, ING2, ISL2, JMJD4, JUP, KANSL3, KAT2A, KAT2B, KMT2A, KMT2C, KMT2D, LARP1, LARP1B, LARP4, LARP4B, LBH, LDB2, LEO1, LMO3, LPIN1, LPIN2, MAML1, MAML2, MAML3, MCRS1, MED10, MED16, MED23, MED26, MED30, MEF2A, MEF2B, MEF2D, MEIOC, MEIS1, MEOX1, MEOX2, MLLT11, MSANTD1, MTF1, MYOG, MYRFL, NCK1, NCOA1, NCOA2, NCOA3, NCOA6, NPM1, NR1D1, NR1D2, NR1H4, NR1I3, NR2C2, NR2E3, NUP85, OCLN, PANX1, PANX2, PANX3, PAXBP1, PAXIP1, PCBP2, PDCL3, PLA2G6, PLAC8L1, PLACL2, PML, PMLL, POU2AF1, PPARA, PPARD, PPARG, PPARGC1A, PPARGC1B, PTMS, PTPN22, RAX2, RBM3, RBMXL1, RMND1, RNF10, RNF111, RNF4, RNF6, RPS6KA1, RXRA, RYBP, SAMD11, SASH3, SEMA7A, SETD4, SF3B4, SLC30A9, SMARCA4, SMARCC1, SMARCC2, SOX11, SOX12, SOX17, SOX18, SOX21, SOX3, SREBF2, SRF, SS18, SS18L1, SS18L2, SSBP4, STOX2, SUPT4H1, SUPT6H, SYNCRIP, TBX1, TBX15, TBX18, TBX19, TBX2, TBX20, TBX21, TBX22, TBX4, TBX5, TBX6, TBXT, TCEA1, TEAD3, TET2, TET3, TFCP2, TFEB, THOC5, THRA, THRAP3, THRB, TICAM1, TMEM173, TP53BP1, TP53INP1, TP53INP2, TRA2A, TRIM28, TRIM45, TRIP4, TRMT10C, UPF3A, UPF3B, VDR, WBP2, WBP2NL, YAF2, YAP1, ZBTB7B, ZFPM1, ZFPM2, ZNF318, ZNF750, LOC121109895
GO:0010557	**positive regulation of macromolecule biosynthetic process**	1.128	0.03781	ABRA, ADCYAP1, AKIRIN2, ALX1, ANGEL2, ARID1A, ARID1B, ASCL1, ASXL1, ASXL2, ASXL3, ATAD2, ATAD2B, BCDIN3D, BCL9, BCL9L, BCLAF1, BICRA, BRCA1, BRD4, CASZ1, CCNC, CCNT1, CD14, CD226, CD40, CD74, CDK12, CDK13, CDK5RAP2, CGAS, CHCHD2, CIITA, CNBP, CREBBP, CRTC1, CTNNB1, CXorf23, CYTL1, DCAF6, DHX33, DHX58, DND1, DYRK1A, EAF1, EIF2S3, ELL, ENY2, EOMES, EP300, FAM46A, FAM46B, FAM46C, FAM46D, FGF1, FGF13, FGF14, FGF16, FGF18, FGF2, FGF20, FGF22, FGF23, FGF6, FGF7, FGF9, FHL5, FMR1, GABPB1, GABPB2, GATA2, GATA3, GATA4, GATA5, GATA6, GLTSCR1L, GMEB1, GMEB2, GPATCH3, GUF1, HEATR1, HIPK2, HMBOX1, HNF1A, HNF1B, HNF4A, HNF4beta, HNRNPU, ICE2, IKBKB, IL15, IL18R1, IL1B, IL2, ING1, ING2, ISL2, JMJD4, JUP, KANSL3, KAT2A, KAT2B, KMT2A, KMT2C, KMT2D, LARP1, LARP1B, LARP4, LARP4B, LBH, LDB2, LEO1, LMO3, LPIN1, LPIN2, MAML1, MAML2, MAML3, MCRS1, MED10, MED16, MED23, MED26, MED30, MEF2A, MEF2B, MEF2D, MEIOC, MEIS1, MEOX1, MEOX2, MLLT11, MSANTD1, MTF1, MYOG, MYRFL, NCK1, NCOA1, NCOA2, NCOA3, NCOA6, NPM1, NR1D1, NR1D2, NR1H4, NR1I3, NR2C2, NR2E3, NUP85, OCLN, PANX1, PANX2, PANX3, PAXBP1, PAXIP1, PCBP2, PDCL3, PLAC8L1, PLACL2, PML, PMLL, POU2AF1, PPARA, PPARD, PPARG, PPARGC1A, PPARGC1B, PTMS, PTPN22, RAX2, RBM3, RBMXL1, RMND1, RNF10, RNF111, RNF4, RNF6, RPS6KA1, RXRA, RYBP, SAMD11, SASH3, SEMA7A, SETD4, SF3B4, SLC30A9, SMARCA4, SMARCC1, SMARCC2, SOX11, SOX12, SOX17, SOX18, SOX21, SOX3, SREBF2, SRF, SS18, SS18L1, SS18L2, SSBP4, STOX2, SUPT4H1, SUPT6H, SYNCRIP, TBX1, TBX15, TBX18, TBX19, TBX2, TBX20, TBX21, TBX22, TBX4, TBX5, TBX6, TBXT, TCEA1, TEAD3, TET2, TET3, TFCP2, TFEB, THOC5, THRA, THRAP3, THRB, TICAM1, TMEM173, TP53BP1, TP53INP1, TP53INP2, TRA2A, TRIM28, TRIM45, TRIP4, TRMT10C, UPF3A, UPF3B, VDR, WBP2, WBP2NL, YAF2, YAP1, ZBTB7B, ZFPM1, ZFPM2, ZNF318, ZNF750, LOC121109895
GO:0065003	**protein-containing complex assembly**	1.123	0.02079	AAR2, ADD1, ADD2, AFG3L2, AIFM1, APOA2, APOA5, ARHGAP18, ARHGAP28, ARHGAP40, ARPC3, ARPC4, ARPC5L, ASB12, ATL2, ATP23, ATPAF2, B2M, BAIAP2, BAIAP2L1, BAIAP2L2, BBS12, BIN2, BLB1, BLB2, BRF2, C12orf45, C12orf73, C20H20ORF24, C26H6ORF125, CAND1, CAND2, CAPG, CAPZA1, CAPZA2, CAPZA3, CAPZB, CCDC103, CCDC53, CCDC63, CD74, CDC45, CDK5RAP2, CDT1, CELF2, CELF3, CELF5, CELF6, CENPC, CENPI, CENPN, CENPO, CENPP, CENPT, CENPW, CENPX, CEP192, CHAF1A, CHAF1B, CLIP1, CLNS1A, CLTB, CLTC, COA5, COA6, COBL, COIL, COPS7A, COTL1, COX14, COX17, COX19, COX20, COX7A2, COX7A2L, CRACD, CRNKL1, CRTC1, CYFIP1, CYFIP2, DBN1, DBNL, DDX20, DENR, DIAPH2, DIAPH3, DMA, DMB1, DMB2, DMC1, DNAAF4, DNAAF5, DNAI2, DRC1, EIF2D, EIF2S2, EIF2S3, EIF6, ERAL1, FAM107A, FAM206A, FAM49A, FAM49B, LOC101748987, FCHSD1, FCHSD2, FERMT3, FGA, FGB, FGG, FLII, GAS7, GEMIN4, GEMIN7, GEMIN8, GLTSCR2, GNMT, GSN, GTF2A2, GTF2H5, H-10, H1-01, H1-010, H1-10, H1-8, H2AFYMACROH2A1, HAX1, HCLS1, HIGD1C, HIGD2A, HIP1, HIP1R, HJURP, HMP19, HP1BP3, HSCB, IGLL1, IMMP2L, ISY1, KANK3, KAT6A, KCNA1, KCNA10, KCNA2, KCNA3, KCNA6, KCNB1,

GO ID	Biological Process	Fold Enrichment	Adjusted p-value	Gene IDs
				KCNB2, KCNC2, KCNC4, KCND2, KCND3, KCNF1, KCNG1, KCNG2, KCNG3, KCNG4, KCNS1, KCNS2, KCNS3, KCNV1, KCTD1, KCTD10, KCTD12, KCTD12B, KCTD14, KCTD15, KCTD16, KCTD17, KCTD19, KCTD2, KCTD21, KCTD4, KCTD5, KCTD6, KCTD7, KCTD8, KNTC1, LMOD1, LMOD2, LMOD3, LONP1, LRRC6, LRRC61, LSM4, LUC7L, LUC7L2, LUC7L3, MCTS1, MDN1, MHCY2B1, MHCY2B2, MHCY2B7, MIS12, MIS18A, MKKS, MRPL20, MRPS11, MRPS7, MRTO4, MTPN, MZT1, NAF1, NAP1L1, NAPA, NAPB, NDE1, NDEL1, NDUFA11, NDUFA12, NDUFAF3, NDUFAF4, NDUFAF5, NDUFAF6, NDUFAF7, NDUFAF8, NDUFS5, NDUFS7, NEDD1, NSG1, NUFIP1, OTOF, OXA1L, PEF1, PFN3, PICALM, VBP1, PIH1D2, PIH1D3, POMP, LOC107051197, PREB, PRNP, PRPF18, PRPF6, PRPF8, PSMD5, PSMD9, PSMG1, PSMG2, PSMG4, PSTPIP1, PTGES3, PTGES3L, PTK2, PTK2B, PUF60, PWP2, RAD51C, RAD52, RPF2, RPL23A, RPL3, RPL38, RPL3L, RPLP0, RPS14, RPS15, RPS27, RPS27L, RPS28, RPSA2, RRP7A, RUVBL1, SAMM50, SAR1B, SCAF11, SCIN, SCO2, SDHAF4, SEC16A, SENP6, SET, SF3A2, SFSWAP, SHFM1, SHKBP1, SHMT1, SHPRH, SHQ1, SLAIN1, SLAIN2, SMIM20, SNAP25, SNAP29, SNAP47, SNAP91, SNRPC, SNRPD1, SNRPD3, SNRPE, SNRPF, SNRPGP15, SPAG1, SPG7, SPIRE1, SPIRE1L, SPIRE2, SRPK1, SRPK2, SRSF4, SRSF6, SSH1, SSH2, STK3, STK4, STRAP, SURF1, SVIL, TAF1, TAF11, TAF12, TAF1B, TAF7, TAF9, TBCB, TBCC, TBCD, TCAP, TFG, TMEM126A, TMEM70, TMOD2, TMOD3, TMOD4, TMSB15B, TMSB4X, TMSB4B, TNFAIP1, TP53I3, TP73, TPPP, TPPP3, TRAF7, TRPM1, TRPM7, TTC19, TUBG1, TUBGCP3, TUBGCP4, TUBGCP5, TUBGCP6, TWF1, TWF2, UNC13A, UNC13C, UQCC1, UVRAG, VAMP1, VAMP3, VASP, VILL, VMA21, WASHC5, ZNHIT3
GO:0031324	**negative regulation of cellular metabolic process**	1.123	0.02856	AEBP1, AGO2, AGO3, AICDA, ALX1, ANGEL2, ANKLE2, ASZ1, ATF7IP, ATXN1, BASP1, BCDIN3D, BCOR, BEND3, BMI1, BMP2, BRCA1, C8orf88, CAMK2N1, CARHSP1, CAV1, CBFA2T2, CBFA2T3, CBL, CBLB, CBX1, CBX2, CBX3, CBX4, CBX5, CBX7, CCDC3, CHD4, CHD5, CIART, CNOT1, CNOT10, CNOT11, CNOT2, CNOT6, CNOT6L, COMMD7, CPEB1, CPEB2, CPEB4, CRY1, CSDC2, CST7, DAP, DBNDD1, DCP1A, DCP1B, DCPS, DGCR8, DHX34, DND1, DNMT3A, DNMT3B, DOT1L, DROSHA, DTNBP1, DUSP10, DLX4, EDC3, EDC4, EED, EIF4EBP1, EIF4ENIF1, EXOSC10, EXOSC5, EXOSC6, EXOSC7, EXOSC8, EXOSC9, FAM132A, FAM172BP, FAM208A, FAM208B, FAM46A, FAM46B, FAM46C, FAM46D, FASTK, FASTKD3, FHL2, FLCN, FMR1, GATA2, GATA3, GATA4, GATA5, GATA6, GATAD2A, GATAD2B, SMG8, GID4, GPATCH3, GZF1L, HDAC7, HDAC9, HELZ, HEXIM1, HHATL, HMX1, HNRNPU, IBTK, ID1, ID2, ID3, ID4, INPP5J, INPP5K, ITM2A, ITM2B, JMJD4, KCNIP3, KCTD1, KLHL31, LARP1, LARP1B, CDK5RAP1, LDB2, LIMD1, LSM1, LSM4, LSM7, LYAR, MAEL, MAF1, MALSU1, MARF1, MEIOC, MIER2, MLIP, MRPL13, MRTO4, MTA3, MTM1, MTMR8, MTMR9, MTMR9LP, MTOR, MXD1, ZFYVE28B, MYEF2, N4BP2L2, NAB2, NANOS3, NCK1, NCOR1, NCOR2, NELFA, NELFB, NELFCD, NELFE, NFX1, NHLRC1, NHLRC3, NOC2L, NR0B1, NR0B2, NR1D1, NR1D2, NR1H4, NR1I3, NR2C1, NR2E1, NR2E3, NR2F2, NR2F6, ORMDL2, ORMDL3, PAIP2B, PAN2, PAN3, PARK2, PARN, PATL2, PATZ1, PCBP4, PCGF2, PDE12, PER3, PHF12, PIWIL1, PKIA, PKIB, PKIG, PLD6, PLEKHN1, PNLDC1, PNPT1, PNRC1, PNRC2, POLE3, PPARA, PPARD, PPARG, PPHLN1, PPM1E, PPM1F, PPP1R26, PRKRIP1, PTPN22, PTPRO, PUM1, PUM2, RCOR3, RESF1, RIPPLY1, RIPPLY2, RIPPLY3, RLIM, RUNX1T1, RXRA, SCAF4, SETDB1, SETDB2, SH3BP5, SIN3A, SIN3B, SKIV2L, SKOR1, SLC27A1, SMARCE1, SMG1, SMG5, SNIP1, SOX10, SOX11, SOX12, SOX21, SOX3, SOX8, SOX9, SPOUT1, SPRY1, SPRY2, SPRY3, SPRY4, SRP9, SUDS3, SYNCRIP, TARBP2, TBRG4, TEN1, THRA, THRB, TIA1, TIGAR, TIMP2, TIMP3, TIMP4, TMBIM6, TMEM39A, TNRC6A, TNRC6B, TNRC6C, TRERF1, TRIM2, TRIM28, TRIM3, UBASH3B, UHRF1, UPF1, UPF2, UPF3A, UPF3B, URI1, VDR, VGLL4, WDTC1, WTIP, WWP2, XRN2, YTHDF1, YTHDF2, YTHDF3, ZBTB11, ZBTB21, ZBTB26, ZBTB32, ZBTB45, ZC3H12A, ZC3H12D, ZC3H4, ZC3H7A, ZC3H7B, ZC3H8, ZFPM1, ZFPM2, ZFYVE28A, ZGPAT, ZNF318, ZNF362, ZNF541, ZNF703, ZNF767, ZNFB1, ZNFX1
GO:0009057	**macromolecule catabolic process**	1.120	0.02638	ABHD10, ABHD17A, ADRM1, AGAP3, AMFR, AMN1, ANAPC1, ANAPC10, ANAPC2, ANAPC4, ANAPC5, ANGEL2, ANKIB1, AOAH, APC2, ARIH1, ARIH2, ASB11, ASB13, ASB5, ASB9, AZIN1, BANP, BAP1, BFAR, CARHSP1, CDC26, CDC34, CHFR, CHIA, CLPX, CNOT1, CNOT10, CNOT11, CNOT2, CNOT6, CNOT6L, COMMD1, COPS3, CSDC2, CSNK1D, CTSB, CTSC, CTSH, CTSK, CTSO, CTSS, CTSZ, CUL1, CUL2, CUL4A, CUL4B, CUL5, CUL9, DCAF11, DCP1A, DCP1B, DCPS, DDA1, DET1, DFFB, DHX34, DIS3, DIS3L, DNAJB6, DNASE1, DNASE1L2, DNASE1L3, DND1, DTL, C2orf40, ECSCR, EDC3, EDC4, EDEM1, EDEM2, ENDOG, ERLEC1, EXOG, EXOSC10, EXOSC2, EXOSC5, EXOSC6, EXOSC7, EXOSC8, EXOSC9, FAM46A, FAM46B, FAM46C, FAM46D, FASTK, FASTKD3, FBXL12, FBXL13, FBXL16, FBXL18, FBXL2, FBXL20, FBXL21, FBXL22, FBXL3, FBXL4, FBXL7, FBXO11, FBXO22, FBXO38, FBXO44, FBXO48, FBXO9, FBXW7, FHIT, FMR1, FZR1, GAA, SMG8, GFAP, GID4, GID8, HACE1, HERC3, HERPUD1, HNRNPU, HYAL1, HYAL2, HYAL3, HYAL6, ITCH, KCTD10, KCTD17, KCTD2, KCTD21, KCTD5, KLHL15, KLHL22, KLHL40, LARP1, LARP1B, LNX1, LONP1, LONP2, LSM1, LSM4, LSM7, LTN1, LYG2, LYGL, LYPLA1, LYPLA2, LYPLAL1, MAEA, MANBA, MEIOC, MRTO4, MVB12A, MYEF2, MYLIP, N4BP1, NAE1, NDFIP1, NDFIP2, NEDD4, NEDD8, NGLY1, NHLRC1, NHLRC3, NPLOC4, NSFL1C, NTAN1, NUB1, OAZ1, OAZ2, OTUD7A, OTUD7B, PAN2, PAN3, PARK2, PARN, PATL2, PCNP, PCYOX1, PCYOX1L, PDE12, PGLYRP2, PLEKHN1, PNLDC1, PNPT1, PNRC1, PNRC2, PSMA2, PSMA4, PSMA5, PSMA7, PSMB1, PSMB2, PSMB3, PSMB4, PSMB5, PSMB7, PSMC2, PSMC5, PSMD11, PSMD3, PSMD4, PSMD6, PSMD7, PSMD8, PSME1, PSMF1, PTPN23, PUM1, PUM2, PYGB, RAD23A, VPS25,

GO ID	Biological Process	Fold Enrichment	Adjusted p-value	Gene IDs
				RB1CC1, RBBP6, RBX1, RCHY1, REXO4, RFFL, RLIM, RMND5A, RNASEH1, RNASEH2B, RNASET2, RNF111, RNF123, RNF139, RNF14, RNF144A, RNF144B, RNF146, RNF166, RNF19A, RNF19AL, RNF19B, RNF213, RNF215, RNF217, RNF26, RNF34, RNF43, RNF5, RNF6, RNF8, RNFT1, RNFT2, RPGR, RPS27A, RSPRY1, SELENOS, SGSH, SH3RF2, SHARPIN, SIAH1, SIAH3, SKIV2L, SKP1, SMG1, SMG5, SMURF1, SMURF2, SNF8, SOCS5, SPAM1, SPATA18, SPOP, SPSB1, SPSB3, STAM, STUB1, SYNCRIP, TBRG4, TCEB1, TIA1, TIMP2, TIMP3, TIMP4, TMEM259, TNFAIP1, TNFAIP3, TNFRSF1B, TNRC6A, TNRC6B, TNRC6C, TRIB1, TRIB2, TRIM2, TRIM3, TRIM71, TRPC4AP, UBA52, UBAP1L, UBB, LOC101747587, UBE2A, UBE2B, UBE2D2, UBE2D3, UBE2G1, UBE2H, UBE2K, UBE3A, UBE3B, UBE3C, UBE3D, UBL7, UBQLN4, UBR2, UBXN11, UBXN2A, UBXN2B, UCHL1, UCHL3, UFL1, UPF1, UPF2, UPF3A, UPF3B, USP14, USP35, USP38, VIP, VPS36, VPS37A, VPS37B, VPS37D, WDR26, WWP1, WWP2, XRN2, YME1L1, YTHDF1, YTHDF2, YTHDF3, ZC3H12A, ZC3H12D, ZCCHC17, ZFAND2A, ZNRF3
GO:0034220	**monoatomic ion transmembrane transport**	1.119	0.04435	AKAP9, ANO10, ANO4, ANO6, ANO8, ARC, ASB10, ASB4, ASIC1, ASIC2, ASIC5, ATP12A, ATP1A1, ATP1B1, ATP2A2, ATP2A3, ATP2B1, ATP2B2, ATP2B4, ATP2C1, ATP2C2, ATP4B, ATP5B, ATP5G1, ATP5G2, ATP6V0A1, ATP6V0A2, ATP6V0A4, ATP6V0C, ATP6V0D1, ATP6V0D2, ATP6V0E1, ATP6V1A, ATP6V1B2, ATP6V1C1, ATP6V1C2, ATP6V1E1, ATP6V1G1, ATP6V1H, CACNA1B, CACNA1C, CACNA1D, CACNA1G, CACNA1H, CACNA1I, CACNA1S, CACNB1, CACNB2, CACNG1, CACNG2, CACNG4, CALML3, CASQ2, CBARP, CFTR, CHRNA2, CHRNA3, CHRNA4, CHRNA5, CHRNA7, CHRNA9, CHRNB2, CHRNB4, CLIC2, CNGA1, CNGA2, CNGA3, CNGA4, COMMD1, DHRS7C, FAM155B, FAM173A, FAM173B, FKBP1B, FXYD6, GABRA1, GABRA2, GABRA3, GABRA4, GABRA5, GABRA6, GABRB2, GABRB3, GABRD, GABRE, GABRG1, GABRG2, GABRG3, GABRP, GABRQ, GABRR1, GABRR2, GABRR3, GEM, GLRA1, GLRA2, GLRA3, GLRA4, GLRB, HECW1, HTR3A, HVCN1, ITPR1, ITPR2, ITPR3, KCNA1, KCNA10, KCNA2, KCNA3, KCNA6, KCNAB2, KCNB1, KCNB2, KCNC2, KCNC4, KCND2, KCND3, KCNE1, KCNE2, KCNE3, KCNE5, KCNF1, KCNG1, KCNG2, KCNG3, KCNG4, KCNH1, KCNH2, KCNH6, KCNH8, KCNIP1, KCNIP3, KCNIP4, KCNJ12, KCNJ15, KCNJ16, KCNJ2, KCNJ4, KCNJ5, KCNJ6, KCNJ8, KCNK12, KCNK15, KCNK16, KCNK17, KCNK2, KCNK3, KCNK5, KCNK7, KCNK9, KCNN1, KCNN3, KCNS1, KCNS2, KCNS3, KCNV1, MCUB, MCUR1, MICU2, MICU3, MRS2, NDUFS7, NEDD4, NPSR1, OTOP1, OTOP2, OTOP3, P2RX1, P2RX2, P2RX4, P2RX5, P2RX6, P2RX7, PIRT, PKD2, PLN, REM1, RNF207, RRAD, LOC101748756, RYR2, SCARA5, LOC395944, SCN11A, SCN4A, SCN4B, SCN5A, SCN8A, SCNN1A, SCNN1B, SCNN1D, SCNN1G, SLC12A1, SLC12A3, SLC12A4, SLC12A5, SLC12A7, SLC13A1, SLC13A2, SLC13A3, SLC13A4, SLC13A5, SLC24A1, SLC24A3, SLC24A5, SLC25A37, SLC30A1, SLC30A10, SLC30A2, SLC30A3, SLC30A4, SLC30A8, SLC31A1, SLC31A2, SLC36A1, SLC39A11, SLC39A12, SLC39A3, SLC39A5, SLC39A6, SLC39A8, SLC5A5, SLC6A1, SLC6A11, SLC6A12, SLC6A13, SLC6A14, SLC6A15, SLC6A17, SLC6A18, SLC6A19, SLC6A2, SLC6A20, SLC6A4, SLC6A6, SLC6A7, SLC6A8, SLC8A1, SLC8A2, SLC8B1, SLC9A1, SLC9A2, SLC9A3, SLC9A4, SLC9A5, SLC9A6, SLC9A7, SLC9B2, SLMAP, SMDT1, STAC, LOC107050760, STIM1, STIM2, LOC121106612, TMCO3, TMEM165, TMEM38A, TRPC3, TRPC4, TRPC5, TRPC6, TRPC7, TRPM1, TRPM7, TRPV1, TRPV2, TRPV3, TRPV4, TRPV6, UBASH3B, VDAC1, VDAC3, WNK1, WNK2, WNK4, WWP2

Table 2 KEGG enrichment

KEGG ID	Biological Process	Fold Enrichment	Adjusted p-value	Gene IDs
gga04517	**IgSF CAM signaling**	1.161	0.00857	ABL1, ACTB, ACTG1, ACTG1L, ACTN4, ACTR2, ACTR3B, AFDN, LOC101750560, AKT3, ANK2, APP, ARPC1A, ARPC1B, ARPC3, ARPC4, ARPC5L, BAIAP2, BCAR1, CABLES1, CABLES2, CADM1, CADM2, CADM3, CASK, CASKIN1, CASKIN2, CD2, CD226, CD244, CD2AP, CD48, CD86, CD88, CDC42, CDH1, CDH2, CLMP, CNTN1, CNTN2, CNTNAP1, CNTNAP2, CRTAM, CSK, CTNNB1, DOK2, DYL1, DYL2, DYNLL2, EPB41L1, EPB41L2, EPB41L3, ERC1, ESAM, EZR, FABP9, FGA, FGB, FGFR1, FGG, FOXO1, FYN, GIT1, GLDN, GRB2, GRIP1, GRIP2, GSK3A, IGSF5, IL1RAPL1, IL1RAPL2, IQGAP1, ITGB1, ITGB3, JAM2, JAM3, JAML, KCNA1, KCNA2, KCNA6, KCNQ2, KCNQ3, KDR, KIRREL1, KIRREL3, LCK, LCP2, LMO7, LRRTM4, LYN, MAGI1, MAGI2, MAP2K1, MAP2K2, MAPK10, MAPK11, MAPK12, MAPK13, MAPK14, MAPK3, MAPK9, MBP, MPP3, MPP6, MPZ, MTSS1, MTSS1L, MYH10, MYH11, MYH9, MYL12A, MYL12B, MYL6, MYL9, MYLK2, MYLK3, MYLK4, MYLKSML, NCAM1, NCAM2, NCK1, NECTIN1, NECTIN3, LOC101750739, NFASC, NLGN3, NLGN4, NRCAM, NRP1, NTN1, NTN3, NTRK3, PAK1, PAK3, PAK4, PAK5, PARD3, PARD6A, PARD6B, PDPK1, PIK3CD, PIK3R2, PLCG1, PLCG2, PLXNA1, PLXNA2, PLXNA4, PMP22, PPFIA2, PPFIA4, PRKCA, PRKCB, PRKCQ, PTK2, PTPN11, PTPN6, PTPRS, PTPRZ1, PXN, RAC1, RAP1A, RAP1B, RAPGEF2, RAPGEF6, RDX, RHOA, RIMS1, ROBO1, ROBO2, ROBO3, ROBO4, SCN8A, SH2D1A, SH2D1B, SLIT2, SLIT3, SLITRK1, SLITRK4, SLITRK5, SLITRK6, SPTAN1, SPTBN1, SPTBN2, SRC, SRGAP1, SRGAP2, SRGAP3, TJP1, TRIO, TRPC6, TSTD1, TUB5A, TUBA1A, TUBA8A,

KEGG ID	Biological Process	Fold Enrichment	Adjusted p-value	Gene IDs
				TUBA8B, TUBAL3, TUBB1, TUBB2A, TUBB2B, TUBB3, TUBB4B, TUBB6, UNC5A, UNC5C, UNC5D, LOC107050724, VAV2, WASL

Figure. Kegg enrichment cnetplot

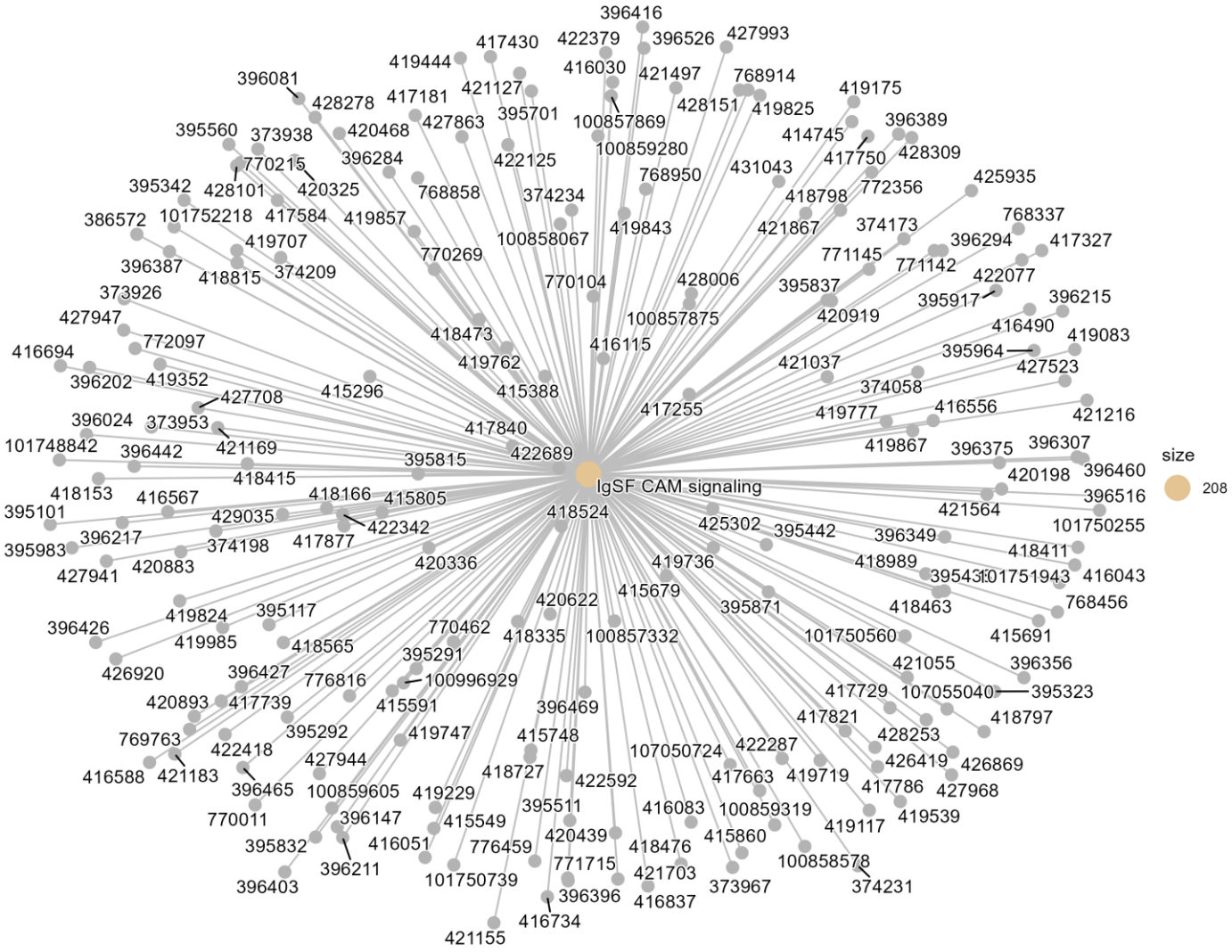

Figure. GO_BP enrichment dotplot

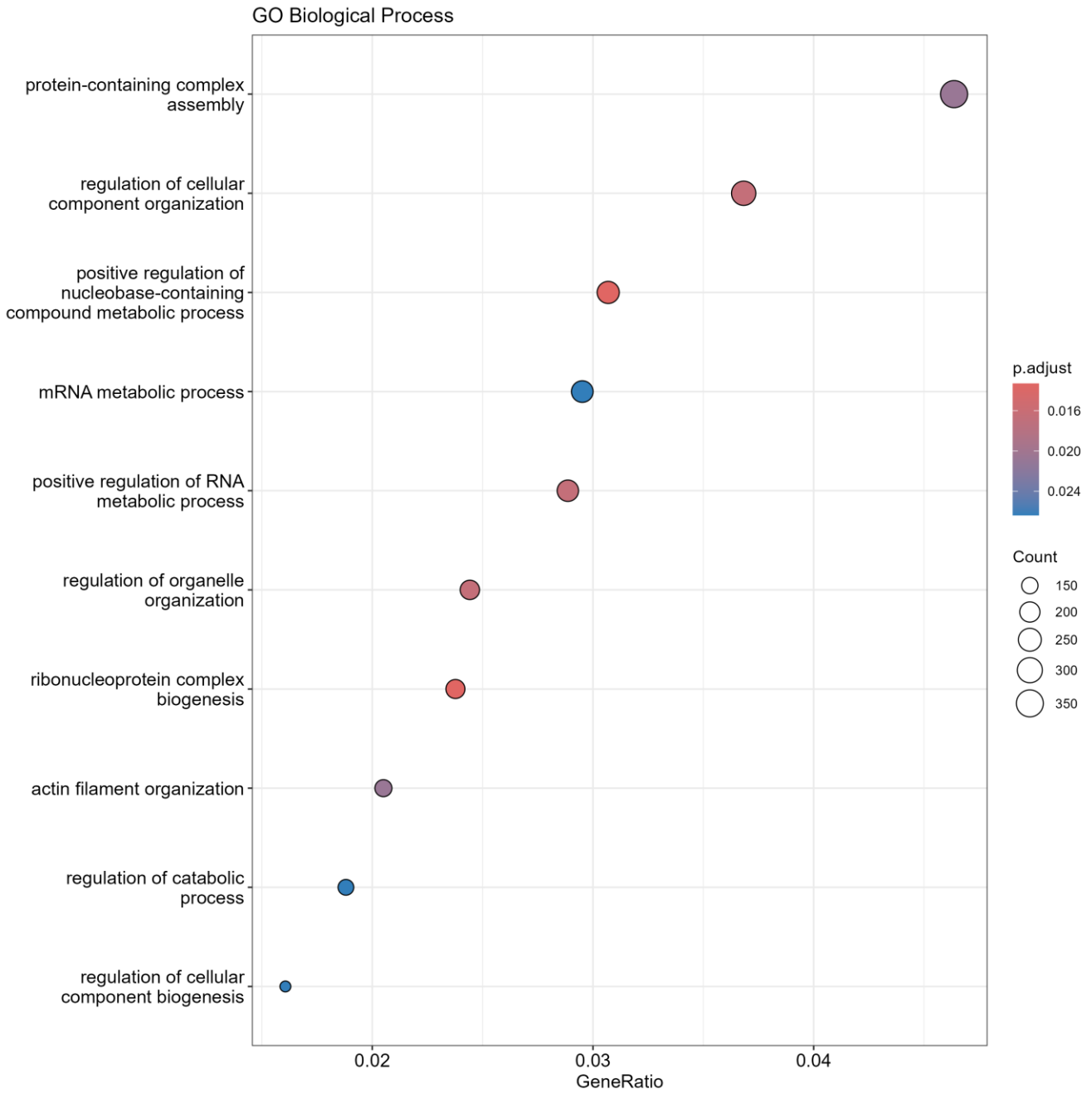

Figure. GO Biological Process enrichment upsetplot

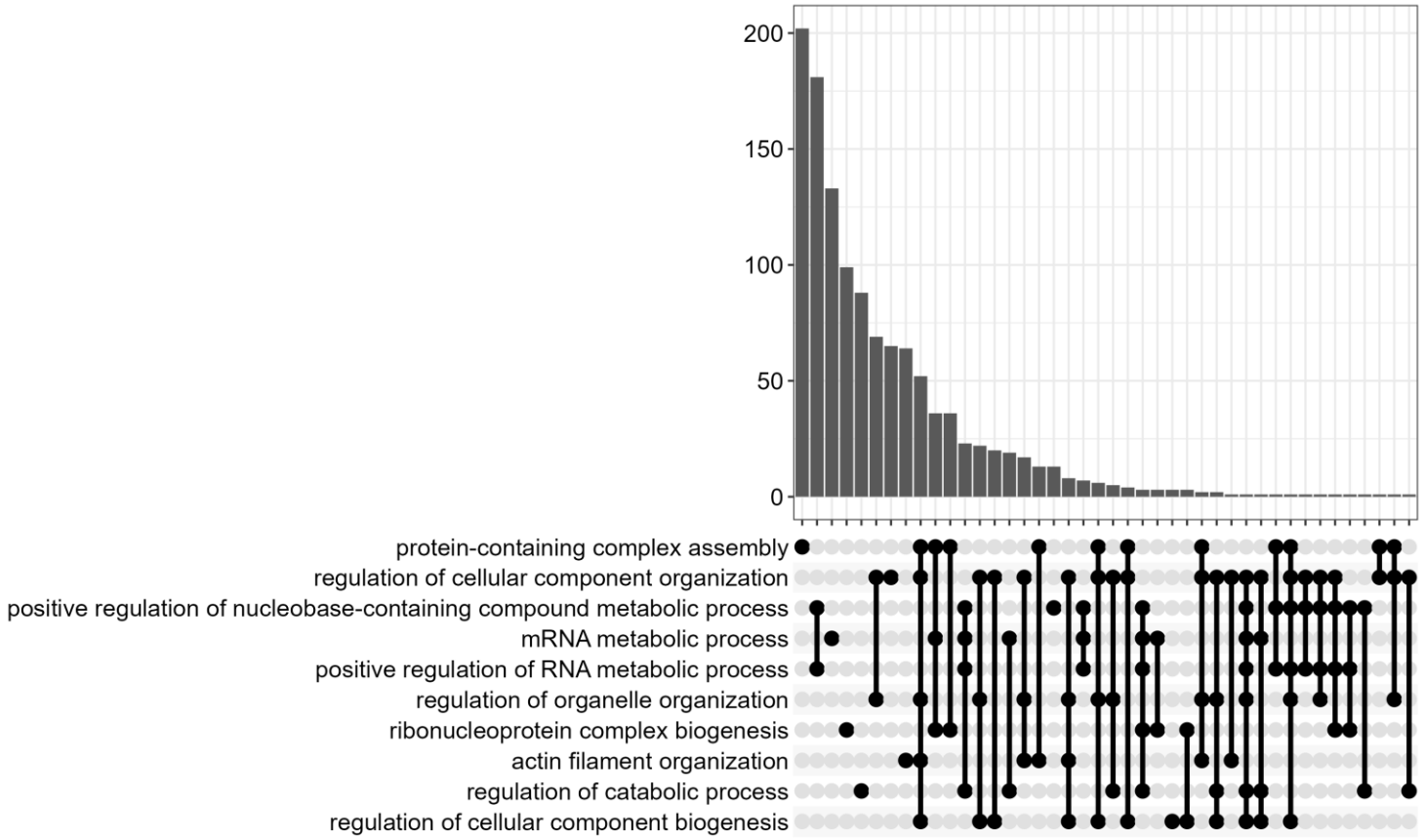

Figure. GO Biological Process enrichment cnetplot