**Supplementary File**

* **The intersection pathway of driver genes and downstream genes**

The original pathway intersection of driver genes and downstream genes in the breast cancer and lung cancer under different cancer subtypes(see **Tables 1-9**). The tables consist of two parts(from the left to the right): the first four columns are the pathway information of driver genes. The left four column are the pathway information of downstream genes. The first column is the intersection pathway terms. The second column is the count of driver genes enriched in this pathway. The third column represents the pvalue of driver genes. The fourth column is the exactly driver genes enriching in this pathway. The ‘**Out-count’** represents the count of downstream genes enriched in this pathway. The ‘**Out-pvalue’** isthe pvalue of downstream genes. The **‘Outs’** is the exactly downstream genes enriching in this pathway. The **‘Outs-drivers-count’** is the count of downstream genes after removing driver genes. **Table 10-11** list the pathways only exists in breast cancer and lung cancer subtypes.

**Table 1. The pathway intersection of driver genes and downstream genes in breast cancer of basal subtype**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Term | drivers\_count | driver\_pvalue | drivers | Out\_count | Out\_pvalue | Outs | Outs\_drivers\_count |
| hsa04014:Ras signaling pathway | 8 | 0.004355011 | PDGFRA, PIK3CA, NF1, KRAS, PLCG1, PIK3R1, SOS1, EGFR | 84 | 9.36E-32 | PIK3CD, FASLG, PIK3CB, ETS1, ETS2, IGF1R, FGF4, FGF5, IKBKB, FGF6, FGF7, TBK1, FGF8, FGF9, PRKACG, KDR, RAC2, RAC3, RAC1, HRAS, PRKCG, PDGFRA, MAP2K1, GAB1, RRAS2, PLA2G4A, PRKCA, RHOA, PGF, MRAS, PIK3CA, RASA1, RAF1, SOS1, MET, SOS2, EPHA2, SHC4, SHC2, SHC3, SHC1, PDGFB, PDGFA, PIK3R2, RASAL2, PLD1, RASGRP1, EGFR, INS, RASGRP3, MAPK9, NRAS, MAPK8, RAP1A, GNG2, RRAS, PDGFD, PDGFC, PLCG2, MAPK1, PAK6, PLCG1, PAK3, FGF22, FGF21, PAK4, MAPK3, BRAP, EGF, PTPN11, IGF1, NFKB1, GRIN1, EFNA1, KITLG, FGF19, GNB1, FGF18, KRAS, FGF13, LAT, FGF11, FGFR2, FGFR1 | 78 |
| hsa05200:Pathways in cancer | 21 | 1.18E-10 | RB1, SMAD2, PDGFRA, STAT3, PTEN, FN1, BRAF, PIK3R1, EGFR, MTOR, RUNX1, PIK3CA, MECOM, TPR, ERBB2, EP300, CTNNB1, KRAS, PLCG1, SOS1, TP53 | 112 | 1.4E-30 | RB1, SPI1, ITGA2B, ETS1, IGF1R, FGF4, FGF5, FGF6, FGF7, FGF8, FGF9, PRKACG, SKP2, PRKCG, PDGFRA, MAP2K1, MITF, PRKCA, PGF, MSH6, MSH2, RAF1, TP53, MAX, PDGFB, PDGFA, TGFA, KLK3, PIK3R2, RASGRP1, FOXO1, HSP90B1, RASGRP3, DVL1, DVL2, PLCG2, DVL3, PLCG1, FGF22, FGF21, CREBBP, JUN, SMAD4, SMAD3, JUP, FZD5, FZD4, IGF1, PTK2, NFKB1, NFKBIA, BMP2, FGF19, FGF18, GNB1, MDM2, FGF13, FGF11, FGFR2, FGFR1, RET, ITGB1, GSK3B, HSP90AB1, PTEN, SLC2A1, PIK3CD, FASLG, LAMC1, PIK3CB, IKBKB, RAC2, RAC3, ITGAV, RAC1, HRAS, ITGA2, FOS, RHOA, PIK3CA, RARA, RARB, ITGA6, PPARG, PLCB1, SOS1, CRK, MET, PLCB2, SOS2, PPARD, HDAC2, HDAC1, CBL, EGFR, GNAI1, GNAI2, MAPK9, NRAS, MAPK8, GNG2, RXRA, GNA11, ERBB2, MAPK1, MAPK3, LAMB3, STAT1, EGF, PML, KITLG, KRAS | 1.02E+02 |
| hsa04015:Rap1 signaling pathway | 8 | 0.002899171 | PDGFRA, PIK3CA, CTNNB1, BRAF, KRAS, PLCG1, PIK3R1, EGFR | 78 | 2.04E-29 | ITGB1, ITGAM, ITGB3, ITGA2B, CTNND1, PIK3CD, PIK3CB, ITGAL, IGF1R, FGF4, FGF5, FGF6, FGF7, FGF8, FGF9, KDR, RAC2, RAC3, RAC1, HRAS, PRKCG, MAP2K3, PDGFRA, PRKCI, MAP2K1, MAGI3, MAGI2, PRKCA, RHOA, PGF, MRAS, PIK3CA, PRKD3, PRKD1, RAF1, PLCB1, MET, PLCB2, CRK, EPHA2, SRC, PDGFB, PDGFA, PIK3R2, THBS1, EGFR, GNAI1, INS, RASGRP3, GNAI2, NRAS, RAP1A, PARD6A, RRAS, PDGFD, PDGFC, MAPK1, PLCG1, FGF22, FGF21, MAPK3, MAP2K6, EGF, IGF1, MAPK14, GRIN1, MAPK13, EFNA1, KITLG, FGF19, ID1, FGF18, KRAS, FGF13, LAT, FGF11, FGFR2, FGFR1 | 7.30E+01 |
| hsa04012:ErbB signaling pathway | 11 | 4.57E-09 | MAP2K4, PIK3CA, ERBB4, ERBB2, BRAF, KRAS, PLCG1, PIK3R1, SOS1, EGFR, MTOR | 48 | 3.81E-27 | SHC4, GSK3B, SHC2, CAMK2D, SHC3, SHC1, SRC, PIK3CD, TGFA, PIK3R2, PIK3CB, CBL, EGFR, MAPK9, NRAS, MAPK8, ERBB3, ERBB4, ERBB2, PLCG2, NCK2, MAPK1, PAK6, PLCG1, PAK3, MAP2K7, HRAS, NCK1, MAPK3, PAK4, PRKCG, JUN, MAP2K1, EGF, GAB1, PRKCA, NRG1, NRG2, PTK2, EREG, PIK3CA, NRG4, KRAS, RAF1, SOS1, CRK, SOS2, HBEGF | 4.10E+01 |
| hsa04151:PI3K-Akt signaling pathway | 13 | 5.50E-05 | PDGFRA, PTEN, FN1, TSC2, PIK3R1, EGFR, MTOR, PIK3CA, MYB, KRAS, SOS1, TP53, TLR4 | 97 | 7.68E-26 | CHRM2, IRS1, ITGA2B, PPP2R2A, IGF1R, FGF4, FGF5, FGF6, STK11, FGF7, FGF8, FGF9, PPP2R1A, MYB, KDR, PDGFRA, MAP2K1, IL4R, PRKCA, PRLR, PGF, RAF1, TP53, IFNAR1, EPHA2, PDGFB, PDGFA, PIK3R2, FOXO3, HSP90B1, PDGFD, PDGFC, FGF22, FGF21, IGF1, PTK2, NFKB1, IL2, EFNA1, IL4, RHEB, IL7, FGF19, FGF18, GNB1, MDM2, FGF13, IL7R, FGF11, FGFR2, FGFR1, ITGB1, GSK3B, HSP90AB1, YWHAB, ITGB3, PTEN, PIK3CD, FASLG, LAMC1, PIK3CB, IKBKB, PPP2R5E, ITGAV, RAC1, JAK2, HRAS, SYK, PDPK1, ITGA2, PPP2R5A, PPP2R5D, PPP2R5C, PIK3CA, ITGA6, SOS1, MET, SOS2, TLR2, IL2RG, THBS1, EGFR, INS, PPP2CA, NRAS, GNG2, RXRA, MAPK1, MAPK3, LAMB3, IFNB1, EGF, NOS3, KITLG, IL2RA, KRAS, PKN2 | 8.90E+01 |
| hsa04010:MAPK signaling pathway | 12 | 1.51E-05 | MAP2K4, PDGFRA, MAP3K1, MECOM, NF1, FLNA, BRAF, KRAS, SOS1, TP53, EGFR, MAP3K4 | 79 | 3.91E-24 | HSPB1, FASLG, ARRB2, FGF4, FGF5, IKBKB, RPS6KA3, FGF6, RPS6KA6, FGF7, FGF8, FGF9, RPS6KA2, PRKACG, RPS6KA1, RAC2, RAC3, RAC1, HRAS, MAP3K7, MAP4K1, PRKCG, MAP2K3, PDGFRA, MAP2K1, MEF2C, RRAS2, PLA2G4A, PRKCA, FOS, IL1A, PPM1A, MRAS, RASA1, IL1B, MAPKAPK5, RAF1, SOS1, TP53, CRK, SOS2, MAX, PDGFB, PDGFA, RASGRP1, EGFR, RASGRP3, MAPK9, NRAS, MAPK8, RAP1A, RRAS, NTF3, MAPK1, MAP2K7, MAP2K5, FGF22, FGF21, MAPK3, MAP2K6, HSPA8, JUN, JUND, MAP3K1, GADD45B, EGF, GADD45A, NFATC1, MAPK14, NFKB1, MAPK13, PPP5C, FGF19, FGF18, KRAS, FGF13, FGF11, FGFR2, FGFR1 | 7.30E+01 |
| hsa04722:Neurotrophin signaling pathway | 9 | 1.18E-05 | MAP3K1, PIK3CA, BRAF, KRAS, PLCG1, PSEN1, PIK3R1, SOS1, TP53 | 53 | 4.57E-24 | GSK3B, IRS1, PIK3CD, FASLG, PIK3CB, IKBKB, RPS6KA3, RPS6KA6, RPS6KA2, RPS6KA1, RAC1, HRAS, MAP2K1, PDPK1, GAB1, IRAK4, RHOA, PIK3CA, RAF1, SOS1, TP53, CRK, SOS2, SHC4, SHC2, CAMK2D, SHC3, SHC1, PIK3R2, FOXO3, MAPK9, NRAS, MAPK8, RAP1A, IRAK1, NTF3, PLCG2, MAPK1, PLCG1, MAP2K7, MAP2K5, MAPK3, JUN, MAP3K1, SORT1, NTRK3, PTPN11, MAPK14, NFKB1, MAPK13, NFKBIA, KRAS, TP73 | 4.70E+01 |
| hsa04660:T cell receptor signaling pathway | 5 | 0.013008636 | PIK3CA, KRAS, PLCG1, PIK3R1, SOS1 | 47 | 9.69E-23 | GSK3B, ITK, PIK3CD, PIK3R2, PIK3CB, RASGRP1, CD3D, IKBKB, NRAS, GRAP2, NCK2, MAPK1, PAK6, FYN, PLCG1, PAK3, MAP2K7, HRAS, MAP3K7, NCK1, MAPK3, PAK4, JUN, MAP2K1, PDPK1, NFATC1, FOS, MAPK14, RHOA, IL2, NFKB1, MAPK13, IL4, NFKBIA, DLG1, CD4, PTPRC, IFNG, PIK3CA, LCK, KRAS, PTPN6, PRKCQ, RAF1, SOS1, SOS2, LAT | 4.30E+01 |
| hsa05218:Melanoma | 9 | 2.12E-07 | RB1, PDGFRA, PIK3CA, PTEN, BRAF, KRAS, PIK3R1, TP53, EGFR | 39 | 5.91E-22 | RB1, PTEN, PDGFB, PDGFA, PIK3CD, PIK3R2, PIK3CB, EGFR, FGF4, IGF1R, FGF5, FGF6, FGF7, NRAS, FGF8, FGF9, PDGFD, PDGFC, MAPK1, HRAS, FGF22, MAPK3, FGF21, PDGFRA, MAP2K1, EGF, MITF, IGF1, PIK3CA, FGF19, FGF18, MDM2, KRAS, RAF1, FGF13, MET, TP53, FGF11, FGFR1 | 3.20E+01 |
| hsa04810:Regulation of actin cytoskeleton | 8 | 0.002899171 | PDGFRA, PIK3CA, FN1, BRAF, KRAS, PIK3R1, SOS1, EGFR | 68 | 9.77E-22 | ITGB1, CHRM2, ITGAM, ITGB3, ARPC1A, ITGA2B, PIK3CD, PIK3CB, ITGAL, FGF4, FGF5, FGF6, FGF7, FGF8, FGF9, RAC2, PIP4K2A, RAC3, PIP4K2B, ITGAV, PIP4K2C, RAC1, HRAS, GIT1, PDGFRA, MAP2K1, ITGA2, RRAS2, RHOA, MRAS, PIK3CA, MYL2, ITGA6, RAF1, SOS1, CRK, SOS2, SRC, PDGFB, PDGFA, PIK3R2, IQGAP1, EGFR, INS, NRAS, RRAS, PDGFD, PDGFC, MAPK1, PAK6, PAK3, FGF22, FGF21, PAK4, MAPK3, GSN, EGF, ARPC5, PTK2, ARPC2, ARPC3, FGF19, FGF18, KRAS, FGF13, FGF11, FGFR2, FGFR1 | 6.30E+01 |
| hsa04919:Thyroid hormone signaling pathway | 15 | 1.12E-12 | NOTCH1, NCOA3, TSC2, PIK3R1, ESR1, MTOR, MED12, NCOR1, MED13, PIK3CA, EP300, CTNNB1, KRAS, PLCG1, TP53 | 48 | 1.48E-20 | NOTCH2, GSK3B, NOTCH3, HDAC2, HDAC3, NOTCH1, HDAC1, SRC, ITGB3, SLC2A1, PIK3CD, PIK3R2, PIK3CB, FOXO1, MED17, MED12, MED14, NRAS, RXRA, PLCZ1, MED30, SIN3A, PRKACG, PLCG2, MAPK1, ITGAV, PLCG1, HRAS, MAPK3, PRKCG, MED1, MAP2K1, CREBBP, PDPK1, STAT1, PRKCA, MED4, MED27, ESR1, PIK3CA, RHEB, MDM2, KRAS, PLCB1, RAF1, PLCB2, TP53, PLCD1 | 4.10E+01 |
| hsa05215:Prostate cancer | 14 | 6.15E-13 | RB1, PDGFRA, PTEN, BRAF, PIK3R1, EGFR, MTOR, PIK3CA, ERBB2, EP300, CTNNB1, KRAS, SOS1, TP53 | 41 | 1.10E-19 | RB1, GSK3B, HSP90AB1, PTEN, PDGFB, PDGFA, PIK3CD, TGFA, KLK3, PIK3R2, PIK3CB, FOXO1, EGFR, HSP90B1, IGF1R, INS, IKBKB, NRAS, PDGFD, ERBB2, PDGFC, MAPK1, HRAS, MAPK3, PDGFRA, MAP2K1, CREBBP, EGF, PDPK1, IGF1, NFKB1, NFKBIA, PIK3CA, MDM2, KRAS, RAF1, SOS1, TP53, SOS2, FGFR2, FGFR1 | 3.20E+01 |
| hsa05214:Glioma | 12 | 9.32E-12 | RB1, PDGFRA, PIK3CA, PTEN, BRAF, KRAS, PLCG1, PIK3R1, SOS1, TP53, EGFR, MTOR | 34 | 2.71E-18 | SHC4, RB1, SHC2, CAMK2D, SHC3, SHC1, PTEN, PDGFB, PDGFA, PIK3CD, TGFA, PIK3R2, PIK3CB, EGFR, IGF1R, NRAS, PLCG2, MAPK1, PLCG1, HRAS, MAPK3, PRKCG, PDGFRA, MAP2K1, EGF, PRKCA, IGF1, PIK3CA, MDM2, KRAS, RAF1, SOS1, TP53, SOS2 | 2.50E+01 |
| hsa05205:Proteoglycans in cancer | 17 | 1.58E-11 | STAT3, FN1, BRAF, PIK3R1, ESR1, EGFR, MTOR, PIK3CA, ERBB4, ERBB2, FLNA, CTNNB1, KRAS, PLCG1, SOS1, TP53, TLR4 | 61 | 4.31E-18 | ITGB1, ITGB3, PIK3CD, FASLG, PIK3CB, IGF1R, PRKACG, KDR, ITGAV, RAC1, HRAS, PRKCG, MAP2K1, PDPK1, ITGA2, GAB1, RRAS2, PRKCA, RHOA, MRAS, PIK3CA, CTTN, RAF1, SOS1, MET, TP53, SOS2, HBEGF, TLR2, CAMK2D, SRC, SDC2, ITPR1, PIK3R2, IQGAP1, CBL, THBS1, HOXD10, EGFR, NRAS, ERBB3, RRAS, ERBB4, ERBB2, PLCG2, MAPK1, PLCG1, MAPK3, FZD5, FZD4, PTPN11, IGF1, MAPK14, ESR1, PTK2, MAPK13, MDM2, KRAS, PTPN6, NANOG, FGFR1 | 5.20E+01 |
| hsa04664:Fc epsilon RI signaling pathway | 7 | 3.26E-05 | LYN, MAP2K4, PIK3CA, KRAS, PLCG1, PIK3R1, SOS1 | 34 | 1.59E-17 | PIK3CD, PIK3R2, PIK3CB, MAPK9, NRAS, MAPK8, PLCG2, RAC2, MAPK1, RAC3, FYN, PLCG1, RAC1, MAP2K7, HRAS, MAPK3, MAP2K6, LYN, MAP2K3, MAP2K1, SYK, PDPK1, PLA2G4A, PRKCA, MAPK14, MAPK13, IL4, PIK3CA, KRAS, RAF1, MS4A2, SOS1, SOS2, LAT | 2.90E+01 |
| hsa05169:Epstein-Barr virus infection | 7 | 0.000819 | LYN, RB1, MAP2K4, PIK3CA, STAT3, PIK3R1, TP53 | 45 | 7.21E-17 | RB1, RBPJL, HDAC2, PSMD11, PSMD14, PSMD13, HDAC1, PIK3CD, PIK3R2, PIK3CB, ITGAL, RBPJ, ICAM1, PSMD8, IKBKB, MAPK9, MAPK8, PSMD7, TBK1, IRAK1, PLCG2, PSMD1, RIPK1, SKP2, MAP2K7, MAP3K7, MAP2K6, LYN, MAP2K3, JUN, SYK, MAPK14, NFKB1, MAPK13, NCOR2, NFKBIA, PSMC6, SNW1, PIK3CA, PSMC1, NEDD4, PSMC2, MDM2, HLA-DRA, TP53 | 4.10E+01 |
| hsa04917:Prolactin signaling pathway | 6 | 0.000449 | PIK3CA, STAT3, KRAS, PIK3R1, SOS1, ESR1 | 34 | 8.2E-17 | SHC4, GSK3B, SHC2, SHC3, SHC1, SRC, PIK3CD, PIK3R2, PIK3CB, FOXO3, INS, MAPK9, NRAS, MAPK8, SOCS1, MAPK1, JAK2, HRAS, MAPK3, SOCS5, MAP2K1, STAT1, FOS, MAPK14, PRLR, ESR1, NFKB1, MAPK13, PIK3CA, IRF1, KRAS, RAF1, SOS1, SOS2 | 3.00E+01 |
| hsa04068:FoxO signaling pathway | 10 | 3.00E-06 | SMAD2, PIK3CA, STAT3, PTEN, EP300, BRAF, KRAS, PIK3R1, SOS1, EGFR | 47 | 1.28E-16 | IRS1, PRKAG1, IRS4, PTEN, PRKAG2, PIK3CD, IRS2, FASLG, PIK3R2, PIK3CB, FOXO3, PRKAG3, FOXO1, EGFR, IGF1R, INS, IKBKB, MAPK9, STK11, NRAS, MAPK8, MAPK1, SKP2, HRAS, MAPK3, MAP2K1, CREBBP, SMAD4, PRKAB2, SMAD3, GADD45B, PRMT1, EGF, GADD45A, PDPK1, IGF1, MAPK14, SIRT1, PRKAB1, MAPK13, PIK3CA, MDM2, KRAS, RAF1, IL7R, SOS1, SOS2 | 4.20E+01 |
| hsa04510:Focal adhesion | 11 | 1.49E-05 | PDGFRA, PIK3CA, ERBB2, PTEN, FN1, CTNNB1, FLNA, BRAF, PIK3R1, SOS1, EGFR | 59 | 5.15E-16 | ITGB1, GSK3B, ITGB3, ITGA2B, PTEN, ILK, PIK3CD, PIK3CB, LAMC1, IGF1R, KDR, RAC2, RAC3, ITGAV, RAC1, HRAS, PRKCG, PDGFRA, MAP2K1, PDPK1, ITGA2, PRKCA, RHOA, PGF, PIK3CA, MYL2, ITGA6, RAF1, SOS1, MET, CRK, SOS2, SHC4, SHC2, SHC3, SRC, SHC1, PDGFB, PDGFA, PIK3R2, THBS1, EGFR, MAPK9, MAPK8, RAP1A, PDGFD, ERBB2, PDGFC, MAPK1, PAK6, FYN, PAK3, PAK4, MAPK3, JUN, LAMB3, EGF, IGF1, PTK2 | 5.30E+01 |
| hsa04071:Sphingolipid signaling pathway | 5 | 0.023813112 | PIK3CA, PTEN, KRAS, PIK3R1, TP53 | 42 | 8.82E-15 | PTEN, PIK3CD, PPP2R2A, PIK3R2, PIK3CB, PLD1, GNAI1, GNAI2, PPP2CA, MAPK9, NRAS, MAPK8, PPP2R1A, PPP2R5E, SMPD1, RAC2, MAPK1, RAC3, FYN, RAC1, HRAS, MAPK3, PRKCG, MAP2K1, NOS3, PDPK1, PPP2R5A, PRKCA, PPP2R5D, PPP2R5C, MAPK14, RHOA, NFKB1, MAPK13, PIK3CA, KRAS, PLCB1, RAF1, MS4A2, PLCB2, TP53, NSMAF | 3.80E+01 |
| hsa05223:Non-small cell lung cancer | 10 | 1.36E-09 | RB1, PIK3CA, ERBB2, BRAF, KRAS, PLCG1, PIK3R1, SOS1, TP53, EGFR | 27 | 1.86E-13 | RB1, PIK3CD, TGFA, PIK3R2, PIK3CB, FOXO3, EGFR, NRAS, RXRA, ERBB2, PLCG2, MAPK1, PLCG1, HRAS, MAPK3, PRKCG, MAP2K1, EGF, PDPK1, PRKCA, PIK3CA, RARB, KRAS, RAF1, SOS1, TP53, SOS2 | 1.90E+01 |
| hsa04550:Signaling pathways regulating pluripotency of stem cells | 9 | 3.63E-05 | SMAD2, PIK3CA, RIF1, STAT3, CTNNB1, KRAS, PIK3R1, ACVR2A, TBX3 | 43 | 6.56E-13 | GSK3B, BMPR2, RIF1, PIK3CD, PIK3R2, PIK3CB, IGF1R, SOX2, NRAS, DVL1, DVL2, DVL3, MAPK1, JAK2, HRAS, MAPK3, MAP2K1, SMAD4, SMAD3, FZD5, FZD4, PCGF2, LIF, PAX6, IGF1, MAPK14, KLF4, ACVR2B, SMAD5, TBX3, MAPK13, BMP2, MEIS1, PIK3CA, ID2, ID1, KRAS, NANOG, RAF1, FGFR2, NODAL, BMPR1A, FGFR1 | 3.90E+01 |
| hsa04662:B cell receptor signaling pathway | 5 | 0.003539179 | LYN, PIK3CA, KRAS, PIK3R1, SOS1 | 29 | 1.35E-12 | GSK3B, INPPL1, PIK3CD, PIK3R2, PIK3CB, RASGRP3, IKBKB, NRAS, PLCG2, RAC2, MAPK1, RAC3, RAC1, HRAS, MAPK3, LYN, JUN, MAP2K1, SYK, NFATC1, FOS, NFKB1, NFKBIA, PIK3CA, KRAS, PTPN6, RAF1, SOS1, SOS2 | 2.50E+01 |
| hsa05142:Chagas disease (American trypanosomiasis) | 5 | 0.014847487 | SMAD2, MAP2K4, PIK3CA, PIK3R1, TLR4 | 36 | 1.42E-12 | PIK3CD, PPP2R2A, FASLG, PIK3R2, PIK3CB, CD3D, GNAI1, GNAI2, PPP2CA, IKBKB, GNA14, MAPK9, GNA15, MAPK8, IRAK1, PPP2R1A, GNA11, MAPK1, MAPK3, JUN, SMAD3, IFNB1, FOS, IRAK4, MAPK14, TICAM1, IL2, NFKB1, MAPK13, NFKBIA, IFNG, PIK3CA, IL1B, PLCB1, PLCB2, TLR2 | 3.50E+01 |
| hsa05160:Hepatitis C | 8 | 0.000194 | PIK3CA, STAT3, BRAF, KRAS, PIK3R1, SOS1, TP53, EGFR | 41 | 2.17E-12 | GSK3B, PIK3CD, PPP2R2A, PIK3R2, PIK3CB, EGFR, PPP2CA, IKBKB, MAPK9, NRAS, MAPK8, RXRA, TBK1, PPP2R1A, MAPK1, RIPK1, HRAS, MAPK3, IFNB1, EGF, PDPK1, STAT1, STAT2, MAPK14, TICAM1, NFKB1, MAPK13, PIAS1, NFKBIA, PIK3CA, IRF1, PSME3, IRF7, KRAS, RAF1, PPARA, SOS1, TP53, SOS2, IRF9, IFNAR1 | 3.60E+01 |
| hsa04370:VEGF signaling pathway | 4 | 0.018074696 | PIK3CA, KRAS, PLCG1, PIK3R1 | 27 | 2.21E-12 | SHC2, SRC, PIK3CD, HSPB1, PIK3R2, PIK3CB, NRAS, KDR, PLCG2, RAC2, MAPK1, RAC3, PLCG1, RAC1, HRAS, MAPK3, PRKCG, MAP2K1, NOS3, PLA2G4A, PRKCA, MAPK14, PTK2, MAPK13, PIK3CA, KRAS, RAF1 | 2.40E+01 |
| hsa04650:Natural killer cell mediated cytotoxicity | 6 | 0.005000964 | PIK3CA, BRAF, KRAS, PLCG1, PIK3R1, SOS1 | 39 | 2.35E-12 | SHC4, SHC2, SHC3, SHC1, PIK3CD, FASLG, PIK3R2, PIK3CB, ITGAL, ICAM1, NRAS, PLCG2, RAC2, PTK2B, MAPK1, RAC3, FYN, PLCG1, RAC1, HRAS, MAPK3, PRKCG, MAP2K1, SYK, IFNB1, PRKCA, PTPN11, TNFRSF10A, NFATC1, IFNG, PIK3CA, LCK, KRAS, PTPN6, RAF1, SOS1, SOS2, LAT, IFNAR1 | 3.50E+01 |
| hsa05211:Renal cell carcinoma | 6 | 0.000319 | PIK3CA, EP300, BRAF, KRAS, PIK3R1, SOS1 | 28 | 2.71E-12 | PDGFB, SLC2A1, PIK3CD, TGFA, PIK3R2, PIK3CB, ETS1, NRAS, RAP1A, MAPK1, PAK6, RAC1, PAK3, HRAS, MAPK3, PAK4, JUN, MAP2K1, CREBBP, GAB1, PTPN11, PIK3CA, KRAS, RAF1, SOS1, MET, CRK, SOS2 | 2.50E+01 |
| hsa05231:Choline metabolism in cancer | 9 | 3.25E-06 | PDGFRA, PIK3CA, TSC2, KRAS, PLCG1, PIK3R1, SOS1, EGFR, MTOR | 35 | 2.96E-12 | PDGFB, PDGFA, PIK3CD, PIK3R2, PIK3CB, PLD1, EGFR, MAPK9, NRAS, MAPK8, PDGFD, PDGFC, RAC2, MAPK1, RAC3, PLCG1, RAC1, HRAS, MAPK3, PRKCG, PDGFRA, JUN, MAP2K1, EGF, PDPK1, PLA2G4A, PRKCA, FOS, PIK3CA, SP1, RHEB, KRAS, RAF1, SOS1, SOS2 | 2.90E+01 |
| hsa00562:Inositol phosphate metabolism | 5 | 0.003924005 | INPP4A, PIK3CA, PTEN, PLCG1, MTM1 | 29 | 3.12E-12 | PI4K2B, MTMR1, MTMR2, MTMR3, PTEN, INPPL1, MTMR8, PIK3CD, PIK3C2G, PIK3CB, PIK3C2A, MTMR6, MTMR7, PIK3C2B, MTM1, INPP5B, PLCZ1, PLCG2, PIP4K2A, PIP4K2B, PLCG1, PIP4K2C, PIK3CA, PI4KA, PIK3C3, PI4KB, PLCB1, PLCB2, PLCD1 | 2.50E+01 |
| hsa05220:Chronic myeloid leukemia | 9 | 2.37E-07 | RB1, PIK3CA, MECOM, BRAF, KRAS, PIK3R1, SOS1, TP53, RUNX1 | 29 | 4.67E-12 | SHC4, RB1, SHC2, HDAC2, SHC3, SHC1, HDAC1, PIK3CD, PIK3R2, PIK3CB, CBL, IKBKB, NRAS, MAPK1, HRAS, MAPK3, MAP2K1, SMAD4, PTPN11, NFKB1, NFKBIA, PIK3CA, MDM2, KRAS, RAF1, SOS1, TP53, CRK, SOS2 | 2.40E+01 |
| hsa04910:Insulin signaling pathway | 8 | 0.000243 | PIK3CA, PRKAR1A, TSC2, BRAF, KRAS, PIK3R1, SOS1, MTOR | 41 | 8.02E-12 | SHC4, GSK3B, SHC2, SHC3, SHC1, IRS1, PRKAG1, IRS4, INPPL1, PRKAG2, PIK3CD, IRS2, PIK3R2, PIK3CB, CBL, PRKAG3, FOXO1, INS, IKBKB, MAPK9, NRAS, MAPK8, SOCS1, PRKACG, MAPK1, HRAS, PPARGC1A, MAPK3, PRKCI, MAP2K1, PRKAB2, PDPK1, PRKAB1, PIK3CA, RHEB, KRAS, RAF1, SOS1, CRK, SOS2, RHOQ | 3.80E+01 |
| hsa04915:Estrogen signaling pathway | 6 | 0.002026145 | PIK3CA, KRAS, PIK3R1, SOS1, ESR1, EGFR | 34 | 8.5E-12 | SHC4, SHC2, SHC3, HSP90AB1, SHC1, SRC, ITPR1, PIK3CD, PIK3R2, PIK3CB, GNAI1, EGFR, HSP90B1, GNAI2, NRAS, PRKACG, MAPK1, HRAS, MAPK3, HSPA8, JUN, MAP2K1, NOS3, FOS, ESR1, PIK3CA, SP1, KRAS, PLCB1, RAF1, SOS1, PLCB2, SOS2, HBEGF | 2.90E+01 |
| hsa04070:Phosphatidylinositol signaling system | 6 | 0.001937314 | INPP4A, PIK3CA, PTEN, PLCG1, PIK3R1, MTM1 | 33 | 3.3E-11 | PI4K2B, MTMR1, MTMR2, MTMR3, PTEN, INPPL1, ITPR1, MTMR8, PIK3CD, PIK3C2G, PIK3R2, PIK3CB, PIK3C2A, MTMR6, MTMR7, PIK3C2B, MTM1, INPP5B, PLCZ1, PLCG2, PIP4K2A, PIP4K2B, PLCG1, PIP4K2C, PRKCG, PRKCA, PIK3CA, PI4KA, PIK3C3, PI4KB, PLCB1, PLCB2, PLCD1 | 2.90E+01 |
| hsa04150:mTOR signaling pathway | 6 | 0.000173 | PIK3CA, PTEN, TSC2, BRAF, PIK3R1, MTOR | 25 | 3.39E-11 | IRS1, PTEN, PIK3CD, PIK3R2, PIK3CB, INS, IKBKB, RPS6KA3, RPS6KA6, STK11, RPS6KA2, RPS6KA1, MAPK1, RICTOR, MAPK3, PRKCG, PDPK1, PRKCA, IGF1, RRAGA, PIK3CA, RRAGC, RRAGB, RHEB, RRAGD | 2.30E+01 |
| hsa05161:Hepatitis B | 11 | 6.24E-07 | RB1, MAP2K4, MAP3K1, PIK3CA, STAT3, PTEN, EP300, KRAS, PIK3R1, TP53, TLR4 | 41 | 4.43E-11 | RB1, PCNA, YWHAB, SRC, PTEN, PIK3CD, FASLG, PIK3R2, PIK3CB, IKBKB, MAPK9, NRAS, MAPK8, TBK1, PTK2B, MAPK1, HRAS, MAPK3, PRKCG, JUN, MAP2K1, CREBBP, SMAD4, MAP3K1, IFNB1, STAT1, STAT2, PRKCA, NFATC1, FOS, TICAM1, TIRAP, NFKB1, NFKBIA, PIK3CA, IRF7, KRAS, RAF1, TP53, TLR2, IFNAR1 | 3.50E+01 |
| hsa04062:Chemokine signaling pathway | 7 | 0.006822538 | LYN, PIK3CA, STAT3, BRAF, KRAS, PIK3R1, SOS1 | 47 | 9.14E-11 | SHC4, GSK3B, ITK, SHC2, GSK3A, SHC3, SHC1, SRC, PIK3CD, PIK3R2, ARRB2, PIK3CB, FOXO3, GNAI1, GNAI2, IKBKB, PREX1, NRAS, RAP1A, GNG2, PRKACG, RAC2, PTK2B, MAPK1, RAC1, JAK2, HRAS, MAPK3, LYN, MAP2K1, STAT1, STAT2, RHOA, PTK2, NFKB1, FGR, NFKBIA, HCK, PIK3CA, GNB1, KRAS, PLCB1, RAF1, SOS1, PLCB2, CRK, SOS2 | 4.30E+01 |
| hsa04912:GnRH signaling pathway | 6 | 0.001393231 | MAP2K4, MAP3K1, KRAS, SOS1, EGFR, MAP3K4 | 31 | 1.05E-10 | CAMK2D, SRC, ITPR1, PLD1, EGFR, MAPK9, NRAS, MAPK8, PRKACG, GNA11, PTK2B, MAPK1, MAP2K7, HRAS, MAPK3, MAP2K6, MAP2K3, JUN, MAP2K1, MAP3K1, PLA2G4A, PRKCA, MAPK14, MAPK13, KRAS, PLCB1, RAF1, SOS1, PLCB2, SOS2, HBEGF | 2.70E+01 |
| hsa05100:Bacterial invasion of epithelial cells | 4 | 0.03426018 | PIK3CA, FN1, CTNNB1, PIK3R1 | 28 | 2.62E-10 | SHC4, ITGB1, SHC2, SHC3, SHC1, SRC, ARPC1A, CLTB, ILK, PIK3CD, PIK3R2, PIK3CB, CBL, CLTCL1, RAC1, RHOG, GAB1, ARPC5, RHOA, DNM1, PTK2, MAD2L2, CTTN, PIK3CA, ARPC2, ARPC3, MET, CRK | 2.70E+01 |
| hsa05166:HTLV-I infection | 14 | 3.51E-07 | RB1, SMAD2, PDGFRA, MAP2K4, MAP3K1, PIK3R1, PIK3CA, CHEK2, MYB, EP300, CTNNB1, KRAS, POLE, TP53 | 56 | 3.11E-10 | RB1, GSK3B, SPI1, SLC2A1, PIK3CD, PIK3CB, ITGAL, CD3D, ETS1, ETS2, ICAM1, IKBKB, PRKACG, MYB, HRAS, PDGFRA, TBP, MSX2, RRAS2, FOS, MRAS, PIK3CA, LCK, TP53, PCNA, PDGFB, PDGFA, GPS2, PIK3R2, IL2RG, NRAS, RRAS, TERT, POLD1, DVL1, DVL2, DVL3, RANBP1, EGR1, JUN, CREBBP, SMAD4, MAP3K1, SMAD3, FZD5, FZD4, NFYB, NFATC1, NFKB1, IL2, NFKBIA, FOSL1, DLG1, IL2RA, HLA-DRA, KRAS | 4.90E+01 |
| hsa04620:Toll-like receptor signaling pathway | 4 | 0.072718181 | MAP2K4, PIK3CA, PIK3R1, TLR4 | 33 | 3.30E-10 | PIK3CD, PIK3R2, PIK3CB, IKBKB, MAPK9, MAPK8, TBK1, IRAK1, MAPK1, RIPK1, RAC1, MAP2K7, MAP3K7, MAPK3, MAP2K6, MAP2K3, JUN, MAP2K1, IFNB1, STAT1, FOS, IRAK4, MAPK14, TICAM1, TIRAP, NFKB1, MAPK13, NFKBIA, PIK3CA, IL1B, IRF7, TLR2, IFNAR1 | 3.20E+01 |
| hsa05212:Pancreatic cancer | 10 | 5.37E-09 | RB1, SMAD2, PIK3CA, ERBB2, STAT3, BRAF, KRAS, PIK3R1, TP53, EGFR | 25 | 5.72E-10 | RB1, PIK3CD, TGFA, PIK3R2, PIK3CB, EGFR, IKBKB, MAPK9, MAPK8, ERBB2, RAC2, MAPK1, RAC3, RAC1, MAPK3, MAP2K1, SMAD4, SMAD3, EGF, STAT1, NFKB1, PIK3CA, KRAS, RAF1, TP53 | 1.90E+01 |
| hsa05213:Endometrial cancer | 10 | 6.78E-10 | PIK3CA, ERBB2, PTEN, CTNNB1, BRAF, KRAS, PIK3R1, SOS1, TP53, EGFR | 22 | 1.01E-09 | GSK3B, MAP2K1, PDPK1, EGF, PTEN, PIK3CD, ILK, PIK3R2, PIK3CB, FOXO3, EGFR, NRAS, PIK3CA, ERBB2, MAPK1, KRAS, RAF1, SOS1, HRAS, TP53, SOS2, MAPK3 | 1.50E+01 |
| hsa04666:Fc gamma R-mediated phagocytosis | 5 | 0.007133685 | LYN, PIK3CA, AMPH, PLCG1, PIK3R1 | 28 | 1.74E-09 | ARPC1A, INPPL1, PIK3CD, PIK3R2, PIK3CB, PLD1, PLCG2, RAC2, MAPK1, PLCG1, RAC1, MAPK3, PRKCG, LYN, MAP2K1, GSN, SYK, PRKCA, ARPC5, HCK, PTPRC, PIK3CA, ARPC2, BIN1, ARPC3, RAF1, CRK, LAT | 2.50E+01 |
| hsa04931:Insulin resistance | 5 | 0.016843664 | PIK3CA, STAT3, PTEN, PIK3R1, MTOR | 32 | 2.49E-09 | GSK3B, IRS1, PRKAG1, PTEN, SLC2A1, PRKAG2, PIK3CD, IRS2, PIK3R2, PIK3CB, PRKAG3, FOXO1, INS, IKBKB, MAPK9, RPS6KA3, RPS6KA6, MAPK8, RPS6KA2, RPS6KA1, PPARGC1A, PPARGC1B, PRKAB2, NOS3, PDPK1, PTPN11, PRKAB1, NFKB1, NFKBIA, PIK3CA, PRKCQ, PPARA | 3.00E+01 |
| hsa05210:Colorectal cancer | 7 | 1.91E-05 | SMAD2, PIK3CA, CTNNB1, BRAF, KRAS, PIK3R1, TP53 | 23 | 7.17E-09 | GSK3B, MAP2K1, JUN, SMAD4, SMAD3, PIK3CD, PIK3R2, PIK3CB, FOS, RHOA, MSH6, MAPK9, MAPK8, PIK3CA, MSH2, RAC2, RAC3, MAPK1, KRAS, RAC1, RAF1, TP53, MAPK3 | 2.00E+01 |
| hsa05230:Central carbon metabolism in cancer | 9 | 9.27E-08 | PDGFRA, PIK3CA, ERBB2, PTEN, KRAS, PIK3R1, TP53, EGFR, MTOR | 23 | 1.41E-08 | RET, PDGFRA, MAP2K1, NTRK3, PTEN, SLC2A1, PIK3CD, PIK3R2, PIK3CB, EGFR, NRAS, PIK3CA, ERBB2, MAPK1, KRAS, RAF1, HRAS, MET, TP53, FGFR2, PDK1, FGFR1, MAPK3 | 1.60E+01 |
| hsa05164:Influenza A | 5 | 0.074551789 | MAP2K4, PIK3CA, EP300, PIK3R1, TLR4 | 41 | 1.55E-08 | GSK3B, PIK3CD, FASLG, PIK3R2, PIK3CB, ICAM1, IKBKB, MAPK9, MAPK8, TBK1, MAPK1, JAK2, MAP2K7, MAPK3, MAP2K6, MAP2K3, HSPA8, JUN, MAP2K1, CREBBP, IFNB1, STAT1, STAT2, PRKCA, TNFRSF10A, IRAK4, MAPK14, TICAM1, NFKB1, PML, MAPK13, NFKBIA, IL1A, IFNG, PIK3CA, IL1B, IRF7, HLA-DRA, RAF1, IRF9, IFNAR1 | 4.00E+01 |
| hsa04540:Gap junction | 4 | 0.046364896 | PDGFRA, KRAS, SOS1, EGFR | 27 | 2.54E-08 | SRC, PDGFB, ITPR1, PDGFA, GNAI1, EGFR, GNAI2, NRAS, PRKACG, GNA11, PDGFD, PDGFC, MAPK1, HRAS, MAP2K5, MAPK3, PRKCG, PDGFRA, MAP2K1, EGF, PRKCA, KRAS, PLCB1, RAF1, SOS1, PLCB2, SOS2 | 2.30E+01 |
| hsa05203:Viral carcinogenesis | 8 | 0.002531941 | LYN, RB1, PIK3CA, STAT3, EP300, KRAS, PIK3R1, TP53 | 45 | 2.67E-08 | HDAC4, RB1, RBPJL, GTF2A1, HDAC2, HDAC3, YWHAB, HDAC1, SRC, GTF2B, PIK3CD, PIK3R2, PIK3CB, RBPJ, HDAC9, NRAS, PRKACG, MAPK1, RAC1, SKP2, HRAS, MAPK3, LYN, RANBP1, JUN, CREBBP, GSN, TBP, SYK, GTF2H1, GTF2H3, GTF2H4, RHOA, NFKB1, NFKBIA, DLG1, HIST1H4A, SNW1, PIK3CA, PSMC1, IRF7, MDM2, KRAS, TP53, IRF9 | 4.00E+01 |
| hsa05221:Acute myeloid leukemia | 8 | 6.27E-07 | PIK3CA, STAT3, BRAF, KRAS, PIK3R1, SOS1, MTOR, RUNX1 | 21 | 3.08E-08 | MAP2K1, SPI1, JUP, PIK3CD, PIK3R2, PIK3CB, NFKB1, PML, IKBKB, NRAS, PIK3CA, PIM1, RARA, MAPK1, KRAS, RAF1, SOS1, HRAS, SOS2, PPARD, MAPK3 | 1.80E+01 |
| hsa05162:Measles | 5 | 0.033093073 | PIK3CA, STAT3, PIK3R1, TP53, TLR4 | 34 | 4.12E-08 | GSK3B, PIK3CD, FASLG, PIK3R2, PIK3CB, IL2RG, CD3D, TBK1, IRAK1, FYN, JAK2, MAP3K7, HSPA8, IFNB1, STAT1, STAT2, TNFRSF10A, IRAK4, IL2, NFKB1, IL4, NFKBIA, IL1A, IFNG, PIK3CA, IL1B, IL2RA, IRF7, PRKCQ, TP53, IRF9, TLR2, TP73, IFNAR1 | 3.20E+01 |
| hsa04330:Notch signaling pathway | 3 | 0.071172599 | NOTCH1, EP300, PSEN1 | 19 | 6.35E-08 | NOTCH2, RBPJL, NOTCH3, CREBBP, HDAC2, NOTCH1, MAML2, MAML1, HDAC1, RBPJ, NCOR2, NCSTN, SNW1, DVL1, DVL2, DVL3, HES1, MAML3, HES5 | 1.80E+01 |
| hsa04350:TGF-beta signaling pathway | 4 | 0.04129784 | SMAD2, EP300, LTBP1, ACVR2A | 25 | 0.000000178 | BMPR2, CUL1, THBS1, PPP2CA, PPP2R1A, MAPK1, PITX2, MAPK3, CREBBP, SMAD4, SMAD3, BMP7, ACVR2B, SMAD5, RHOA, BMP6, BMP5, BMP2, TFDP1, IFNG, SP1, ID2, ID1, NODAL, BMPR1A | 2.50E+01 |
| hsa04914:Progesterone-mediated oocyte maturation | 4 | 0.04507032 | PIK3CA, BRAF, KRAS, PIK3R1 | 25 | 0.000000366 | HSP90AB1, PIK3CD, PIK3R2, PIK3CB, GNAI1, GNAI2, IGF1R, INS, MAPK9, RPS6KA3, RPS6KA6, MAPK8, PRKACG, RPS6KA2, RPS6KA1, MAPK1, MAPK3, MAP2K1, IGF1, MAPK14, MAPK13, MAD2L2, PIK3CA, KRAS, RAF1 | 2.30E+01 |
| hsa04066:HIF-1 signaling pathway | 9 | 2.21E-06 | PIK3CA, ERBB2, STAT3, EP300, PLCG1, PIK3R1, TLR4, EGFR, MTOR | 26 | 0.000000694 | CAMK2D, TFRC, SLC2A1, PIK3CD, PIK3R2, PIK3CB, EGFR, IGF1R, INS, ERBB2, PLCG2, HMOX1, MAPK1, PLCG1, MAPK3, PDK1, PRKCG, MAP2K1, CREBBP, EGF, NOS3, PRKCA, IGF1, NFKB1, IFNG, PIK3CA | 2.20E+01 |
| hsa05219:Bladder cancer | 6 | 3.19E-05 | RB1, ERBB2, BRAF, KRAS, TP53, EGFR | 16 | 1.17E-06 | RB1, MAP2K1, SRC, EGF, THBS1, EGFR, NRAS, ERBB2, MDM2, MAPK1, KRAS, RAF1, HRAS, TP53, HBEGF, MAPK3 | 1.10E+01 |
| hsa04520:Adherens junction | 5 | 0.003924005 | SMAD2, ERBB2, EP300, CTNNB1, EGFR | 21 | 2.42E-06 | CREBBP, SMAD4, SMAD3, SRC, CTNND1, IQGAP1, RHOA, EGFR, IGF1R, ERBB2, SNAI1, RAC2, RAC3, MAPK1, FYN, PTPN6, RAC1, MAP3K7, MET, FGFR1, MAPK3 | 1.90E+01 |
| hsa04630:Jak-STAT signaling pathway | 5 | 0.043306915 | PIK3CA, STAT3, EP300, PIK3R1, SOS1 | 32 | 0.00000347 | PIK3CD, PIK3R2, PIK3CB, IL2RG, SOCS1, PIM1, JAK2, IL12RB2, SOCS5, PIAS4, CREBBP, IL4R, IFNB1, STAT1, STAT2, LIF, PTPN11, PRLR, IL2, PIAS2, PIAS1, IL4, IFNG, PIK3CA, IL7, IL2RA, PTPN6, IL7R, SOS1, SOS2, IRF9, IFNAR1 | 3.00E+01 |
| hsa04310:Wnt signaling pathway | 5 | 0.037154944 | TBL1XR1, EP300, CTNNB1, PSEN1, TP53 | 31 | 0.00000348 | GSK3B, CAMK2D, CUL1, LRP5, LRP6, MAPK9, MAPK8, SOX17, PRKACG, RUVBL1, DVL1, DVL2, RAC2, DVL3, RAC3, RAC1, MAP3K7, PRKCG, JUN, CREBBP, SMAD4, FZD5, FZD4, PRKCA, NFATC1, RHOA, FOSL1, PLCB1, PLCB2, TP53, PPARD | 3.00E+01 |
| hsa04670:Leukocyte transendothelial migration | 4 | 0.087932947 | PIK3CA, CTNNB1, PLCG1, PIK3R1 | 27 | 0.00000736 | ITGB1, ITK, ITGAM, CTNND1, PIK3CD, PIK3R2, PIK3CB, ITGAL, GNAI1, GNAI2, ICAM1, RAP1A, PLCG2, RAC2, PTK2B, PLCG1, RAC1, PRKCG, RHOH, PRKCA, PTPN11, MAPK14, RHOA, PTK2, MAPK13, PIK3CA, MYL2 | 2.50E+01 |
| hsa04320:Dorso-ventral axis formation | 4 | 0.001830727 | NOTCH1, KRAS, SOS1, EGFR | 12 | 0.00000962 | NOTCH2, NOTCH3, MAP2K1, NOTCH1, MAPK1, KRAS, SOS1, ETS1, SOS2, ETS2, EGFR, MAPK3 | 8.00E+00 |
| hsa05222:Small cell lung cancer | 6 | 0.001024862 | RB1, PIK3CA, PTEN, FN1, PIK3R1, TP53 | 22 | 0.0000132 | RB1, ITGB1, LAMB3, MAX, ITGA2, ITGA2B, PTEN, PIK3CD, PIK3R2, PIK3CB, LAMC1, PTK2, NFKB1, NFKBIA, IKBKB, RXRA, PIK3CA, RARB, ITGAV, ITGA6, SKP2, TP53 | 1.80E+01 |
| hsa04960:Aldosterone-regulated sodium reabsorption | 3 | 0.049246517 | PIK3CA, KRAS, PIK3R1 | 14 | 0.0000197 | PRKCG, PDPK1, IRS1, PIK3CD, PRKCA, PIK3R2, PIK3CB, IGF1, INS, PIK3CA, MAPK1, KRAS, SFN, MAPK3 | 1.20E+01 |
| hsa04110:Cell cycle | 8 | 0.000125 | RB1, SMAD2, MCM7, CHEK2, RAD21, EP300, SMC1A, TP53 | 27 | 0.0000305 | RB1, GSK3B, HDAC2, PCNA, MCM7, PRKDC, YWHAB, HDAC1, CUL1, SMC3, RAD21, SFN, SKP2, CREBBP, SMAD4, SMAD3, GADD45B, GADD45A, SMC1A, SMC1B, MAD2L2, STAG1, STAG2, TFDP1, TFDP2, MDM2, TP53 | 2.20E+01 |
| hsa05206:MicroRNAs in cancer | 12 | 4.73E-05 | PDGFRA, NOTCH1, ERBB2, STAT3, PTEN, EP300, KRAS, PLCG1, SOS1, TP53, EGFR, MTOR | 47 | 0.0000584 | SHC4, NOTCH2, NOTCH3, BMPR2, NOTCH1, SHC1, IRS1, ITGB3, PTEN, PDGFB, PDGFA, IRS2, THBS1, HOXD10, EGFR, IKBKB, NRAS, SOCS1, ERBB3, ERBB2, PLCG2, PIM1, HMOX1, PLCG1, HRAS, PAK4, PRKCG, PDGFRA, MAP2K1, CREBBP, UBE2I, PRKCA, SIRT1, RHOA, SERPINB5, NFKB1, ZEB1, MDM2, KRAS, MDM4, RAF1, SOS1, MET, TP53, CRK, SOS2, EZH2 | 3.80E+01 |
| hsa05120:Epithelial cell signaling in Helicobacter pylori infection | 4 | 0.023148523 | LYN, MAP2K4, PLCG1, EGFR | 18 | 6.07E-05 | LYN, JUN, SRC, PTPN11, MAPK14, EGFR, NFKB1, MAPK13, NFKBIA, IKBKB, MAPK9, MAPK8, PLCG2, PLCG1, RAC1, MET, GIT1, HBEGF | 1.50E+01 |
| hsa04930:Type II diabetes mellitus | 3 | 0.071172599 | PIK3CA, PIK3R1, MTOR | 14 | 0.000219 | IRS1, IRS4, PIK3CD, PIK3R2, IRS2, PIK3CB, INS, IKBKB, MAPK9, MAPK8, SOCS1, PIK3CA, MAPK1, MAPK3 | 1.30E+01 |
| hsa05216:Thyroid cancer | 5 | 0.000128 | TPR, CTNNB1, BRAF, KRAS, TP53 | 10 | 0.000696 | RET, MAP2K1, NRAS, RXRA, MAPK1, KRAS, PPARG, HRAS, TP53, MAPK3 | 8 |
| hsa05146:Amoebiasis | 4 | 0.072718181 | PIK3CA, FN1, PIK3R1, TLR4 | 21 | 0.001037143 | PRKCG, ITGAM, LAMB3, PIK3CD, HSPB1, PRKCA, PIK3R2, PIK3CB, LAMC1, PTK2, NFKB1, GNA14, GNA15, IFNG, PIK3CA, PRKACG, IL1B, GNA11, PLCB1, PLCB2, TLR2 | 20 |
| hsa04115:p53 signaling pathway | 4 | 0.023148523 | CHEK2, PTEN, TSC2, TP53 | 12 | 0.035070773 | GADD45B, GADD45A, PERP, PTEN, MDM2, MDM4, SFN, IGF1, THBS1, TP53, SERPINB5, TP73 | 10 |
| hsa04020:Calcium signaling pathway | 5 | 0.080855001 | PDGFRA, ERBB4, ERBB2, PLCG1, EGFR | 23 | 0.079926475 | CHRM2, PRKCG, PDGFRA, CAMK2D, NOS3, ITPR1, PRKCA, EGFR, GRIN1, GNA14, GNA15, PLCZ1, ERBB3, ERBB4, PRKACG, GNA11, ERBB2, PLCG2, PTK2B, PLCG1, PLCB1, PLCB2, PLCD1 | 18 |

**Table 2. The pathway intersection of driver genes and downstream genes in breast cancer of Her2 subtype**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Term | drivers\_count | driver\_pvalue | drivers | Out\_count | Out\_pvalue | Outs | Outs\_drivers\_count |
| hsa04014:Ras signaling pathway | 8 | 0.001270989 | PDGFRA, PIK3CA, NF1, KRAS, PLCG1, PIK3R1, SOS1, EGFR | 46 | 1.01E-18 | FLT1, SHC1, PDGFB, PIK3R3, PIK3R2, PIK3CB, PIK3R1, ETS2, FGF3, RELA, RAP1B, FGF6, PAK1, NRAS, MAPK8, RAP1A, TBK1, PDGFD, PDGFC, MAPK1, RAC3, IKBKG, PLCG1, RAC1, HRAS, PAK2, PAK4, PRKCG, PDGFRB, MAP2K2, GAB1, PLA2G4A, PRKCA, PTPN11, GRIN2B, RHOA, NFKB1, MAPK10, FGF17, PIK3CA, RASA1, NF1, KRAS, FGF12, SOS2, FGFR2 | 41 |
| hsa04722:Neurotrophin signaling pathway | 7 | 0.000236 | MAP3K1, PIK3CA, KRAS, PLCG1, PIK3R1, SOS1, TP53 | 33 | 1.86E-17 | SHC1, PIK3R3, PIK3R2, PIK3CB, PIK3R1, FOXO3, RELA, RAP1B, NRAS, MAPK8, RAP1A, RPS6KA2, RPS6KA1, MAPK1, PLCG1, RAC1, HRAS, MAP3K5, MAP3K3, MAP2K2, PRKCD, GAB1, PTPN11, IRAK4, RHOA, MAPK12, NFKB1, MAPK10, NFKBIA, PIK3CA, KRAS, SOS2, TP73 | 29 |
| hsa04919:Thyroid hormone signaling pathway | 14 | 1.12E-12 | NOTCH1, NCOA3, TSC2, PIK3R1, ESR1, MTOR, MED12, NCOR1, MED13, PIK3CA, EP300, KRAS, PLCG1, TP53 | 32 | 4.32E-17 | HDAC2, HDAC1, PIK3R3, GATA4, PIK3R2, PIK3CB, PIK3R1, HIF1A, SLC9A1, NRAS, MED13, MED30, MYC, MAPK1, ITGAV, PLCG1, HRAS, PRKCG, NCOA2, MED1, MAP2K2, STAT1, PRKCA, MED27, PLCB3, MED24, NCOR1, PIK3CA, MDM2, KRAS, PLCB1, PLCB2 | 26 |
| hsa05200:Pathways in cancer | 18 | 1.28E-09 | RB1, SMAD2, PDGFRA, PTEN, FN1, PIK3R1, BRCA2, EGFR, MTOR, RUNX1, PIK3CA, MECOM, ERBB2, EP300, KRAS, PLCG1, SOS1, TP53 | 58 | 8.66E-17 | PIK3CB, GLI1, FGF3, FGF6, MYC, RAC3, ITGAV, IKBKG, RAC1, SKP2, HRAS, PDGFRB, PRKCG, HSP90AA1, MAP2K2, PRKCA, RHOA, MSH6, PLCB3, PIK3CA, PLCB1, PLCB2, SOS2, PPARD, HDAC2, MAX, HDAC1, PDGFB, GNAI3, PIK3R3, PIK3R2, PIK3R1, HIF1A, GNAI1, RELA, HSP90B1, NRAS, MAPK8, GNA11, ERBB2, MAPK1, PLCG1, SMAD2, SMAD4, JUP, STAT1, STAT3, NFKB1, NFKBIA, MAPK10, FGF17, CDK4, CDK2, GNAS, MDM2, KRAS, FGF12, FGFR2 | 52 |
| hsa05169:Epstein-Barr virus infection | 6 | 0.001978152 | LYN, RB1, MAP2K4, PIK3CA, PIK3R1, TP53 | 32 | 2.70E-16 | PSMD12, HDAC2, PSMD11, PSMD14, HDAC1, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RBPJ, RELA, PSMD6, MAPK8, TBK1, PSMD4, MYC, PSMD2, PSMD3, IKBKG, SKP2, STAT3, MAPK12, NFKB1, MAPK10, NFKBIA, PSMC5, PSMC3, IRF3, PIK3CA, PSMC4, CDK2, MDM2 | 30 |
| hsa05161:Hepatitis B | 9 | 9.50E-06 | RB1, MAP2K4, MAP3K1, PIK3CA, PTEN, EP300, KRAS, PIK3R1, TP53 | 34 | 1.07E-15 | YWHAB, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, NRAS, MAPK8, TBK1, MYC, MAPK1, IKBKG, HRAS, PRKCG, SMAD4, MAP2K2, IFNB1, STAT1, STAT2, STAT3, PRKCA, TICAM1, NFKB1, NFATC4, MAPK10, NFKBIA, IRF3, PIK3CA, CDK4, CDK2, IRF7, KRAS, MYD88, IFNAR1 | 31 |
| hsa04012:ErbB signaling pathway | 10 | 1.07E-08 | MAP2K4, PIK3CA, ERBB4, ERBB2, KRAS, PLCG1, PIK3R1, SOS1, EGFR, MTOR | 26 | 1.16E-14 | SHC1, PIK3R3, PIK3R2, PIK3CB, PIK3R1, PAK1, NRAS, MAPK8, ERBB4, MYC, ERBB2, MAPK1, PLCG1, HRAS, PAK2, NCK1, PAK4, PRKCG, MAP2K2, GAB1, PRKCA, MAPK10, PIK3CA, NRG4, KRAS, SOS2 | 20 |
| hsa04015:Rap1 signaling pathway | 6 | 0.019013271 | PDGFRA, PIK3CA, KRAS, PLCG1, PIK3R1, EGFR | 39 | 1.99E-14 | FLT1, ITGB2, GNAI3, PDGFB, PIK3R3, PIK3R2, PIK3CB, PIK3R1, FGF3, GNAI1, RAP1B, FGF6, NRAS, RAP1A, PDGFD, PDGFC, MAPK1, RAC3, PLCG1, RAC1, HRAS, PRKCG, PDGFRB, MAP2K2, PRKCA, GRIN2B, RHOA, MAPK12, FGF17, PLCB3, PIK3CA, ID1, GNAS, KRAS, PRKD1, PLCB1, FGF12, PLCB2, FGFR2 | 35 |
| hsa04071:Sphingolipid signaling pathway | 5 | 0.011709101 | PIK3CA, PTEN, KRAS, PIK3R1, TP53 | 29 | 9.39E-14 | SGMS1, GNAI3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, GNAI1, RELA, NRAS, MAPK8, SMPD1, MAPK1, RAC3, RAC1, HRAS, MAP3K5, PRKCG, MAP2K2, PRKCA, PPP2R5C, RHOA, MAPK12, NFKB1, MAPK10, PLCB3, PIK3CA, KRAS, PLCB1, PLCB2 | 26 |
| hsa05220:Chronic myeloid leukemia | 8 | 8.21E-07 | RB1, PIK3CA, MECOM, KRAS, PIK3R1, SOS1, TP53, RUNX1 | 23 | 1.19E-13 | SMAD4, HDAC2, MAP2K2, SHC1, HDAC1, PIK3R3, PIK3R2, PTPN11, PIK3CB, PIK3R1, RELA, NFKB1, NFKBIA, NRAS, PIK3CA, CDK4, MYC, MDM2, MAPK1, KRAS, IKBKG, HRAS, SOS2 | 20 |
| hsa05142:Chagas disease (American trypanosomiasis) | 4 | 0.041433321 | SMAD2, MAP2K4, PIK3CA, PIK3R1 | 27 | 1.30E-13 | GNAI3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, GNAI1, RELA, GNA14, MAPK8, GNA11, MAPK1, IKBKG, SMAD2, IFNB1, IRAK4, TICAM1, MAPK12, NFKB1, MAPK10, NFKBIA, PLCB3, IFNG, PIK3CA, GNAS, PLCB1, PLCB2, MYD88 | 24 |
| hsa05215:Prostate cancer | 12 | 2.48E-11 | RB1, PDGFRA, PIK3CA, ERBB2, PTEN, EP300, KRAS, PIK3R1, SOS1, TP53, EGFR, MTOR | 25 | 1.47E-13 | PDGFB, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, HSP90B1, NRAS, PDGFD, ERBB2, PDGFC, MAPK1, IKBKG, HRAS, PDGFRB, HSP90AA1, MAP2K2, NFKB1, NFKBIA, PIK3CA, CDK2, MDM2, KRAS, SOS2, FGFR2 | 21 |
| hsa05231:Choline metabolism in cancer | 9 | 6.18E-07 | PDGFRA, PIK3CA, TSC2, KRAS, PLCG1, PIK3R1, SOS1, EGFR, MTOR | 26 | 5.04E-13 | PDGFB, PIK3R3, PIK3R2, PIK3CB, PIK3R1, HIF1A, NRAS, MAPK8, PDGFD, PDGFC, MAPK1, RAC3, PIP5K1B, PLCG1, PIP5K1C, RAC1, HRAS, PRKCG, PDGFRB, MAP2K2, PLA2G4A, PRKCA, MAPK10, PIK3CA, KRAS, SOS2 | 22 |
| hsa04917:Prolactin signaling pathway | 5 | 0.001806337 | PIK3CA, KRAS, PIK3R1, SOS1, ESR1 | 22 | 8.99E-13 | MAP2K2, SHC1, STAT1, STAT3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, FOXO3, RELA, NFKB1, MAPK12, MAPK10, NRAS, MAPK8, PIK3CA, MAPK1, KRAS, HRAS, SOCS7, SOS2, SOCS5 | 19 |
| hsa05211:Renal cell carcinoma | 5 | 0.001376825 | PIK3CA, EP300, KRAS, PIK3R1, SOS1 | 21 | 1.93E-12 | MAP2K2, PDGFB, GAB1, PIK3R3, PIK3R2, PTPN11, PIK3CB, PIK3R1, HIF1A, RAP1B, PAK1, NRAS, RAP1A, PIK3CA, MAPK1, KRAS, RAC1, HRAS, PAK2, SOS2, PAK4 | 18 |
| hsa04660:T cell receptor signaling pathway | 5 | 0.006227935 | PIK3CA, KRAS, PLCG1, PIK3R1, SOS1 | 25 | 3.10E-12 | PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, PAK1, NRAS, MAPK1, IKBKG, PLCG1, HRAS, PAK2, NCK1, PAK4, MAP2K2, RHOA, MAPK12, NFKB1, IL4, NFKBIA, IFNG, PIK3CA, CDK4, KRAS, SOS2 | 21 |
| hsa05205:Proteoglycans in cancer | 12 | 1.64E-07 | PIK3CA, ERBB4, ERBB2, FN1, KRAS, PLCG1, PIK3R1, SOS1, ESR1, TP53, EGFR, MTOR | 35 | 3.37E-12 | DDX5, SDC2, PIK3R3, PIK3R2, PIK3CB, PIK3R1, HIF1A, HOXD10, SLC9A1, PPP1CB, PPP1CC, PAK1, NRAS, ERBB4, MYC, ERBB2, MAPK1, ITGAV, PLCG1, RAC1, HRAS, PRKCG, MAP2K2, RPS6, STAT3, GAB1, PRKCA, PTPN11, RHOA, MAPK12, PPP1CA, PIK3CA, MDM2, KRAS, SOS2 | 29 |
| hsa05203:Viral carcinogenesis | 8 | 0.000716 | LYN, RB1, PIK3CA, EP300, CHD4, KRAS, PIK3R1, TP53 | 35 | 6.94E-12 | GTF2A1, HDAC5, HDAC2, YWHAB, HDAC1, GTF2B, PIK3R3, CHD4, PIK3R2, PIK3CB, PIK3R1, RBPJ, HDAC8, RELA, NRAS, MAPK1, PMAIP1, IKBKG, RAC1, SKP2, HRAS, RANBP1, TBP, STAT3, RHOA, NFKB1, NFKBIA, IRF3, PIK3CA, CDK4, CDK2, IRF7, MDM2, KRAS, IRF9 | 31 |
| hsa04010:MAPK signaling pathway | 10 | 8.39E-05 | MAP2K4, PDGFRA, MAP3K1, MECOM, NF1, KRAS, SOS1, TP53, EGFR, MAP3K4 | 39 | 8.49E-12 | MAX, PDGFB, FGF3, RELA, RAP1B, FGF6, PAK1, NRAS, MAPK8, RAP1A, MYC, RPS6KA2, RPS6KA1, MAPK1, RAC3, IKBKG, RAC1, HRAS, PAK2, MAP3K5, PRKCG, PDGFRB, HSPA8, MAP3K3, MAP2K2, PLA2G4A, PRKCA, MAPK12, NFKB1, MAPK10, FGF17, IL1A, RASA1, NF1, KRAS, MAPKAPK5, FGF12, SOS2, FGFR2 | 37 |
| hsa04810:Regulation of actin cytoskeleton | 7 | 0.004313819 | PDGFRA, PIK3CA, FN1, KRAS, PIK3R1, SOS1, EGFR | 35 | 1.39E-11 | ITGB2, PDGFB, PIK3R3, PIK3R2, PIK3CB, PIK3R1, FGF3, SLC9A1, PPP1CB, FGF6, PPP1CC, PAK1, NRAS, PDGFD, PDGFC, MAPK1, RAC3, PIP5K1B, ITGAV, PIP5K1C, RAC1, HRAS, PAK2, GIT1, PAK4, PDGFRB, MAP2K2, RHOA, PPP1CA, FGF17, PIK3CA, KRAS, FGF12, SOS2, FGFR2 | 32 |
| hsa05212:Pancreatic cancer | 9 | 1.89E-08 | RB1, SMAD2, PIK3CA, ERBB2, KRAS, PIK3R1, BRCA2, TP53, EGFR | 20 | 1.43E-11 | SMAD2, SMAD4, STAT1, STAT3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, NFKB1, MAPK10, MAPK8, PIK3CA, CDK4, ERBB2, RAC3, MAPK1, KRAS, IKBKG, RAC1 | 15 |
| hsa04664:Fc epsilon RI signaling pathway | 7 | 9.47E-06 | LYN, MAP2K4, PIK3CA, KRAS, PLCG1, PIK3R1, SOS1 | 20 | 3.46E-11 | MAP2K2, PLA2G4A, PIK3R3, PRKCA, PIK3R2, PIK3CB, PIK3R1, MAPK12, MAPK10, IL4, NRAS, MAPK8, PIK3CA, RAC3, MAPK1, KRAS, PLCG1, RAC1, HRAS, SOS2 | 16 |
| hsa04151:PI3K-Akt signaling pathway | 12 | 3.36E-05 | PDGFRA, PIK3CA, MYB, PTEN, FN1, TSC2, KRAS, PIK3R1, SOS1, TP53, EGFR, MTOR | 45 | 4.89E-11 | PRKAA1, FLT1, EPO, YWHAB, PDGFB, PIK3R3, PIK3R2, PIK3CB, PIK3R1, FOXO3, FGF3, RELA, HSP90B1, FGF6, STK11, NRAS, MYC, PDGFD, PDGFC, MAPK1, ITGAV, IKBKG, RAC1, HRAS, PDGFRB, HSP90AA1, MAP2K2, IFNB1, RPS6, PRKCA, PPP2R5C, NFKB1, IL4, FGF17, PIK3CA, IL7, CDK4, CDK2, MDM2, KRAS, PKN2, FGF12, SOS2, FGFR2, IFNAR1 | 42 |
| hsa05160:Hepatitis C | 6 | 0.002885288 | PIK3CA, KRAS, PIK3R1, SOS1, TP53, EGFR | 27 | 5.57E-11 | PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, NRAS, MAPK8, TBK1, MAPK1, IKBKG, HRAS, IFNB1, STAT1, STAT2, STAT3, TICAM1, MAPK12, NFKB1, MAPK10, NFKBIA, IRF3, PIK3CA, IRF7, KRAS, SOS2, IRF9, IFNAR1 | 24 |
| hsa04068:FoxO signaling pathway | 8 | 5.16E-05 | SMAD2, PIK3CA, PTEN, EP300, KRAS, PIK3R1, SOS1, EGFR | 27 | 6.65E-11 | PRKAA1, PRKAG1, PRKAG2, PIK3R3, PIK3R2, PIK3CB, PIK3R1, FOXO3, PRKAG3, STK11, NRAS, MAPK8, MAPK1, SKP2, HRAS, SMAD2, SMAD4, MAP2K2, STAT3, PRKAB1, MAPK12, MAPK10, PIK3CA, CDK2, MDM2, KRAS, SOS2 | 23 |
| hsa05218:Melanoma | 8 | 7.45E-07 | RB1, PDGFRA, PIK3CA, PTEN, KRAS, PIK3R1, TP53, EGFR | 20 | 7.96E-11 | PDGFRB, MAP2K2, PDGFB, PIK3R3, PIK3R2, PIK3CB, PIK3R1, FGF3, FGF17, FGF6, NRAS, PIK3CA, CDK4, PDGFD, PDGFC, MDM2, MAPK1, KRAS, HRAS, FGF12 | 17 |
| hsa05221:Acute myeloid leukemia | 6 | 5.26E-05 | PIK3CA, KRAS, PIK3R1, SOS1, MTOR, RUNX1 | 18 | 8.98E-11 | MAP2K2, JUP, STAT3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, NFKB1, NRAS, PIK3CA, MYC, MAPK1, KRAS, IKBKG, HRAS, SOS2, PPARD | 15 |
| hsa04931:Insulin resistance | 4 | 0.04551158 | PIK3CA, PTEN, PIK3R1, MTOR | 24 | 1.23E-10 | PRKAA1, PRKCD, STAT3, PRKAG1, PIK3R3, PRKAG2, PIK3R2, PTPN11, PIK3CB, PIK3R1, PRKAB1, PRKAG3, RELA, NFKB1, PPP1CA, MAPK10, NFKBIA, PPP1CB, PPP1CC, MAPK8, PIK3CA, RPS6KA2, RPS6KA1, PPARGC1A | 22 |
| hsa05214:Glioma | 11 | 2.61E-11 | RB1, PDGFRA, PIK3CA, PTEN, KRAS, PLCG1, PIK3R1, SOS1, TP53, EGFR, MTOR | 19 | 1.36E-10 | PDGFRB, PRKCG, MAP2K2, SHC1, PDGFB, PIK3R3, PRKCA, PIK3R2, PIK3CB, PIK3R1, NRAS, PIK3CA, CDK4, MDM2, MAPK1, KRAS, PLCG1, HRAS, SOS2 | 15 |
| hsa04650:Natural killer cell mediated cytotoxicity | 5 | 0.012385414 | PIK3CA, KRAS, PLCG1, PIK3R1, SOS1 | 25 | 2.76E-10 | SHC1, ITGB2, PIK3R3, PIK3R2, PIK3CB, PIK3R1, PAK1, NRAS, KLRK1, MAPK1, RAC3, PLCG1, RAC1, HRAS, PRKCG, MAP2K2, IFNB1, TNFRSF10B, PRKCA, PTPN11, IFNG, PIK3CA, KRAS, SOS2, IFNAR1 | 21 |
| hsa04915:Estrogen signaling pathway | 6 | 0.000776 | PIK3CA, KRAS, PIK3R1, SOS1, ESR1, EGFR | 22 | 8.78E-10 | HSPA8, HSP90AA1, MAP2K2, SHC1, PRKCD, GNAI3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, GNAI1, HSP90B1, PLCB3, NRAS, PIK3CA, GNAS, MAPK1, KRAS, PLCB1, HRAS, PLCB2, SOS2 | 19 |
| hsa05223:Non-small cell lung cancer | 9 | 5.59E-09 | RB1, PIK3CA, ERBB2, KRAS, PLCG1, PIK3R1, SOS1, TP53, EGFR | 17 | 8.94E-10 | PRKCG, MAP2K2, PIK3R3, PRKCA, PIK3R2, PIK3CB, PIK3R1, FOXO3, NRAS, PIK3CA, CDK4, ERBB2, MAPK1, KRAS, PLCG1, HRAS, SOS2 | 12 |
| hsa04062:Chemokine signaling pathway | 5 | 0.048276644 | LYN, PIK3CA, KRAS, PIK3R1, SOS1 | 30 | 1.23E-09 | SHC1, GNAI3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, FOXO3, GNAI1, RELA, RAP1B, PAK1, NRAS, RAP1A, MAPK1, IKBKG, RAC1, HRAS, STAT1, STAT2, PRKCD, STAT3, RHOA, NFKB1, NFKBIA, PLCB3, PIK3CA, KRAS, PLCB1, PLCB2, SOS2 | 27 |
| hsa04630:Jak-STAT signaling pathway | 4 | 0.091949961 | PIK3CA, EP300, PIK3R1, SOS1 | 26 | 2.15E-09 | EPO, IL24, PIK3R3, PIK3R2, PIK3CB, PIK3R1, MYC, IL12RB1, SOCS7, SOCS5, PIAS4, PIAS3, IFNB1, STAT1, STAT2, STAT3, LIF, PTPN11, PIAS2, IL4, IFNG, PIK3CA, IL7, SOS2, IRF9, IFNAR1 | 24 |
| hsa04066:HIF-1 signaling pathway | 7 | 6.85E-05 | PIK3CA, ERBB2, EP300, PLCG1, PIK3R1, EGFR, MTOR | 21 | 3.14E-09 | PRKCG, MAP2K2, FLT1, TFRC, EPO, RPS6, STAT3, PIK3R3, PRKCA, PIK3R2, PIK3CB, PIK3R1, HIF1A, RELA, NFKB1, IFNG, PIK3CA, ERBB2, HMOX1, MAPK1, PLCG1 | 17 |
| hsa04510:Focal adhesion | 8 | 0.000737 | PDGFRA, PIK3CA, ERBB2, PTEN, FN1, PIK3R1, SOS1, EGFR | 31 | 3.34E-09 | FLT1, SHC1, PDGFB, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RAP1B, PPP1CB, PPP1CC, PAK1, MAPK8, RAP1A, PDGFD, ERBB2, PDGFC, MAPK1, RAC3, ITGAV, RAC1, HRAS, PAK2, PAK4, PRKCG, PDGFRB, PRKCA, RHOA, PPP1CA, MAPK10, PIK3CA, SOS2 | 28 |
| hsa04370:VEGF signaling pathway | 4 | 0.010214892 | PIK3CA, KRAS, PLCG1, PIK3R1 | 17 | 3.57E-09 | PRKCG, MAP2K2, PLA2G4A, PIK3R3, PRKCA, PIK3R2, PIK3CB, PIK3R1, MAPK12, NRAS, PIK3CA, RAC3, MAPK1, KRAS, PLCG1, RAC1, HRAS | 13 |
| hsa04150:mTOR signaling pathway | 5 | 0.000847 | PIK3CA, PTEN, TSC2, PIK3R1, MTOR | 16 | 1.38E-08 | PRKCG, PRKAA1, RPS6, PIK3R3, PRKCA, PIK3R2, PIK3CB, PIK3R1, STK11, PIK3CA, RRAGB, RPS6KA2, RRAGD, RPS6KA1, MAPK1, RICTOR | 14 |
| hsa04910:Insulin signaling pathway | 7 | 0.000501 | PIK3CA, PRKAR1A, TSC2, KRAS, PIK3R1, SOS1, MTOR | 24 | 1.90E-08 | PRKAA1, MAP2K2, SHC1, RPS6, PRKAG1, PIK3R3, PRKAG2, PIK3R2, PIK3CB, PIK3R1, PRKAB1, PRKAG3, PPP1CA, MAPK10, PPP1CB, PPP1CC, NRAS, MAPK8, PIK3CA, MAPK1, KRAS, HRAS, PPARGC1A, SOS2 | 21 |
| hsa04662:B cell receptor signaling pathway | 5 | 0.001624751 | LYN, PIK3CA, KRAS, PIK3R1, SOS1 | 17 | 2.46E-08 | MAP2K2, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, NFKB1, NFKBIA, NRAS, PIK3CA, RAC3, MAPK1, KRAS, IKBKG, RAC1, HRAS, SOS2 | 14 |
| hsa04540:Gap junction | 4 | 0.027099953 | PDGFRA, KRAS, SOS1, EGFR | 19 | 2.67E-08 | PDGFRB, PRKCG, MAP2K2, PDGFB, GNAI3, PRKCA, GNAI1, PLCB3, NRAS, GNA11, PDGFD, PDGFC, GNAS, MAPK1, KRAS, PLCB1, HRAS, PLCB2, SOS2 | 18 |
| hsa05210:Colorectal cancer | 5 | 0.001089142 | SMAD2, PIK3CA, KRAS, PIK3R1, TP53 | 16 | 3.68E-08 | SMAD2, SMAD4, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RHOA, MAPK10, MSH6, MAPK8, PIK3CA, MYC, RAC3, MAPK1, KRAS, RAC1 | 12 |
| hsa05213:Endometrial cancer | 8 | 8.34E-08 | PIK3CA, ERBB2, PTEN, KRAS, PIK3R1, SOS1, TP53, EGFR | 14 | 2.02E-07 | MAP2K2, PIK3R3, PIK3R2, PIK3CB, PIK3R1, FOXO3, NRAS, PIK3CA, MYC, ERBB2, MAPK1, KRAS, HRAS, SOS2 | 10 |
| hsa04912:GnRH signaling pathway | 6 | 0.000527 | MAP2K4, MAP3K1, KRAS, SOS1, EGFR, MAP3K4 | 18 | 2.65E-07 | MAP3K3, MAP2K2, PRKCD, PLA2G4A, PRKCA, MAPK12, MAPK10, PLCB3, NRAS, MAPK8, GNA11, GNAS, MAPK1, KRAS, PLCB1, HRAS, PLCB2, SOS2 | 17 |
| hsa05230:Central carbon metabolism in cancer | 9 | 1.66E-08 | PDGFRA, PIK3CA, ERBB2, PTEN, KRAS, PIK3R1, TP53, EGFR, MTOR | 15 | 4.08E-07 | PDGFRB, MAP2K2, PIK3R3, PIK3R2, PIK3CB, PIK3R1, HIF1A, NRAS, PIK3CA, MYC, ERBB2, MAPK1, KRAS, HRAS, FGFR2 | 11 |
| hsa04550:Signaling pathways regulating pluripotency of stem cells | 5 | 0.019617109 | SMAD2, PIK3CA, RIF1, KRAS, PIK3R1 | 22 | 5.10E-07 | SMAD2, SMAD1, SMAD4, MAP2K2, STAT3, LIF, PIK3R3, PIK3R2, PAX6, PIK3CB, PIK3R1, MAPK12, SOX2, NRAS, PIK3CA, MYC, ID2, ID1, MAPK1, KRAS, HRAS, FGFR2 | 18 |
| hsa04110:Cell cycle | 9 | 2.96E-06 | RB1, SMAD2, MCM7, CHEK2, RAD21, EP300, SMC1A, TP53, ATR | 20 | 1.30E-06 | SMAD2, SMAD4, HDAC2, YWHAB, PRKDC, HDAC1, CDC6, MAD2L2, STAG1, TFDP1, TFDP2, CDK4, MYC, CDK2, MDM2, MCM3, MCM5, E2F4, SKP2, MCM2 | 19 |
| hsa05222:Small cell lung cancer | 6 | 0.000385 | RB1, PIK3CA, PTEN, FN1, PIK3R1, TP53 | 15 | 1.42E-05 | MAX, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, NFKB1, NFKBIA, PIK3CA, CDK4, MYC, CDK2, ITGAV, IKBKG, SKP2 | 13 |
| hsa04960:Aldosterone-regulated sodium reabsorption | 3 | 0.033538735 | PIK3CA, KRAS, PIK3R1 | 10 | 3.20E-05 | PRKCG, PIK3CA, PIK3R3, MAPK1, NEDD4L, PIK3R2, KRAS, PRKCA, PIK3CB, PIK3R1 | 7 |
| hsa05166:HTLV-I infection | 13 | 2.18E-07 | RB1, SMAD2, PDGFRA, MAP2K4, MAP3K1, PIK3R1, PIK3CA, CHEK2, MYB, EP300, KRAS, TP53, ATR | 27 | 3.46E-05 | ITGB2, PDGFB, PIK3R3, PIK3R2, PIK3CB, PIK3R1, ETS2, RELA, NRAS, TERT, MYC, IKBKG, HRAS, PDGFRB, SMAD2, RANBP1, MAP3K3, SMAD4, TBP, NFYB, NFKB1, NFATC4, NFKBIA, PIK3CA, CDK4, KRAS, RAN | 23 |
| hsa04666:Fc gamma R-mediated phagocytosis | 4 | 0.024019447 | LYN, PIK3CA, PLCG1, PIK3R1 | 14 | 5.69E-05 | PRKCG, PRKCD, PIK3R3, PRKCA, PIK3R2, PIK3CB, PIK3R1, PAK1, PIK3CA, MAPK1, PIP5K1B, PIP5K1C, PLCG1, RAC1 | 11 |
| hsa04070:Phosphatidylinositol signaling system | 4 | 0.035684041 | PIK3CA, PTEN, PLCG1, PIK3R1 | 15 | 7.35E-05 | PRKCG, PIK3R3, PRKCA, PIK3R2, OCRL, PIK3CB, PIK3R1, PLCB3, PIK3CA, PIK3C3, PIP5K1B, PIP5K1C, PLCG1, PLCB1, PLCB2 | 12 |
| hsa05120:Epithelial cell signaling in Helicobacter pylori infection | 4 | 0.013181464 | LYN, MAP2K4, PLCG1, EGFR | 12 | 0.000123 | MAPK10, NFKBIA, PAK1, MAPK8, PTPN11, IKBKG, PLCG1, RAC1, RELA, GIT1, NFKB1, MAPK12 | 11 |
| hsa05219:Bladder cancer | 5 | 0.000222 | RB1, ERBB2, KRAS, TP53, EGFR | 9 | 0.000309 | NRAS, MAP2K2, CDK4, MYC, ERBB2, MDM2, MAPK1, KRAS, HRAS | 7 |
| hsa04152:AMPK signaling pathway | 4 | 0.062501762 | PIK3CA, TSC2, PIK3R1, MTOR | 15 | 0.00082 | PRKAA1, PRKAG1, PIK3R3, PRKAG2, PIK3R2, PIK3CB, PIK3R1, PPP2R5C, FOXO3, PRKAB1, PRKAG3, STK11, PIK3CA, HNF4A, PPARGC1A | 13 |
| hsa04930:Type II diabetes mellitus | 3 | 0.048956774 | PIK3CA, PIK3R1, MTOR | 9 | 0.000937 | MAPK10, MAPK8, PIK3CA, PRKCD, PIK3R3, MAPK1, PIK3R2, PIK3CB, PIK3R1 | 7 |
| hsa04210:Apoptosis | 3 | 0.076916832 | PIK3CA, PIK3R1, TP53 | 10 | 0.001275662 | NFKBIA, PIK3CA, PIK3R3, TNFRSF10B, PIK3R2, IKBKG, PIK3CB, PIK3R1, RELA, NFKB1 | 8 |
| hsa00562:Inositol phosphate metabolism | 3 | 0.096974914 | PIK3CA, PTEN, PLCG1 | 10 | 0.003332164 | PLCB3, PIK3CA, OCRL, PIK3C3, PIP5K1B, PIP5K1C, PLCG1, PIK3CB, PLCB1, PLCB2 | 8 |
| hsa04520:Adherens junction | 4 | 0.015405296 | SMAD2, ERBB2, EP300, EGFR | 9 | 0.011197328 | SMAD2, SMAD4, CSNK2A1, ERBB2, RAC3, MAPK1, SNAI2, RAC1, RHOA | 7 |
| hsa05206:MicroRNAs in cancer | 12 | 5.71E-06 | PDGFRA, NOTCH1, ERBB2, DNMT3A, PTEN, EP300, KRAS, PLCG1, SOS1, TP53, EGFR, MTOR | 21 | 0.022746451 | PDGFRB, PRKCG, MAP2K2, SHC1, STAT3, PDGFB, PRKCA, HOXD10, RHOA, NFKB1, NRAS, MYC, ERBB2, MDM2, DNMT3B, HMOX1, KRAS, PLCG1, HRAS, SOS2, PAK4 | 18 |
| hsa04115:p53 signaling pathway | 5 | 0.001456294 | CHEK2, PTEN, TSC2, TP53, ATR | 7 | 0.069058698 | CDK4, IGFBP3, CDK2, MDM2, PMAIP1, PPM1D, TP73 | 7 |

**Table 3. The pathway intersection of driver genes and downstream genes in breast cancer of LumA subtype**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Term | drivers\_count | driver\_pvalue | drivers | Out\_count | Out\_pvalue | Outs | Outs\_drivers\_count |
| hsa04151:PI3K-Akt signaling pathway | 16 | 4.09E-06 | PDGFRA, CDKN1B, PTEN, FN1, PIK3R1, EGFR, MTOR, CREB1, PIK3CA, CCND1, MYB, AKT1, KRAS, SOS1, TP53, TLR4 | 157 | 3.16E-57 | CRTC2, EPO, IRS1, PPP2R2A, FGF2, IGF1R, FGF5, FGF6, CCND3, STK11, CCND2, FGF8, CCND1, FGF9, CREB3L3, CREB3L4, PPP2R1A, MYC, AKT2, CREB3L2, KDR, PDGFRB, PDGFRA, MAP2K1, MAP2K2, IL4R, HGF, TSC1, PRLR, PGF, COL4A1, COL4A4, CDC37, COL4A3, COL4A6, COL4A5, RAF1, TP53, IFNAR1, EPHA2, PDGFA, PIK3R3, PIK3R2, FOXO3, HSP90B1, PIK3R5, CD19, PDGFD, FGF20, EIF4EBP1, FGF23, FGF22, MCL1, INSR, FN1, PTK2, NFKB1, IL2, FGF17, GH2, EFNA1, IL4, NR4A1, IL3, IL6, FGF14, CDK6, COL1A2, COL5A1, RHEB, IL7, COL5A3, FGF19, COL5A2, FGF18, GNB1, CDK2, BCL2, MDM2, GRB2, FGF13, FGFR4, IL7R, FGF12, FGFR3, FGF11, FGFR2, FGF10, FGFR1, ITGB1, GSK3B, CDKN1A, CDKN1B, FLT1, HSP90AB1, ITGB4, ITGB3, PTEN, PIK3CD, FASLG, LAMC1, PIK3CB, PIK3CG, CASP9, IKBKB, PPP2R5E, IKBKG, RAC1, JAK2, JAK3, HRAS, JAK1, HSP90AA1, ITGA4, SYK, PDPK1, PPP2R5B, PPP2R5A, PPP2R5D, PPP2R5C, RBL2, CREB3, COL2A1, CREB1, PIK3CA, COL6A2, COL6A1, KIT, COL6A3, ITGA6, SOS1, SOS2, TLR2, LAMA5, PRKAA1, PRKAA2, COL11A1, IL2RG, THBS1, RELA, INS, PPP2CA, PPP2CB, NRAS, GNG2, RXRA, EIF4E, MAPK3, IFNB1, NOS3, OSM, COL3A1, KITLG, IL2RA, IL2RB, KRAS, PKN2 | 147 |
| hsa05200:Pathways in cancer | 24 | 1.40E-11 | RB1, SMAD2, PDGFRA, CDKN1B, STAT3, PTEN, FN1, PIK3R1, EGFR, MTOR, RUNX1, MECOM, PIK3CA, CCND1, CDH1, TPR, ERBB2, AKT1, EP300, CTNNB1, KRAS, PLCG1, SOS1, TP53 | 151 | 1.38E-43 | SPI1, ETS1, FGF2, IGF1R, FGF5, FGF6, EDNRA, FGF8, CCND1, FGF9, CDH1, MYC, PRKACG, AKT2, PRKACA, PRKACB, PDGFRB, PRKCG, PDGFRA, MAP2K1, MAP2K2, HGF, PGF, RUNX1, MSH2, COL4A1, COL4A4, COL4A3, COL4A6, COL4A5, RAF1, TP53, MAX, CTBP1, EPAS1, PDGFA, PIK3R3, KLK3, PIK3R2, HIF1A, RASGRP1, FOXO1, HSP90B1, RASGRP3, PIK3R5, DVL1, DVL2, FGF20, DVL3, FADD, PLCG1, FGF23, FGF22, SMAD2, FZD3, CREBBP, JUN, SMAD3, JUP, FZD5, FN1, PTK2, NFKB1, NFKB2, FGF17, NFKBIA, IL6, FGF14, CDK6, FGF19, FGF18, GNB1, CDK2, BCL2, MDM2, GNAS, GRB2, FGF13, FGF12, FGFR3, FGF11, FGFR2, FGF10, FGFR1, ITGB1, GSK3B, CDKN1A, CDKN1B, HSP90AB1, PTEN, PIK3CD, FASLG, LAMC1, PIK3CB, GLI1, PIK3CG, GLI3, CKS1B, GLI2, CASP9, IKBKB, RAC2, IKBKG, RAC1, HRAS, JAK1, APPL1, HSP90AA1, MMP2, ARNT, FOS, PLCB3, PLCB4, PIK3CA, KIT, RARA, BIRC5, ITGA6, PPARG, PLCB1, SOS1, PLCB2, SOS2, BIRC3, CEBPA, LAMA5, HDAC2, HDAC1, LEF1, GNAI3, CXCR4, RELA, GNAI2, GNA13, CDC42, NRAS, MAPK8, GNG2, RXRA, GNA11, ERBB2, E2F3, CTNNA3, CTNNA2, MAPK3, NTRK1, STAT1, PML, MAPK10, KITLG, KRAS | 137 |
| hsa04014:Ras signaling pathway | 9 | 0.003300741 | PDGFRA, PIK3CA, NF1, AKT1, KRAS, PLCG1, PIK3R1, SOS1, EGFR | 97 | 4.15E-32 | ETS1, FGF2, ELK1, ETS2, IGF1R, FGF5, FGF6, TBK1, FGF8, FGF9, PRKACG, AKT2, KDR, PLCE1, PRKACA, PRKACB, PDGFRB, PRKCG, PDGFRA, MAP2K1, MAP2K2, HGF, PGF, RAF1, EPHA2, SHC4, SHC1, PDGFA, PIK3R3, PIK3R2, FOXO4, RASAL2, RASGRP1, RASGRP3, PIK3R5, RAP1B, RAP1A, RRAS, PDGFD, FGF20, PLCG1, FGF23, FGF22, INSR, NFKB1, FGF17, EFNA1, FGF14, FGF19, FGF18, GNB1, NF1, CALM3, GRB2, FGF13, FGFR4, FGF12, FGFR3, LAT, FGF11, FGFR2, FGF10, FGFR1, FLT1, PIK3CD, FASLG, PIK3CB, PIK3CG, IKBKB, RAC2, IKBKG, RAC1, HRAS, RRAS2, GAB2, PIK3CA, RASA1, KIT, SOS1, SOS2, RELA, INS, CDC42, NRAS, PAK1, MAPK8, GNG2, PAK6, PAK3, PAK2, PAK4, MAPK3, PTPN11, GRIN1, MAPK10, KITLG, KRAS | 91 |
| hsa04660:T cell receptor signaling pathway | 6 | 0.004799768 | PIK3CA, AKT1, KRAS, PLCG1, PIK3R1, SOS1 | 62 | 8.70E-32 | GSK3B, ITK, PIK3CD, CD3G, PIK3CB, CD3D, PIK3CG, IKBKB, GRAP2, AKT2, NCK2, IKBKG, HRAS, MAP2K1, MAP2K2, PDPK1, FOS, IFNG, PIK3CA, LCK, PRKCQ, LCP2, RAF1, SOS1, SOS2, PIK3R3, PIK3R2, BCL10, RASGRP1, RELA, PIK3R5, CDC42, NRAS, PAK1, PAK6, FYN, PLCG1, PAK3, MAP2K7, PAK2, PAK4, MAPK3, JUN, NFATC2, NFATC1, MAPK14, MAPK12, NFKB1, IL2, MAPK13, NFKBIA, IL4, MAPK11, CD4, DLG1, PTPRC, CD40LG, IL5, KRAS, PTPN6, GRB2, LAT | 58 |
| hsa04015:Rap1 signaling pathway | 10 | 0.000469 | PDGFRA, PIK3CA, CDH1, CTNNB1, AKT1, KRAS, PLCG1, PIK3R1, EGFR, ACTG1 | 91 | 1.78E-30 | ITGB1, FLT1, ITGAM, ITGB3, CTNND1, ITGB2, PIK3CD, PIK3CB, ITGAL, FGF2, PIK3CG, IGF1R, FGF5, FGF6, FGF8, FGF9, CDH1, AKT2, KDR, RAC2, PLCE1, RAC1, HRAS, PDGFRB, PRKCG, PDGFRA, PRKCI, MAP2K1, MAP2K2, HGF, MAGI3, MAGI2, PGF, PLCB3, PLCB4, PIK3CA, KIT, PRKD2, LCP2, RAF1, PLCB1, PLCB2, EPHA2, SRC, GNAI3, PDGFA, PIK3R3, PIK3R2, THBS1, INS, RASGRP3, GNAI2, PIK3R5, RAP1B, CDC42, NRAS, RAP1A, PARD6A, RRAS, PDGFD, FGF20, PLCG1, FGF23, FGF22, MAPK3, INSR, MAPK14, MAPK12, GRIN1, MAPK13, EFNA1, GNAO1, FGF17, MAPK11, KITLG, FGF14, FGF19, ID1, FGF18, GNAS, KRAS, CALM3, FGF13, FGFR4, FGF12, FGFR3, LAT, FGF11, FGFR2, FGF10, FGFR1 | 86 |
| hsa04919:Thyroid hormone signaling pathway | 17 | 6.03E-14 | NOTCH1, NCOA3, PIK3R1, ESR1, MTOR, ACTG1, MED12, NCOR1, MED13, PIK3CA, CCND1, AKT1, EP300, CTNNB1, KRAS, PLCG1, TP53 | 65 | 4.91E-30 | GSK3B, ITGB3, PIK3CD, PIK3CB, MED16, PIK3CG, MED17, CASP9, MED12, MED14, MED13, PLCZ1, CCND1, MYC, PRKACG, AKT2, PLCE1, PRKACA, PRKACB, HRAS, NCOA1, PRKCG, NCOA2, MED1, MAP2K1, MAP2K2, PDPK1, NCOA3, MED4, MED27, PLCB3, MED24, NCOR1, PLCB4, PIK3CA, RAF1, PLCB1, PLCB2, TP53, NOTCH2, NOTCH3, HDAC2, SRC, HDAC1, NOTCH4, PIK3R3, PIK3R2, GATA4, HIF1A, FOXO1, SLC9A1, PIK3R5, NRAS, RXRA, MED30, PLCG1, MAPK3, CREBBP, STAT1, MED13L, RHEB, MDM2, KRAS, PLCD3, PLCD1 | 56 |
| hsa05215:Prostate cancer | 17 | 7.03E-16 | RB1, PDGFRA, CDKN1B, PTEN, PIK3R1, EGFR, MTOR, CREB1, PIK3CA, CCND1, ERBB2, AKT1, EP300, CTNNB1, KRAS, SOS1, TP53 | 56 | 1.57E-29 | GSK3B, CDKN1A, CDKN1B, HSP90AB1, PTEN, PIK3CD, PIK3CB, PIK3CG, IGF1R, CASP9, IKBKB, CCND1, CREB3L3, CREB3L4, AKT2, CREB3L2, IKBKG, HRAS, PDGFRB, PDGFRA, MAP2K1, HSP90AA1, MAP2K2, PDPK1, CREB3, CREB1, PIK3CA, RAF1, SOS1, TP53, SOS2, LEF1, PDGFA, PIK3R3, PIK3R2, KLK3, FOXO1, RELA, HSP90B1, INS, PIK3R5, NRAS, PDGFD, ERBB2, E2F3, MAPK3, CREBBP, NFKB1, NFKBIA, CDK2, BCL2, MDM2, KRAS, GRB2, FGFR2, FGFR1 | 46 |
| hsa04010:MAPK signaling pathway | 12 | 9.21E-05 | MAP2K4, PDGFRA, MAP3K1, MECOM, NF1, FLNA, AKT1, KRAS, SOS1, TP53, EGFR, MAP3K4 | 97 | 1.78E-27 | FGF2, ELK1, FGF5, RPS6KA3, FGF6, RPS6KA6, FGF8, FGF9, MYC, PRKACG, AKT2, RPS6KA1, PRKACA, PRKACB, MAP3K5, PDGFRB, PRKCG, MAP2K4, PDGFRA, DAXX, MEF2C, MAP2K1, MAP2K2, MAPKAPK2, MAPKAPK5, RAF1, TP53, MAX, PDGFA, RASGRP1, RASGRP3, RAP1B, RAP1A, RRAS, FGF20, MAP2K7, FGF23, FGF22, MAP2K5, JUN, JUND, GADD45B, GADD45A, NFATC1, NFKB1, NFKB2, FGF17, NR4A1, PPP5C, FGF14, FGF19, FGF18, NF1, GRB2, FGF13, FGFR4, FGF12, FGFR3, FGF11, FGFR2, FGF10, FGFR1, FASLG, ARRB1, IKBKB, RAC2, IKBKG, RAC1, HRAS, MAP4K1, RRAS2, FOS, RASA1, IL1B, SOS1, SOS2, RELA, CDC42, NRAS, PAK1, MAPK8, NTF3, FLNA, FLNB, FLNC, PAK2, MAPK3, NTRK1, NTRK2, MAP3K3, MAP3K1, MAPK14, MAPK12, MAPK13, MAPK10, MAPK11, KRAS | 89 |
| hsa04510:Focal adhesion | 13 | 2.17E-06 | PDGFRA, PTEN, FN1, PIK3R1, EGFR, ACTG1, PIK3CA, CCND1, ERBB2, FLNA, AKT1, CTNNB1, SOS1 | 86 | 2.18E-27 | ITGB1, GSK3B, FLT1, ITGB4, ITGB3, PTEN, PIK3CD, PIK3CB, LAMC1, ELK1, PIK3CG, IGF1R, CCND3, CCND2, CCND1, AKT2, KDR, RAC2, RAC1, HRAS, PDGFRB, PRKCG, PDGFRA, MAP2K1, ACTN3, ITGA4, PDPK1, ACTN2, HGF, ACTN1, ACTN4, PGF, COL2A1, PIK3CA, COL4A1, COL4A4, COL6A2, COL4A3, COL6A1, COL4A6, COL4A5, COL6A3, ITGA6, RAF1, SOS1, SOS2, BIRC3, SHC4, LAMA5, SRC, SHC1, COL11A1, PDGFA, PIK3R3, PIK3R2, THBS1, PIK3R5, RAP1B, CDC42, PAK1, MAPK8, RAP1A, PDGFD, ERBB2, FLNA, PAK6, FLNB, FYN, FLNC, PAK3, PAK2, PAK4, MAPK3, JUN, FN1, PTK2, PPP1CA, MAPK10, DIAPH1, COL3A1, COL1A2, COL5A1, COL5A3, COL5A2, BCL2, GRB2 | 78 |
| hsa05169:Epstein-Barr virus infection | 9 | 5.35E-05 | LYN, RB1, MAP2K4, CDKN1B, PIK3CA, STAT3, AKT1, PIK3R1, TP53 | 64 | 4.03E-27 | CDKN1A, CD40, CDKN1B, PIK3CD, PIK3CB, RBPJ, ITGAL, PIK3CG, ICAM1, PSMD8, IKBKB, PSMD6, TBK1, PSMD4, MYC, PSMD2, AKT2, PSMD3, IKBKG, JAK3, JAK1, HLA-DPA1, MAP2K4, SYK, HLA-E, NCOR2, PIK3CA, IRF3, TP53, HLA-DQB1, RBPJL, HDAC2, PSMD14, PSMD13, HDAC1, PIK3R3, PIK3R2, RELA, PIK3R5, MAPK8, IRAK1, CD19, RIPK1, MAP2K7, HLA-DQA2, JUN, HLA-DRB5, MAPK14, MAPK12, NFKB1, NFKB2, MAPK13, NFKBIA, MAPK10, MAPK11, PSMC5, SNW1, PSMC6, PSMC3, PSMC4, CDK2, BCL2, MDM2, HLA-DRA | 60 |
| hsa04722:Neurotrophin signaling pathway | 9 | 4.75E-05 | MAP3K1, PIK3CA, AKT1, KRAS, PLCG1, PSEN1, PIK3R1, SOS1, TP53 | 63 | 1.01E-26 | GSK3B, IRS1, PIK3CD, FASLG, PIK3CB, PIK3CG, IKBKB, RPS6KA3, RPS6KA6, AKT2, RPS6KA1, RAC1, HRAS, MAP3K5, MAP2K1, MAP2K2, PDPK1, PRKCD, FRS2, IRAK4, PIK3CA, MAPKAPK2, RAF1, SOS1, TP53, SOS2, SHC4, ZNF274, SHC1, PIK3R3, PIK3R2, FOXO3, RELA, PIK3R5, RAP1B, CDC42, NRAS, MAPK8, RAP1A, IRAK1, NTF3, PLCG1, MAP2K7, MAP2K5, MAPK3, NTRK1, NTRK2, MAP3K3, JUN, MAP3K1, PTPN11, MAPK14, MAPK12, NFKB1, MAPK13, NFKBIA, MAPK10, MAPK11, BCL2, KRAS, CALM3, GRB2, TP73 | 57 |
| hsa05161:Hepatitis B | 15 | 4.08E-10 | RB1, MAP2K4, CDKN1B, MAP3K1, STAT3, PTEN, PIK3R1, CREB1, PIK3CA, CCND1, AKT1, EP300, KRAS, TP53, TLR4 | 69 | 5.34E-26 | CDKN1A, CDKN1B, DDX3X, PTEN, PIK3CD, FASLG, PIK3CB, ELK1, PIK3CG, CASP9, IKBKB, TBK1, CCND1, CREB3L3, CASP10, CREB3L4, MYC, AKT2, CREB3L2, IKBKG, HRAS, JAK1, PRKCG, MAP2K4, MAP2K1, MAP2K2, FOS, TICAM1, TIRAP, CREB3, CREB1, PIK3CA, IRF3, IRF7, BIRC5, RAF1, TP53, TLR2, IFNAR1, SRC, PIK3R3, PIK3R2, RELA, PIK3R5, NRAS, MAPK8, PTK2B, E2F3, FADD, MAPK3, JUN, CREBBP, MAP3K1, IFNB1, STAT1, STAT2, NFATC2, NFATC1, NFKB1, NFATC4, NFKBIA, MAPK10, IL6, CDK6, CDK2, BCL2, KRAS, GRB2, MYD88 | 60 |
| hsa05218:Melanoma | 11 | 3.97E-09 | RB1, PDGFRA, CCND1, PIK3CA, CDH1, PTEN, AKT1, KRAS, PIK3R1, TP53, EGFR | 46 | 1.01E-24 | CDKN1A, PTEN, PDGFA, PIK3CD, PIK3R3, PIK3R2, PIK3CB, FGF2, PIK3CG, IGF1R, PIK3R5, FGF5, FGF6, NRAS, FGF8, FGF9, CCND1, CDH1, AKT2, PDGFD, FGF20, E2F3, HRAS, FGF23, FGF22, MAPK3, PDGFRB, PDGFRA, MAP2K1, MAP2K2, HGF, FGF17, FGF14, CDK6, PIK3CA, FGF19, FGF18, MDM2, KRAS, RAF1, FGF13, FGF12, TP53, FGF11, FGF10, FGFR1 | 39 |
| hsa04810:Regulation of actin cytoskeleton | 8 | 0.008214388 | PDGFRA, PIK3CA, FN1, KRAS, PIK3R1, SOS1, EGFR, ACTG1 | 83 | 1.61E-24 | ITGB1, ITGAM, ITGB4, ITGB3, ARPC1A, ITGB2, PIK3CD, PIK3CB, ITGAL, FGF2, PIK3CG, FGF5, FGF6, FGF8, FGF9, CFL1, RAC2, PIP4K2A, PIP4K2B, PIP4K2C, RAC1, HRAS, GIT1, PDGFRB, PDGFRA, MAP2K1, MAP2K2, ACTN3, ITGA4, ACTN2, ACTN1, RRAS2, ACTN4, PIK3CA, ITGA6, RAF1, SOS1, SOS2, SRC, PDGFA, PIK3R3, PIK3R2, IQGAP1, SLC9A1, INS, PIK3R5, GNA13, CDC42, NRAS, PAK1, RRAS, PDGFD, FGF20, PAK6, PIP5K1C, PAK3, FGF23, PAK2, FGF22, PAK4, MAPK3, GSN, FN1, ARPC4, BAIAP2, PTK2, PPP1CA, FGF17, DIAPH1, DIAPH2, FGF14, ARPC3, FGF19, FGF18, KRAS, FGF13, FGFR4, FGF12, FGFR3, FGF11, FGFR2, FGF10, FGFR1 | 78 |
| hsa04068:FoxO signaling pathway | 12 | 1.98E-07 | SMAD2, CDKN1B, CCND1, PIK3CA, STAT3, PTEN, EP300, AKT1, KRAS, PIK3R1, SOS1, EGFR | 63 | 2.15E-23 | CDKN1A, CDKN1B, IRS1, IRS4, PRKAG1, PTEN, PIK3CD, IRS2, FASLG, PIK3CB, PRKAG3, PIK3CG, IGF1R, IKBKB, STK11, CCND2, CCND1, AKT2, HRAS, PRKAB2, MAP2K1, MAP2K2, PDPK1, PRMT1, PRKAB1, SIRT1, RBL2, PIK3CA, RAF1, SOS1, SOS2, PRKAA1, PRKAA2, PIK3R3, PIK3R2, FOXO4, FOXO3, FOXO1, INS, PIK3R5, NRAS, MAPK8, CCNB1, MAPK3, SMAD2, PLK3, CREBBP, SMAD3, GADD45B, GADD45A, INSR, MAPK14, MAPK12, KLF2, MAPK13, MAPK10, MAPK11, IL6, CDK2, MDM2, KRAS, GRB2, IL7R | 56 |
| hsa05166:HTLV-I infection | 16 | 8.08E-08 | RB1, SMAD2, PDGFRA, MAP2K4, MAP3K1, PIK3R1, CREB1, PIK3CA, CCND1, MYB, AKT1, EP300, CTNNB1, KRAS, POLE, TP53 | 91 | 2.56E-23 | GSK3B, CDKN1A, CD40, CRTC2, CRTC3, SPI1, CRTC1, ITGB2, PIK3CD, CD3G, PIK3CB, ITGAL, CD3D, ETS1, ELK1, PIK3CG, ETS2, ICAM1, POLB, IKBKB, CCND3, ZFP36, CCND2, CCND1, MYC, PRKACG, AKT2, IKBKG, PRKACA, JAK3, PRKACB, HRAS, JAK1, HLA-DPA1, PDGFRB, MAP2K4, PDGFRA, TBP, RRAS2, FOS, HLA-E, CREB1, PIK3CA, LCK, TP53, HLA-DQB1, CREM, PDGFA, PIK3R3, GPS2, PIK3R2, IL2RG, RELA, PIK3R5, NRAS, RRAS, TERT, POLD1, POLD2, DVL1, DVL2, DVL3, E2F3, HLA-DQA2, SMAD2, EGR1, MAP3K3, JUN, FZD3, HLA-DRB5, CREBBP, CDKN2C, MAP3K1, SMAD3, FZD5, NFYB, NFATC2, NFATC1, NFKB1, IL2, NFATC4, NFKB2, NFKBIA, FOSL1, DLG1, IL6, IL2RA, IL2RB, HLA-DRA, KRAS, RAN | 82 |
| hsa05142:Chagas disease (American trypanosomiasis) | 6 | 0.005666468 | SMAD2, MAP2K4, PIK3CA, AKT1, PIK3R1, TLR4 | 54 | 1.26E-22 | SERPINE1, PIK3CD, PPP2R2A, CD3G, FASLG, PIK3CB, CD3D, PIK3CG, IKBKB, PPP2R1A, AKT2, IKBKG, MAP2K4, FOS, IRAK4, TICAM1, PLCB3, PLCB4, IFNG, PIK3CA, IL1B, PLCB1, PLCB2, TLR2, GNAI3, PIK3R3, PIK3R2, RELA, GNAI2, PIK3R5, PPP2CA, PPP2CB, GNA15, MAPK8, IRAK1, GNA11, FADD, MAPK3, SMAD2, JUN, SMAD3, IFNB1, MAPK14, MAPK12, NFKB1, IL2, MAPK13, NFKBIA, GNAO1, MAPK10, MAPK11, IL6, GNAS, MYD88 | 51 |
| hsa05205:Proteoglycans in cancer | 19 | 2.92E-12 | STAT3, FN1, PIK3R1, ESR1, EGFR, MTOR, ACTG1, PIK3CA, CCND1, ERBB4, ERBB2, FLNA, AKT1, CTNNB1, KRAS, PLCG1, SOS1, TP53, TLR4 | 78 | 1.28E-22 | ITGB1, CDKN1A, ITGB3, PIK3CD, FASLG, PIK3CB, FGF2, ELK1, PIK3CG, IGF1R, CCND1, MYC, PRKACG, AKT2, KDR, PLCE1, RAC1, PRKACA, PRKACB, HRAS, PRKCG, MAP2K1, MAP2K2, PDPK1, HGF, MMP2, RRAS2, ANK2, FRS2, PIK3CA, CTTN, HCLS1, RAF1, SOS1, TP53, SOS2, HBEGF, TLR2, DDX5, SRC, SDC2, ITPR1, PIK3R3, PIK3R2, IQGAP1, THBS1, HIF1A, HOXD10, SLC9A1, PIK3R5, CDC42, NRAS, PAK1, ERBB3, RRAS, ERBB2, FLNA, FLNB, FLNC, PLCG1, MAPK3, FZD3, FZD5, IGF2, FN1, PTPN11, MAPK14, MAPK12, PTK2, MAPK13, PPP1CA, MAPK11, MDM2, PDCD4, KRAS, PTPN6, GRB2, FGFR1 | 69 |
| hsa04917:Prolactin signaling pathway | 8 | 1.15E-05 | CCND1, PIK3CA, STAT3, AKT1, KRAS, PIK3R1, SOS1, ESR1 | 43 | 1.78E-21 | SHC4, GSK3B, SHC1, SRC, PIK3CD, PIK3R3, PIK3R2, PIK3CB, FOXO3, RELA, PIK3CG, PIK3R5, INS, SOCS2, SOCS3, NRAS, MAPK8, SOCS1, CCND2, CCND1, AKT2, JAK2, HRAS, MAPK3, MAP2K1, MAP2K2, STAT1, FOS, MAPK14, PRLR, MAPK12, ESR2, NFKB1, MAPK13, MAPK10, MAPK11, PIK3CA, IRF1, GRB2, KRAS, RAF1, SOS1, SOS2 | 39 |
| hsa04915:Estrogen signaling pathway | 8 | 1.00E-04 | CREB1, PIK3CA, AKT1, KRAS, PIK3R1, SOS1, ESR1, EGFR | 50 | 2.69E-20 | HSP90AB1, PIK3CD, PIK3CB, PIK3CG, CREB3L3, CREB3L4, PRKACG, AKT2, CREB3L2, PRKACA, PRKACB, HRAS, MAP2K1, HSP90AA1, MAP2K2, MMP2, PRKCD, FOS, CREB3, PLCB3, PLCB4, CREB1, PIK3CA, RAF1, PLCB1, SOS1, PLCB2, SOS2, HBEGF, SHC4, SRC, SHC1, GNAI3, ITPR1, PIK3R3, PIK3R2, HSP90B1, GNAI2, PIK3R5, NRAS, MAPK3, JUN, NOS3, ESR2, GNAO1, SP1, GNAS, KRAS, CALM3, GRB2 | 46 |
| hsa05203:Viral carcinogenesis | 12 | 1.32E-05 | LYN, RB1, CDKN1B, CREB1, CCND1, PIK3CA, STAT3, EP300, CHD4, KRAS, PIK3R1, TP53 | 75 | 7.48E-20 | CDKN1A, CDKN1B, DDX3X, HDAC10, GTF2B, PIK3CD, CHD4, PIK3CB, RBPJ, PIK3CG, POLB, CCND3, CCND2, CCND1, CREB3L3, CREB3L4, PRKACG, CREB3L2, IKBKG, RAC1, PRKACA, JAK3, PRKACB, HRAS, JAK1, TBP, SYK, ACTN3, ACTN2, ACTN1, ACTN4, HLA-E, RBL2, CREB3, CREB1, PIK3CA, IRF3, MAPKAPK2, IRF7, TP53, MAD1L1, HIST1H2BN, RBPJL, GTF2A1, GTF2A2, SP100, HDAC2, SRC, HDAC1, PIK3R3, PIK3R2, HDAC8, RELA, PIK3R5, CDC42, NRAS, PMAIP1, MAPK3, JUN, CREBBP, GSN, GTF2H1, GTF2H3, GTF2H4, NFKB1, NFKB2, NFKBIA, HIST1H4A, DLG1, SNW1, CDK6, CDK2, MDM2, KRAS, GRB2 | 68 |
| hsa04012:ErbB signaling pathway | 12 | 2.04E-09 | MAP2K4, CDKN1B, PIK3CA, ERBB4, ERBB2, AKT1, KRAS, PLCG1, PIK3R1, SOS1, EGFR, MTOR | 46 | 1.02E-19 | SHC4, GSK3B, CDKN1A, CDKN1B, SHC1, SRC, PIK3CD, PIK3R3, PIK3R2, PIK3CB, ELK1, PIK3CG, PIK3R5, PAK1, NRAS, MAPK8, ERBB3, MYC, AKT2, ERBB2, NCK2, EIF4EBP1, PAK6, PLCG1, PAK3, MAP2K7, HRAS, PAK2, MAPK3, PAK4, PRKCG, MAP2K4, JUN, MAP2K1, MAP2K2, NRG2, PTK2, EREG, MAPK10, PIK3CA, GRB2, KRAS, RAF1, SOS1, SOS2, HBEGF | 39 |
| hsa04664:Fc epsilon RI signaling pathway | 8 | 8.58E-06 | LYN, MAP2K4, PIK3CA, AKT1, KRAS, PLCG1, PIK3R1, SOS1 | 39 | 2.30E-18 | PIK3CD, PIK3R3, PIK3R2, PIK3CB, PIK3CG, PIK3R5, NRAS, MAPK8, AKT2, RAC2, FYN, PLCG1, RAC1, MAP2K7, HRAS, MAPK3, MAP2K4, MAP2K1, MAP2K2, SYK, PDPK1, IL13, GAB2, MAPK14, MAPK12, MAPK13, MAPK10, IL4, MAPK11, IL3, IL5, PIK3CA, GRB2, KRAS, LCP2, RAF1, SOS1, SOS2, LAT | 34 |
| hsa04071:Sphingolipid signaling pathway | 6 | 0.01024955 | PIK3CA, PTEN, AKT1, KRAS, PIK3R1, TP53 | 52 | 1.75E-17 | PTEN, PIK3CD, PPP2R2A, PIK3CB, PIK3CG, PPP2R1A, PPP2R5E, AKT2, RAC2, RAC1, HRAS, MAP3K5, PRKCG, MAP2K1, MAP2K2, PDPK1, PRKCE, PPP2R5B, PPP2R5A, PPP2R5D, PPP2R5C, GAB2, PLCB3, PLCB4, PIK3CA, RAF1, PLCB1, PLCB2, TP53, SGMS1, GNAI3, PIK3R3, PIK3R2, RELA, GNAI2, PIK3R5, PPP2CA, GNA13, PPP2CB, NRAS, MAPK8, FYN, MAPK3, NOS3, MAPK14, MAPK12, NFKB1, MAPK13, MAPK10, MAPK11, BCL2, KRAS | 48 |
| hsa05220:Chronic myeloid leukemia | 11 | 4.57E-09 | RB1, CDKN1B, CCND1, MECOM, PIK3CA, AKT1, KRAS, PIK3R1, SOS1, TP53, RUNX1 | 39 | 3.11E-17 | SHC4, CDKN1A, HDAC2, CDKN1B, SHC1, CTBP1, HDAC1, PIK3CD, PIK3R3, PIK3R2, PIK3CB, RELA, PIK3CG, PIK3R5, IKBKB, NRAS, CCND1, MYC, AKT2, E2F3, IKBKG, HRAS, MAPK3, MAP2K1, MAP2K2, PTPN11, GAB2, NFKB1, RUNX1, NFKBIA, CDK6, PIK3CA, MDM2, GRB2, KRAS, RAF1, SOS1, TP53, SOS2 | 32 |
| hsa05221:Acute myeloid leukemia | 9 | 1.41E-07 | CCND1, PIK3CA, STAT3, AKT1, KRAS, PIK3R1, SOS1, MTOR, RUNX1 | 34 | 4.56E-17 | CEBPA, SPI1, LEF1, PIK3CD, PIK3R3, PIK3R2, PIK3CB, RELA, PIK3CG, PIK3R5, IKBKB, NRAS, CCND1, MYC, AKT2, PIM1, EIF4EBP1, IKBKG, HRAS, MAPK3, MAP2K1, MAP2K2, JUP, NFKB1, PML, RUNX1, PIK3CA, KIT, RARA, GRB2, KRAS, RAF1, SOS1, SOS2 | 29 |
| hsa04152:AMPK signaling pathway | 6 | 0.011328552 | CREB1, CCND1, PIK3CA, AKT1, PIK3R1, MTOR | 52 | 6.16E-17 | CRTC2, IRS1, IRS4, PRKAG1, PIK3CD, PPP2R2A, IRS2, PIK3CB, ELAVL1, PRKAG3, PIK3CG, IGF1R, STK11, CCND1, CREB3L3, PPP2R1A, PPP2R5E, CREB3L4, AKT2, HNF4A, CREB3L2, LEPR, SREBF1, PRKAB2, PDPK1, PPP2R5B, PPP2R5A, PPP2R5D, TSC1, PPP2R5C, PRKAB1, SIRT1, CREB3, CREB1, PIK3CA, AKT1S1, PPARG, CFTR, PRKAA1, PRKAA2, PIK3R3, PIK3R2, FOXO3, FOXO1, INS, PIK3R5, PPP2CA, PPP2CB, EIF4EBP1, INSR, EEF2, RHEB | 49 |
| hsa05213:Endometrial cancer | 12 | 5.96E-12 | CCND1, PIK3CA, CDH1, ERBB2, PTEN, CTNNB1, AKT1, KRAS, PIK3R1, SOS1, TP53, EGFR | 32 | 2.61E-16 | GSK3B, LEF1, PTEN, PIK3CD, PIK3R3, PIK3R2, PIK3CB, FOXO3, ELK1, PIK3CG, PIK3R5, CASP9, NRAS, CCND1, CDH1, MYC, AKT2, ERBB2, CTNNA3, CTNNA2, HRAS, MAPK3, MAP2K1, MAP2K2, PDPK1, PIK3CA, GRB2, KRAS, RAF1, SOS1, TP53, SOS2 | 24 |
| hsa04630:Jak-STAT signaling pathway | 8 | 0.001037758 | CCND1, PIK3CA, STAT3, EP300, AKT1, LIFR, PIK3R1, SOS1 | 56 | 5.09E-16 | EPO, IL24, PIK3CD, IL5RA, PIK3CB, PIK3CG, CCND3, CCND2, CCND1, MYC, AKT2, PIM1, LEPR, JAK2, JAK3, JAK1, PIAS4, PIAS3, IL4R, IL13, PRLR, PIAS2, PIAS1, IFNG, PIK3CA, SOS1, SOS2, IFNAR1, PIK3R3, CSF2RB, PIK3R2, IL2RG, PIK3R5, SOCS2, SOCS3, SOCS1, IL12RB1, CREBBP, IFNB1, STAT1, STAT2, LIF, OSM, PTPN11, IL2, GH2, IL4, IL3, IL6, IL5, IL7, IL2RA, IL2RB, PTPN6, GRB2, IL7R | 53 |
| hsa04931:Insulin resistance | 8 | 0.000174 | CREB1, PIK3CA, NR1H2, STAT3, PTEN, AKT1, PIK3R1, MTOR | 47 | 7.29E-16 | GSK3B, CRTC2, PRKAA1, PRKAA2, IRS1, PRKAG1, PTEN, PIK3CD, PIK3R3, IRS2, PIK3R2, PIK3CB, PRKAG3, FOXO1, RELA, PIK3CG, PIK3R5, INS, IKBKB, RPS6KA3, SOCS3, RPS6KA6, MAPK8, CREB3L3, CREB3L4, AKT2, RPS6KA1, CREB3L2, SREBF1, PRKAB2, NOS3, PDPK1, PRKCE, INSR, PRKCD, PTPN11, PRKAB1, NFKB1, PPP1CA, MAPK10, NFKBIA, CREB3, IL6, CREB1, PIK3CA, PRKCQ, OGT | 44 |
| hsa04668:TNF signaling pathway | 5 | 0.030204137 | MAP2K4, CREB1, PIK3CA, AKT1, PIK3R1 | 46 | 2.72E-15 | PIK3CD, PIK3R3, PIK3R2, PIK3CB, NOD2, RELA, PIK3CG, PIK3R5, ICAM1, IKBKB, SOCS3, CASP7, MAPK8, CREB3L3, CASP10, CREB3L4, AKT2, CREB3L2, RIPK1, FADD, IKBKG, MAP2K7, JUNB, MAPK3, MAP3K5, MAP2K4, JUN, MAP2K1, EDN1, JAG1, LIF, FOS, MAPK14, MAPK12, NFKB1, MAPK13, MAPK10, NFKBIA, MAPK11, CREB3, ITCH, IL6, CREB1, PIK3CA, IL1B, BIRC3 | 43 |
| hsa05211:Renal cell carcinoma | 6 | 0.000762 | PIK3CA, EP300, AKT1, KRAS, PIK3R1, SOS1 | 35 | 4.41E-15 | EPAS1, PIK3CD, PIK3R3, PIK3R2, PIK3CB, ETS1, HIF1A, PIK3CG, PIK3R5, RAP1B, CDC42, PAK1, NRAS, RAP1A, AKT2, PAK6, RAC1, PAK3, HRAS, PAK2, MAPK3, PAK4, JUN, MAP2K1, CREBBP, MAP2K2, HGF, ARNT, PTPN11, PIK3CA, GRB2, KRAS, RAF1, SOS1, SOS2 | 32 |
| hsa04910:Insulin signaling pathway | 7 | 0.00404323 | PIK3CA, PRKAR1A, AKT1, KRAS, PIK3R1, SOS1, MTOR | 53 | 4.44E-15 | GSK3B, IRS1, IRS4, PRKAG1, PIK3CD, IRS2, PIK3CB, ELK1, PRKAG3, PIK3CG, IKBKB, PRKACG, AKT2, PRKACA, PRKACB, HRAS, SREBF1, PRKAB2, PRKCI, MAP2K1, MAP2K2, PDPK1, TSC1, PRKAB1, PIK3CA, RAF1, SOS1, SOS2, RHOQ, SHC4, PRKAA1, PRKAA2, SHC1, PIK3R3, PIK3R2, FOXO1, INS, PIK3R5, SOCS2, SOCS3, NRAS, MAPK8, SOCS1, EIF4EBP1, EIF4E, MAPK3, INSR, PPP1CA, MAPK10, RHEB, KRAS, CALM3, GRB2 | 50 |
| hsa05164:Influenza A | 9 | 0.000621 | MAP2K4, PIK3CA, EP300, NLRP3, AKT1, NUP98, PIK3R1, TLR4, ACTG1 | 60 | 1.62E-14 | GSK3B, NXT1, PIK3CD, FASLG, PIK3CB, PIK3CG, ICAM1, CASP9, IKBKB, TBK1, AKT2, JAK2, JAK1, HLA-DPA1, KPNA1, MAP2K4, MAP2K1, MAP2K2, IRAK4, TICAM1, IFNG, PIK3CA, IRF3, IL1B, IRF7, NUP98, RAF1, HLA-DQB1, IFNAR1, PIK3R3, PIK3R2, RELA, PIK3R5, SOCS3, NXF1, MAPK8, MAP2K7, RAE1, HLA-DQA2, MAPK3, IL33, JUN, HLA-DRB5, CREBBP, IFNB1, STAT1, STAT2, TNFRSF10B, TNFRSF10A, MAPK14, MAPK12, NFKB1, PML, MAPK13, NFKBIA, MAPK10, MAPK11, IL6, HLA-DRA, MYD88 | 57 |
| hsa05214:Glioma | 13 | 3.40E-12 | RB1, PDGFRA, PTEN, PIK3R1, EGFR, MTOR, PIK3CA, CCND1, AKT1, KRAS, PLCG1, SOS1, TP53 | 34 | 1.95E-14 | SHC4, CDKN1A, SHC1, PTEN, PDGFA, PIK3CD, PIK3R3, PIK3R2, PIK3CB, PIK3CG, IGF1R, PIK3R5, NRAS, CCND1, AKT2, E2F3, PLCG1, HRAS, MAPK3, PRKCG, PDGFRB, PDGFRA, MAP2K1, MAP2K2, CDK6, PIK3CA, MDM2, GRB2, KRAS, CALM3, RAF1, SOS1, TP53, SOS2 | 26 |
| hsa04662:B cell receptor signaling pathway | 6 | 0.000934 | LYN, PIK3CA, AKT1, KRAS, PIK3R1, SOS1 | 35 | 2.45E-14 | GSK3B, PIK3CD, PIK3R3, PIK3R2, BCL10, PIK3CB, RELA, PIK3CG, PIK3R5, RASGRP3, IKBKB, NRAS, AKT2, CD19, RAC2, IKBKG, RAC1, HRAS, MAPK3, JUN, MAP2K1, MAP2K2, SYK, NFATC2, NFATC1, FOS, NFKB1, NFKBIA, PIK3CA, GRB2, KRAS, PTPN6, RAF1, SOS1, SOS2 | 32 |
| hsa04620:Toll-like receptor signaling pathway | 5 | 0.029313713 | MAP2K4, PIK3CA, AKT1, PIK3R1, TLR4 | 44 | 5.43E-14 | CD40, PIK3CD, PIK3R3, PIK3R2, PIK3CB, RELA, PIK3CG, PIK3R5, IKBKB, MAPK8, TBK1, IRAK1, AKT2, RIPK1, FADD, IKBKG, RAC1, MAP2K7, MAPK3, MAP2K4, JUN, MAP2K1, MAP2K2, IFNB1, STAT1, FOS, IRAK4, MAPK14, TICAM1, MAPK12, TIRAP, NFKB1, MAPK13, MAPK10, NFKBIA, MAPK11, IL6, IRF3, PIK3CA, IL1B, IRF7, MYD88, TLR2, IFNAR1 | 42 |
| hsa05162:Measles | 8 | 0.000621 | CDKN1B, CCND1, PIK3CA, STAT3, AKT1, PIK3R1, TP53, TLR4 | 50 | 7.89E-14 | GSK3B, CDKN1B, PIK3CD, CD3G, FASLG, PIK3CB, CD3D, PIK3CG, CCND3, TBK1, CCND2, CCND1, AKT2, JAK2, JAK3, JAK1, IL13, IRAK4, IFNG, PIK3CA, IRF3, IL1B, IRF7, PRKCQ, TP53, TLR2, IFNAR1, PIK3R3, PIK3R2, IL2RG, RELA, PIK3R5, IRAK1, FYN, IFNB1, STAT1, STAT2, TNFRSF10B, TNFRSF10A, NFKB1, IL2, NFKBIA, IL4, IL6, CDK6, IL2RA, IL2RB, CDK2, MYD88, TP73 | 46 |
| hsa05160:Hepatitis C | 8 | 0.000621 | PIK3CA, STAT3, AKT1, KRAS, PIK3R1, SOS1, TP53, EGFR | 50 | 7.89E-14 | GSK3B, CDKN1A, PIK3CD, PPP2R2A, PIK3CB, PIK3CG, IKBKB, TBK1, PPP2R1A, AKT2, IKBKG, HRAS, JAK1, PDPK1, TICAM1, PIAS1, PIK3CA, IRF3, IRF1, IRF7, RAF1, SOS1, TP53, SOS2, IFNAR1, PIK3R3, PIK3R2, RELA, PIK3R5, PPP2CA, PPP2CB, SOCS3, NRAS, MAPK8, RXRA, RIPK1, LDLR, MAPK3, IFNB1, STAT1, STAT2, MAPK14, MAPK12, NFKB1, MAPK13, NFKBIA, MAPK10, MAPK11, KRAS, GRB2 | 46 |
| hsa05222:Small cell lung cancer | 9 | 3.71E-06 | RB1, CDKN1B, CCND1, PIK3CA, PTEN, FN1, AKT1, PIK3R1, TP53 | 38 | 2.37E-13 | ITGB1, LAMA5, CDKN1B, MAX, PTEN, PIK3CD, PIK3R3, PIK3R2, LAMC1, PIK3CB, RELA, PIK3CG, CKS1B, PIK3R5, CASP9, IKBKB, RXRA, CCND1, MYC, AKT2, E2F3, IKBKG, FN1, PTK2, NFKB1, NFKBIA, CDK6, PIK3CA, COL4A1, COL4A4, COL4A3, CDK2, COL4A6, BCL2, COL4A5, ITGA6, TP53, BIRC3 | 32 |
| hsa04062:Chemokine signaling pathway | 8 | 0.00427696 | LYN, PIK3CA, STAT3, AKT1, KRAS, PIK3R1, DOCK2, SOS1 | 60 | 4.50E-13 | GSK3B, ITK, GSK3A, PIK3CD, ARRB1, PIK3CB, PIK3CG, IKBKB, PREX1, PRKACG, AKT2, RAC2, IKBKG, RAC1, JAK2, PRKACA, JAK3, PRKACB, HRAS, MAP2K1, PRKCD, FGR, HCK, PLCB3, PLCB4, PIK3CA, ELMO1, RAF1, PLCB1, SOS1, PLCB2, SOS2, SHC4, SRC, SHC1, GNAI3, CXCR4, PIK3R3, PIK3R2, FOXO3, RELA, GNAI2, PIK3R5, RAP1B, CDC42, NRAS, PAK1, RAP1A, GNG2, GRK5, PTK2B, MAPK3, STAT1, STAT2, NFKB1, PTK2, NFKBIA, GNB1, KRAS, GRB2 | 57 |
| hsa04912:GnRH signaling pathway | 6 | 0.003201266 | MAP2K4, MAP3K1, KRAS, SOS1, EGFR, MAP3K4 | 39 | 5.53E-13 | SRC, ITPR1, ELK1, CDC42, NRAS, MAPK8, PRKACG, GNA11, PTK2B, MAP2K7, PRKACA, HRAS, PRKACB, MAPK3, MAP2K4, MAP3K3, JUN, MAP2K1, MAP2K2, MAP3K1, MMP2, PRKCD, MAPK14, MAPK12, MAPK13, MAPK10, MAPK11, PLCB3, PLCB4, GNAS, GRB2, KRAS, CALM3, PLCB1, RAF1, SOS1, PLCB2, SOS2, HBEGF | 35 |
| hsa04370:VEGF signaling pathway | 5 | 0.004460947 | PIK3CA, AKT1, KRAS, PLCG1, PIK3R1 | 31 | 9.00E-13 | SRC, PIK3CD, PIK3R3, PIK3R2, PIK3CB, PIK3CG, PIK3R5, CASP9, CDC42, NRAS, AKT2, KDR, RAC2, PLCG1, RAC1, HRAS, MAPK3, PRKCG, MAP2K1, MAP2K2, NOS3, NFATC2, MAPK14, MAPK12, PTK2, MAPK13, MAPK11, PIK3CA, MAPKAPK2, KRAS, RAF1 | 28 |
| hsa04611:Platelet activation | 5 | 0.055126799 | LYN, PIK3CA, AKT1, PIK3R1, ACTG1 | 47 | 2.50E-12 | ITGB1, SRC, COL11A1, ITGB3, GNAI3, ITPR1, PIK3CD, PIK3R3, PIK3R2, PIK3CB, RASGRP1, PIK3CG, GNAI2, PIK3R5, RAP1B, GNA13, RAP1A, PRKACG, AKT2, FYN, PRKACA, PRKACB, MAPK3, PRKCI, SYK, NOS3, GP1BB, GP1BA, MAPK14, GP5, MAPK12, MAPK13, PPP1CA, MAPK11, COL3A1, PLCB3, COL2A1, PLCB4, COL1A2, COL5A1, PIK3CA, COL5A3, COL5A2, GNAS, LCP2, PLCB1, PLCB2 | 46 |
| hsa05223:Non-small cell lung cancer | 11 | 3.49E-10 | RB1, CCND1, PIK3CA, ERBB2, AKT1, KRAS, PLCG1, PIK3R1, SOS1, TP53, EGFR | 29 | 3.12E-12 | PIK3CD, PIK3R3, PIK3R2, PIK3CB, FOXO3, PIK3CG, PIK3R5, CASP9, NRAS, RXRA, CCND1, AKT2, ERBB2, E2F3, PLCG1, HRAS, MAPK3, PRKCG, MAP2K1, MAP2K2, PDPK1, CDK6, PIK3CA, GRB2, KRAS, RAF1, SOS1, TP53, SOS2 | 22 |
| hsa04550:Signaling pathways regulating pluripotency of stem cells | 10 | 2.07E-05 | SMAD2, PIK3CA, RIF1, STAT3, CTNNB1, AKT1, KRAS, LIFR, PIK3R1, TBX3 | 49 | 3.13E-12 | GSK3B, ONECUT1, PIK3CD, PIK3CB, FGF2, PIK3CG, IGF1R, MYC, AKT2, JAK2, JARID2, JAK3, HRAS, JAK1, MAP2K1, MAP2K2, PIK3CA, RAF1, PIK3R3, PIK3R2, PIK3R5, NRAS, DVL1, DVL2, PCGF1, DVL3, SKIL, MAPK3, SMAD2, FZD3, SMAD3, FZD5, LIF, INHBA, MAPK14, KLF4, SMAD5, MAPK12, MAPK13, MAPK11, MEIS1, ID2, ID1, KRAS, GRB2, FGFR4, FGFR3, FGFR2, FGFR1 | 46 |
| hsa05212:Pancreatic cancer | 11 | 1.62E-09 | RB1, SMAD2, CCND1, PIK3CA, ERBB2, STAT3, AKT1, KRAS, PIK3R1, TP53, EGFR | 31 | 7.21E-12 | PIK3CD, PIK3R3, PIK3R2, PIK3CB, RELA, PIK3CG, PIK3R5, CASP9, IKBKB, CDC42, MAPK8, CCND1, AKT2, ERBB2, RAC2, E2F3, IKBKG, RAC1, JAK1, MAPK3, SMAD2, MAP2K1, SMAD3, STAT1, NFKB1, MAPK10, CDK6, PIK3CA, KRAS, RAF1, TP53 | 25 |
| hsa05210:Colorectal cancer | 8 | 4.59E-06 | SMAD2, CCND1, PIK3CA, CTNNB1, AKT1, KRAS, PIK3R1, TP53 | 30 | 1.07E-11 | GSK3B, LEF1, PIK3CD, PIK3R3, PIK3R2, PIK3CB, PIK3CG, PIK3R5, CASP9, MAPK8, CCND1, MYC, AKT2, RAC2, RAC1, APPL1, MAPK3, SMAD2, JUN, MAP2K1, SMAD3, FOS, MAPK10, MSH2, PIK3CA, BCL2, BIRC5, KRAS, RAF1, TP53 | 25 |
| hsa04650:Natural killer cell mediated cytotoxicity | 5 | 0.045489093 | PIK3CA, KRAS, PLCG1, PIK3R1, SOS1 | 44 | 1.53E-11 | SHC4, SHC1, ITGB2, PIK3CD, PIK3R3, FASLG, PIK3R2, PIK3CB, ITGAL, PIK3CG, PIK3R5, ICAM1, PAK1, NRAS, KLRK1, RAC2, PTK2B, FYN, PLCG1, RAC1, HRAS, MAPK3, PRKCG, MAP2K1, MAP2K2, SYK, IFNB1, TNFRSF10B, NFATC2, PTPN11, TNFRSF10A, NFATC1, IFNG, PIK3CA, LCK, GRB2, KRAS, PTPN6, LCP2, RAF1, SOS1, SOS2, LAT, IFNAR1 | 40 |
| hsa04914:Progesterone-mediated oocyte maturation | 4 | 0.071100692 | PIK3CA, AKT1, KRAS, PIK3R1 | 36 | 1.68E-11 | HSP90AB1, GNAI3, PIK3CD, PIK3R3, PIK3R2, PIK3CB, PIK3CG, GNAI2, IGF1R, PIK3R5, INS, RPS6KA3, RPS6KA6, FZR1, MAPK8, CCNB1, PRKACG, AKT2, RPS6KA1, PRKACA, PRKACB, MAPK3, MAP2K1, HSP90AA1, MAPK14, MAPK12, CDC25A, MAPK13, MAD2L2, MAPK10, MAPK11, PIK3CA, CDK2, KRAS, RAF1, MAD1L1 | 34 |
| hsa04150:mTOR signaling pathway | 5 | 0.003718155 | PIK3CA, PTEN, AKT1, PIK3R1, MTOR | 28 | 6.42E-11 | PRKAA1, PRKAA2, IRS1, PTEN, PIK3CD, PIK3R3, PIK3R2, PIK3CB, PIK3CG, PIK3R5, INS, IKBKB, RPS6KA3, RPS6KA6, STK11, AKT2, RPS6KA1, EIF4EBP1, EIF4E, MAPK3, PRKCG, PDPK1, TSC1, PIK3CA, RRAGC, RHEB, RRAGD, AKT1S1 | 26 |
| hsa04670:Leukocyte transendothelial migration | 5 | 0.037904311 | PIK3CA, CTNNB1, PLCG1, PIK3R1, ACTG1 | 41 | 1.27E-10 | ITGB1, ITK, ITGAM, CTNND1, ITGB2, GNAI3, CXCR4, PIK3CD, PIK3R3, PIK3R2, PIK3CB, ITGAL, PIK3CG, GNAI2, PIK3R5, ICAM1, RAP1B, CDC42, CDH5, RAP1A, RAC2, PTK2B, CTNNA3, PLCG1, CTNNA2, RAC1, PRKCG, ACTN3, ITGA4, ACTN2, ACTN1, MMP2, RHOH, PTPN11, ACTN4, MAPK14, MAPK12, PTK2, MAPK13, MAPK11, PIK3CA | 39 |
| hsa04066:HIF-1 signaling pathway | 11 | 7.78E-08 | CDKN1B, PIK3CA, ERBB2, STAT3, EP300, AKT1, PLCG1, PIK3R1, TLR4, EGFR, MTOR | 36 | 4.28E-10 | CDKN1A, CDKN1B, FLT1, TFRC, EPO, SERPINE1, PIK3CD, PIK3R3, PIK3R2, PIK3CB, HIF1A, RELA, PIK3CG, IGF1R, PIK3R5, INS, AKT2, ERBB2, EIF4EBP1, HMOX1, PLCG1, EIF4E, MAPK3, PRKCG, MAP2K1, CREBBP, EDN1, MAP2K2, NOS3, INSR, ARNT, NFKB1, IL6, IFNG, PIK3CA, BCL2 | 32 |
| hsa05231:Choline metabolism in cancer | 9 | 1.35E-05 | PDGFRA, PIK3CA, AKT1, KRAS, PLCG1, PIK3R1, SOS1, EGFR, MTOR | 37 | 5.00E-10 | PDGFA, PIK3CD, PIK3R3, PIK3R2, PIK3CB, HIF1A, PIK3CG, PIK3R5, NRAS, MAPK8, AKT2, PDGFD, RAC2, EIF4EBP1, PLCG1, PIP5K1C, RAC1, HRAS, MAPK3, PRKCG, PDGFRB, PDGFRA, JUN, MAP2K1, MAP2K2, PDPK1, TSC1, FOS, MAPK10, PIK3CA, SP1, RHEB, GRB2, KRAS, RAF1, SOS1, SOS2 | 32 |
| hsa04916:Melanogenesis | 4 | 0.098197783 | CREB1, EP300, CTNNB1, KRAS | 36 | 1.54E-09 | GSK3B, LEF1, GNAI3, GNAI2, NRAS, CREB3L3, CREB3L4, PRKACG, CREB3L2, DVL1, DVL2, DVL3, PRKACA, HRAS, PRKACB, MAPK3, PRKCG, MAP2K1, FZD3, CREBBP, EDN1, MAP2K2, FZD5, GNAO1, CREB3, PLCB3, KITLG, PLCB4, CREB1, KIT, GNAS, KRAS, CALM3, PLCB1, RAF1, PLCB2 | 34 |
| hsa05100:Bacterial invasion of epithelial cells | 6 | 0.00162396 | PIK3CA, CDH1, FN1, CTNNB1, PIK3R1, ACTG1 | 31 | 1.75E-09 | SHC4, ITGB1, SHC1, SRC, ARPC1A, CLTC, CLTB, PIK3CD, PIK3R3, CLTA, PIK3R2, PIK3CB, PIK3CG, PIK3R5, CDC42, CDH1, CTNNA3, CTNNA2, RAC1, RHOG, FN1, ARPC4, DNM1, PTK2, DNM2, MAD2L2, CTTN, PIK3CA, ARPC3, ELMO1, HCLS1 | 28 |
| hsa04210:Apoptosis | 4 | 0.030777976 | PIK3CA, AKT1, PIK3R1, TP53 | 27 | 2.42E-09 | PIK3CD, PIK3R3, CSF2RB, FASLG, PIK3R2, PIK3CB, RELA, PIK3CG, PIK3R5, CASP9, IKBKB, CASP7, CASP10, AKT2, RIPK1, FADD, IKBKG, NTRK1, TNFRSF10B, TNFRSF10A, NFKB1, NFKBIA, IL3, PIK3CA, BCL2, TP53, BIRC3 | 25 |
| hsa05230:Central carbon metabolism in cancer | 10 | 2.55E-08 | PDGFRA, PIK3CA, ERBB2, PTEN, AKT1, KRAS, PIK3R1, TP53, EGFR, MTOR | 27 | 5.48E-09 | PTEN, PIK3CD, PIK3R3, PIK3R2, PIK3CB, HIF1A, PIK3CG, PIK3R5, NRAS, MYC, AKT2, ERBB2, HRAS, MAPK3, PDGFRB, NTRK1, PDGFRA, MAP2K1, MAP2K2, PIK3CA, KIT, KRAS, RAF1, FGFR3, TP53, FGFR2, FGFR1 | 21 |
| hsa04725:Cholinergic synapse | 5 | 0.033925647 | CREB1, PIK3CA, AKT1, KRAS, PIK3R1 | 37 | 9.41E-09 | GNAI3, ITPR1, PIK3CD, PIK3R3, PIK3R2, PIK3CB, PIK3CG, GNAI2, PIK3R5, NRAS, GNG2, CREB3L3, CREB3L4, PRKACG, GNA11, AKT2, CREB3L2, FYN, JAK2, PRKACA, HRAS, PRKACB, MAPK3, PRKCG, MAP2K1, FOS, GNAO1, CREB3, PLCB3, PLCB4, CREB1, PIK3CA, GNB1, BCL2, KRAS, PLCB1, PLCB2 | 34 |
| hsa04666:Fc gamma R-mediated phagocytosis | 7 | 0.000306 | LYN, PIK3CA, AKT1, AMPH, PLCG1, PIK3R1, DOCK2 | 31 | 1.34E-08 | ARPC1A, PIK3CD, PIK3R3, PIK3R2, PIK3CB, PIK3CG, PIK3R5, CDC42, PAK1, AKT2, CFL1, RAC2, PLCG1, PIP5K1C, RAC1, MAPK3, PRKCG, MAP2K1, GSN, SYK, PRKCE, PRKCD, ARPC4, GAB2, HCK, PTPRC, PIK3CA, BIN1, ARPC3, RAF1, LAT | 29 |
| hsa05219:Bladder cancer | 7 | 4.93E-06 | RB1, CCND1, CDH1, ERBB2, KRAS, TP53, EGFR | 20 | 4.98E-08 | CDKN1A, MAP2K1, MAP2K2, SRC, MMP2, THBS1, NRAS, CCND1, CDH1, MYC, ERBB2, MDM2, KRAS, E2F3, RAF1, HRAS, FGFR3, TP53, HBEGF, MAPK3 | 15 |
| hsa04520:Adherens junction | 7 | 0.000121 | SMAD2, CDH1, ERBB2, EP300, CTNNB1, EGFR, ACTG1 | 27 | 6.97E-08 | SRC, CTNND1, LEF1, IQGAP1, IGF1R, CDC42, CDH1, ERBB2, RAC2, FYN, CTNNA3, CTNNA2, RAC1, MAPK3, SMAD2, CREBBP, SMAD3, ACTN3, ACTN2, ACTN1, INSR, ACTN4, BAIAP2, SNAI1, SNAI2, PTPN6, FGFR1 | 24 |
| hsa04024:cAMP signaling pathway | 7 | 0.021728233 | CREB1, GRIN3A, PIK3CA, EP300, AKT1, SOX9, PIK3R1 | 51 | 1.50E-07 | PIK3CD, PIK3CB, GLI1, PIK3CG, GLI3, EDNRA, CREB3L3, CREB3L4, PRKACG, AKT2, CREB3L2, RAC2, PLCE1, SOX9, RAC1, PRKACA, PRKACB, MAP2K1, MAP2K2, RRAS2, FOS, SSTR2, CREB3, CREB1, PIK3CA, RAF1, CFTR, GRIA2, GNAI3, PIK3R3, PIK3R2, RELA, SLC9A1, GNAI2, PIK3R5, RAP1B, PAK1, MAPK8, RAP1A, RRAS, MAPK3, JUN, CREBBP, NFATC1, NFKB1, GRIN1, PPP1CA, NFKBIA, MAPK10, GNAS, CALM3 | 48 |
| hsa04930:Type II diabetes mellitus | 3 | 0.098181422 | PIK3CA, PIK3R1, MTOR | 21 | 1.96E-07 | IRS1, PRKCE, INSR, PRKCD, IRS4, PIK3CD, PIK3R3, PIK3R2, IRS2, PIK3CB, PIK3CG, PIK3R5, INS, MAPK10, SOCS2, IKBKB, SOCS3, MAPK8, SOCS1, PIK3CA, MAPK3 | 20 |
| hsa04540:Gap junction | 4 | 0.073047214 | PDGFRA, KRAS, SOS1, EGFR | 29 | 6.57E-07 | SRC, GNAI3, ITPR1, PDGFA, GNAI2, NRAS, PRKACG, GNA11, PDGFD, PRKACA, HRAS, PRKACB, MAP2K5, MAPK3, PRKCG, PDGFRB, PDGFRA, MAP2K1, MAP2K2, PLCB3, PLCB4, GNAS, GRB2, KRAS, PLCB1, RAF1, SOS1, PLCB2, SOS2 | 26 |
| hsa04070:Phosphatidylinositol signaling system | 5 | 0.022758703 | PIK3CA, PTEN, PLCG1, PIK3R1, MTM1 | 31 | 6.70E-07 | PTEN, ITPR1, PIK3CD, PIK3R3, PIK3C2G, PIK3R2, PIK3CB, PIK3C2A, PIK3CG, PIK3R5, PLCZ1, PIP4K2A, PLCE1, PIP4K2B, PLCG1, PIP4K2C, PIP5K1C, PRKCG, OCRL, PLCB3, PLCB4, PIK3CA, PI4KA, CALM3, PIK3C3, PI4KB, PLCD3, PLCB1, PLCB2, PI4K2A, PLCD1 | 28 |
| hsa00562:Inositol phosphate metabolism | 4 | 0.043374131 | PIK3CA, PTEN, PLCG1, MTM1 | 25 | 1.22E-06 | PTEN, PIK3CD, PIK3C2G, PIK3CB, PIK3C2A, PIK3CG, PLCZ1, PIP4K2A, PLCE1, PIP4K2B, PLCG1, PIP4K2C, PIP5K1C, OCRL, PLCB3, PLCB4, PIK3CA, PI4KA, PIK3C3, PI4KB, PLCD3, PLCB1, PLCB2, PI4K2A, PLCD1 | 22 |
| hsa04310:Wnt signaling pathway | 7 | 0.00404323 | CCND1, TBL1XR1, CHD8, EP300, CTNNB1, PSEN1, TP53 | 38 | 1.36E-06 | GSK3B, CTBP1, LEF1, LRP5, CCND3, MAPK8, CCND2, SOX17, CCND1, PRKACG, MYC, RUVBL1, DVL1, DVL2, RAC2, DVL3, RAC1, TBL1X, BTRC, PRKACA, PRKACB, PRKCG, JUN, FZD3, CREBBP, FZD5, SIAH1, NFATC2, NFATC1, DKK1, NFATC4, MAPK10, FOSL1, PLCB3, PLCB4, PLCB1, PLCB2, TP53 | 36 |
| hsa04330:Notch signaling pathway | 3 | 0.098181422 | NOTCH1, EP300, PSEN1 | 19 | 4.96E-06 | NOTCH2, RBPJL, NOTCH3, CREBBP, HDAC2, JAG1, MAML1, CTBP1, HDAC1, NOTCH4, RBPJ, APH1A, NCOR2, SNW1, DVL1, DVL2, DVL3, HES1, MAML3 | 19 |
| hsa04110:Cell cycle | 9 | 6.01E-05 | RB1, SMAD2, CDKN1B, MCM7, CCND1, RAD21, EP300, SMC1A, TP53 | 34 | 6.03E-06 | CDKN1C, GSK3B, CDKN1A, HDAC2, CDKN1B, CCNH, HDAC1, CCND3, FZR1, CCNB1, CCND2, CCND1, MYC, E2F3, E2F4, SMAD2, CREBBP, CDKN2C, SMAD3, GADD45B, GADD45A, SMC1A, CDC25A, MAD2L2, RBL2, CDK7, STAG2, CDK6, ESPL1, CDK2, MDM2, MCM6, TP53, MAD1L1 | 29 |
| hsa05216:Thyroid cancer | 6 | 1.39E-05 | CCND1, CDH1, TPR, CTNNB1, KRAS, TP53 | 14 | 1.07E-05 | NTRK1, MAP2K1, MAP2K2, LEF1, NRAS, RXRA, CCND1, CDH1, MYC, KRAS, PPARG, HRAS, TP53, MAPK3 | 10 |
| hsa05120:Epithelial cell signaling in Helicobacter pylori infection | 4 | 0.03749949 | LYN, MAP2K4, PLCG1, EGFR | 21 | 7.25E-05 | MAP2K4, JUN, SRC, PTPN11, MAPK14, RELA, NFKB1, MAPK12, MAPK13, MAPK10, CDC42, NFKBIA, IKBKB, MAPK11, PAK1, MAPK8, IKBKG, PLCG1, RAC1, GIT1, HBEGF | 19 |
| hsa05206:MicroRNAs in cancer | 15 | 2.26E-06 | PDGFRA, CDKN1B, NOTCH1, STAT3, DNMT3A, PTEN, EGFR, MTOR, CCND1, ERBB2, EP300, KRAS, PLCG1, SOS1, TP53 | 57 | 0.000118 | CDKN1A, CDKN1B, IRS1, ITGB3, PTEN, IRS2, IKBKB, CCND2, CCND1, MYC, PIM1, CYP1B1, HRAS, PDGFRB, PRKCG, PDGFRA, MAP2K1, MAP2K2, PRKCE, DNMT3A, SIRT1, CDC25A, ZEB1, RAF1, SOS1, TP53, SOS2, SHC4, NOTCH2, NOTCH3, SHC1, NOTCH4, PDGFA, THBS1, HOXD10, NRAS, SOCS1, ERBB3, ERBB2, HMOX1, E2F3, PLCG1, PAK4, MCL1, FZD3, CREBBP, UBE2I, NFKB1, CDK6, BCL2, MDM2, PDCD4, KRAS, GRB2, MDM4, FGFR3, EZH2 | 47 |
| hsa04960:Aldosterone-regulated sodium reabsorption | 3 | 0.068662464 | PIK3CA, KRAS, PIK3R1 | 14 | 0.000404 | PRKCG, PDPK1, IRS1, INSR, PIK3CD, PIK3R3, PIK3R2, PIK3CB, PIK3CG, PIK3R5, INS, PIK3CA, KRAS, MAPK3 | 12 |
| hsa04320:Dorso-ventral axis formation | 4 | 0.003132797 | NOTCH1, KRAS, SOS1, EGFR | 11 | 0.000737 | NOTCH2, NOTCH3, MAP2K1, NOTCH4, GRB2, KRAS, SOS1, ETS1, SOS2, ETS2, MAPK3 | 9 |
| hsa04390:Hippo signaling pathway | 5 | 0.085241353 | SMAD2, CCND1, CDH1, CTNNB1, ACTG1 | 33 | 0.000856 | GSK3B, LEF1, ITGB2, SERPINE1, PPP2R2A, GLI2, PPP2CA, PPP2CB, CCND3, PARD6A, CCND2, CCND1, PPP2R1A, CDH1, MYC, DVL1, DVL2, DVL3, CTNNA3, CTNNA2, BTRC, SMAD2, PRKCI, FZD3, SMAD3, FZD5, PPP1CA, DLG1, ID2, ID1, BIRC5, SNAI2, TP73 | 30 |
| hsa05130:Pathogenic Escherichia coli infection | 4 | 0.018466158 | CDH1, CTNNB1, TLR4, ACTG1 | 11 | 0.07898248 | CDC42, ITGB1, CTTN, CDH1, ARPC3, NCL, ARPC1A, NCK2, HCLS1, FYN, ARPC4 | 10 |

**Table 4. The pathway intersection of driver genes and downstream genes in breast cancer of LumB subtype**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Term | drivers\_count | driver\_pvalue | drivers | Out\_count | Out\_pvalue | Outs | Outs\_drivers\_count |
| hsa05200:Pathways in cancer | 21 | 6.77E-12 | RB1, SMAD2, PDGFRA, STAT3, PTEN, FN1, BRAF, PIK3R1, BRCA2, EGFR, MTOR, RUNX1, PIK3CA, MECOM, ERBB2, EP300, CTNNB1, KRAS, PLCG1, SOS1, TP53 | 86 | 2.51E-24 | RB1, HSP90AB1, ITGA2B, LAMC2, FASLG, LAMC1, BRCA2, FGF1, ETS1, PIK3CG, FGF6, FGF7, FGF8, FGF9, EP300, RAC3, ITGAV, RAC1, SKP2, PRKACB, JAK1, HSP90AA1, MAP2K2, MMP2, FOS, RHOA, RUNX1, RBX1, MSH6, PLCB3, PLCB4, MSH2, RARA, PLCB1, SOS1, PLCB2, CRK, SOS2, PPARD, CTBP1, EPAS1, HDAC1, LEF1, GNAI3, PDGFA, PIK3R3, RASGRP1, GNAI1, HSP90B1, RASGRP3, GNAI2, GNA13, MAPK8, RXRA, ERBB2, DVL2, PLCG2, FGF23, NTRK1, JUN, SMAD4, TGFB1, SMAD3, JUP, LAMB3, EGF, STAT3, FN1, PTK2, PML, NFKB2, MAPK10, FGF17, RAD51, CDK4, FGF19, GNB1, CDK2, GNAS, MDM2, CTNNB1, GRB2, FGF13, FGF11, FGF10, FGFR1 | 77 |
| hsa04015:Rap1 signaling pathway | 8 | 0.001306141 | PDGFRA, PIK3CA, CTNNB1, BRAF, KRAS, PLCG1, PIK3R1, EGFR | 57 | 1.17E-20 | FLT1, ITGAM, ITGA2B, CTNND1, FGF1, ITGAL, PIK3CG, FGF6, FGF7, FGF8, FGF9, KDR, RAC3, PLCE1, RAC1, PRKCI, MAP2K2, MAGI2, RHOA, PLCB3, PLCB4, PRKD3, PRKD2, LCP2, PRKD1, PLCB1, PLCB2, CRK, SRC, GNAI3, PDGFA, PIK3R3, THBS1, GNAI1, INS, RASGRP3, GNAI2, RAP1B, RAP1A, RRAS, PDGFC, FGF23, EGF, MAPK14, GRIN2B, MAPK12, MAPK13, EFNA1, GNAO1, FGF17, FGF19, GNAS, CTNNB1, FGF13, FGF11, FGF10, FGFR1 | 56 |
| hsa04010:MAPK signaling pathway | 11 | 2.57E-05 | MAP2K4, PDGFRA, MAP3K1, MECOM, NF1, BRAF, KRAS, SOS1, TP53, EGFR, MAP3K4 | 60 | 1.25E-18 | HSPB1, FASLG, FGF1, FGF6, FGF7, FGF8, FGF9, RPS6KA2, RAC3, RAC1, PRKACB, MAP3K7, MAP3K5, MAP2K4, MEF2C, MAP2K2, RRAS2, FOS, RASA1, IL1B, SOS1, CRK, SOS2, PDGFA, RASGRP1, RASGRP3, RAP1B, PAK1, MAPK8, RAP1A, RRAS, MAP2K7, FGF23, PAK2, MAP2K5, NTRK1, NTRK2, HSPA8, MAP3K3, JUN, TGFB1, JUND, GADD45B, EGF, GADD45A, NFATC1, MAPK14, MAPK12, NFKB2, MAPK13, MAPK10, FGF17, PPP5C, FGF19, NF1, GRB2, FGF13, FGF11, FGF10, FGFR1 | 57 |
| hsa04014:Ras signaling pathway | 8 | 0.001993503 | PDGFRA, PIK3CA, NF1, KRAS, PLCG1, PIK3R1, SOS1, EGFR | 55 | 1.29E-17 | FLT1, FASLG, FGF1, ETS1, PIK3CG, FGF6, FGF7, TBK1, FGF8, FGF9, KDR, RAC3, PLCE1, RAC1, PRKACB, MAP2K2, GAB1, RRAS2, GAB2, RHOA, RASA1, SOS1, SOS2, PDGFA, PIK3R3, FOXO4, RASAL2, RASGRP1, INS, RASGRP3, RAP1B, PAK1, MAPK8, RAP1A, RRAS, PDGFC, PLCG2, PAK6, FGF23, PAK2, PAK4, BRAP, EGF, GRIN2B, EFNA1, MAPK10, FGF17, FGF19, GNB1, NF1, GRB2, FGF13, FGF11, FGF10, FGFR1 | 53 |
| hsa05169:Epstein-Barr virus infection | 7 | 0.000392 | LYN, RB1, MAP2K4, PIK3CA, STAT3, PIK3R1, TP53 | 39 | 8.86E-17 | RB1, PSMD12, PSMD11, PSMD13, HDAC1, PIK3R3, ITGAL, RBPJ, PIK3CG, ICAM1, PSMD8, MAPK8, PSMD7, TBK1, PSMD4, PLCG2, PSMD1, SKP2, MAP2K7, MAP3K7, JAK1, MAP2K4, JUN, SYK, STAT3, MAPK14, MAPK12, MAPK13, NFKB2, MAPK10, CCNA2, PSMC5, SNW1, PSMC3, PSMC4, NEDD4, CDK2, MDM2, HLA-DRA | 36 |
| hsa04151:PI3K-Akt signaling pathway | 12 | 7.04E-05 | PDGFRA, PIK3CA, MYB, PTEN, FN1, KRAS, PIK3R1, SOS1, TP53, TLR4, EGFR, MTOR | 65 | 8.81E-15 | FLT1, HSP90AB1, ITGB4, ITGA2B, PPP2R2A, LAMC2, FASLG, BRCA1, LAMC1, FGF1, PIK3CG, FGF6, STK11, FGF7, FGF8, FGF9, PPP2R1A, KDR, ITGAV, RAC1, JAK1, HSP90AA1, MAP2K2, IL4R, SYK, RPS6, PPP2R5B, TSC1, PPP2R5C, PRLR, SOS1, SOS2, TLR2, PRKAA1, PRKAA2, PDGFA, PIK3R3, FOXO3, THBS1, HSP90B1, INS, PPP2CB, RXRA, PDGFC, FGF23, LAMB3, EGF, FN1, PTK2, EFNA1, FGF17, IL7, CDK4, IL2RA, FGF19, GNB1, CDK2, MDM2, GRB2, PKN2, FGF13, IL7R, FGF11, FGF10, FGFR1 | 63 |
| hsa04919:Thyroid hormone signaling pathway | 14 | 3.22E-12 | NOTCH1, NCOA3, PIK3R1, ESR1, MTOR, MED12, NCOR1, MED13, PIK3CA, EP300, CTNNB1, KRAS, PLCG1, TP53 | 35 | 2.58E-14 | NOTCH2, HDAC3, HDAC1, SRC, NOTCH4, PIK3R3, GATA4, MED16, PIK3CG, SLC9A1, MED17, MED14, RXRA, MED13, MED30, PLCG2, EP300, PLCE1, ITGAV, PRKACB, NCOA1, MAP2K2, NCOA3, MED27, MED13L, PLCB3, MED24, PLCB4, MDM2, CTNNB1, PLCD3, PLCB1, PLCD4, PLCB2, PLCD1 | 31 |
| hsa04810:Regulation of actin cytoskeleton | 8 | 0.001306141 | PDGFRA, PIK3CA, FN1, BRAF, KRAS, PIK3R1, SOS1, EGFR | 47 | 1.50E-13 | ITGAM, ITGB4, SRC, ITGA2B, PDGFA, PIK3R3, IQGAP1, FGF1, ITGAL, PIK3CG, SLC9A1, INS, GNA13, FGF6, PAK1, FGF7, FGF8, FGF9, RRAS, PDGFC, PAK6, RAC3, PIP5K1B, ITGAV, PIP4K2C, RAC1, PAK2, FGF23, PAK4, MAP2K2, GSN, EGF, FN1, RRAS2, RHOA, PTK2, PPP1CA, FGF17, MYL2, FGF19, FGF13, SOS1, CRK, SOS2, FGF11, FGF10, FGFR1 | 45 |
| hsa05142:Chagas disease (American trypanosomiasis) | 5 | 0.009315874 | SMAD2, MAP2K4, PIK3CA, PIK3R1, TLR4 | 32 | 2.92E-13 | SERPINE1, GNAI3, PIK3R3, PPP2R2A, FASLG, GNAI1, PIK3CG, GNAI2, PPP2CB, GNA14, GNA15, MAPK8, PPP2R1A, MAP2K4, JUN, TGFB1, SMAD3, FOS, MAPK14, TICAM1, MAPK12, MAPK13, GNAO1, MAPK10, PLCB3, PLCB4, IL1B, GNAS, PLCB1, PLCB2, MYD88, TLR2 | 31 |
| hsa04068:FoxO signaling pathway | 10 | 9.19E-07 | SMAD2, PIK3CA, STAT3, PTEN, EP300, BRAF, KRAS, PIK3R1, SOS1, EGFR | 36 | 6.34E-13 | PRKAA1, PRKAA2, IRS4, PRKAG2, PIK3R3, IRS2, FASLG, FOXO4, FOXO3, PIK3CG, INS, STK11, MAPK8, EP300, SKP2, PLK3, SMAD4, PRKAB2, TGFB1, MAP2K2, SMAD3, GADD45B, EGF, GADD45A, STAT3, MAPK14, SIRT1, MAPK12, MAPK13, MAPK10, CDK2, MDM2, GRB2, IL7R, SOS1, SOS2 | 33 |
| hsa05205:Proteoglycans in cancer | 16 | 2.27E-11 | STAT3, FN1, BRAF, PIK3R1, ESR1, EGFR, MTOR, PIK3CA, ERBB4, ERBB2, CTNNB1, KRAS, PLCG1, SOS1, TP53, TLR4 | 44 | 1.94E-12 | CAMK2B, CAMK2D, DDX5, SRC, SDC2, PIK3R3, FASLG, IQGAP1, THBS1, PIK3CG, SLC9A1, PAK1, RRAS, ERBB2, KDR, PLCG2, PLCE1, ITGAV, RAC1, PRKACB, TGFB1, MAP2K2, MMP2, RPS6, STAT3, FN1, GAB1, RRAS2, MAPK14, RHOA, MAPK12, PTK2, MAPK13, PPP1CA, CTTN, MDM2, CTNNB1, GRB2, PTPN6, NANOG, SOS1, SOS2, FGFR1, TLR2 | 39 |
| hsa04722:Neurotrophin signaling pathway | 9 | 4.16E-06 | MAP3K1, PIK3CA, BRAF, KRAS, PLCG1, PSEN1, PIK3R1, SOS1, TP53 | 31 | 9.90E-11 | CAMK2B, ZNF274, CAMK2D, PIK3R3, FASLG, FOXO3, PIK3CG, RAP1B, MAPK8, RAP1A, RPS6KA2, PLCG2, RAC1, MAP2K7, MAP2K5, MAP3K5, NTRK1, NTRK2, MAP3K3, JUN, MAP2K2, GAB1, MAPK14, RHOA, MAPK12, MAPK13, MAPK10, GRB2, SOS1, CRK, SOS2 | 30 |
| hsa04660:T cell receptor signaling pathway | 5 | 0.008133038 | PIK3CA, KRAS, PLCG1, PIK3R1, SOS1 | 28 | 1.32E-10 | ITK, PIK3R3, RASGRP1, PIK3CG, PAK1, GRAP2, PAK6, FYN, MAP2K7, PAK2, MAP3K7, PAK4, JUN, MAP2K2, NFATC2, NFATC1, FOS, MAPK14, RHOA, MAPK12, MAPK13, CDK4, GRB2, PTPN6, PRKCQ, LCP2, SOS1, SOS2 | 27 |
| hsa04071:Sphingolipid signaling pathway | 5 | 0.015154711 | PIK3CA, PTEN, KRAS, PIK3R1, TP53 | 30 | 4.92E-10 | SGMS1, GNAI3, PIK3R3, PPP2R2A, GNAI1, PIK3CG, GNAI2, GNA13, PPP2CB, MAPK8, PPP2R1A, RAC3, FYN, RAC1, MAP3K5, MAP2K2, PRKCE, PPP2R5B, PPP2R5C, GAB2, MAPK14, RHOA, MAPK12, MAPK13, MAPK10, PLCB3, PLCB4, PLCB1, PLCB2, NSMAF | 30 |
| hsa04310:Wnt signaling pathway | 4 | 0.097667407 | EP300, CTNNB1, PSEN1, TP53 | 32 | 8.66E-10 | CAMK2B, CAMK2D, CTBP1, LEF1, CUL1, LRP5, LRP6, MAPK8, DVL2, EP300, RAC3, RAC1, TBL1X, MAP3K7, PRKACB, JUN, SMAD4, CSNK2A1, FBXW11, SIAH1, NFATC2, NFATC1, RHOA, NFATC4, RBX1, MAPK10, PLCB3, PLCB4, CTNNB1, PLCB1, PLCB2, PPARD | 30 |
| hsa04012:ErbB signaling pathway | 11 | 1.14E-09 | MAP2K4, PIK3CA, ERBB4, ERBB2, BRAF, KRAS, PLCG1, PIK3R1, SOS1, EGFR, MTOR | 25 | 8.93E-10 | CAMK2B, CAMK2D, SRC, PIK3R3, PIK3CG, PAK1, MAPK8, ERBB2, PLCG2, PAK6, MAP2K7, PAK2, PAK4, MAP2K4, JUN, MAP2K2, EGF, GAB1, PTK2, EREG, MAPK10, GRB2, SOS1, CRK, SOS2 | 22 |
| hsa05211:Renal cell carcinoma | 6 | 0.000167 | PIK3CA, EP300, BRAF, KRAS, PIK3R1, SOS1 | 21 | 3.86E-09 | JUN, TGFB1, MAP2K2, EPAS1, GAB1, PIK3R3, ETS1, PIK3CG, RBX1, RAP1B, PAK1, RAP1A, EP300, PAK6, GRB2, RAC1, SOS1, PAK2, CRK, SOS2, PAK4 | 19 |
| hsa04110:Cell cycle | 9 | 5.32E-06 | RB1, SMAD2, MCM7, CHEK2, RAD21, EP300, SMC1A, TP53, ATR | 29 | 5.14E-09 | RB1, PCNA, MCM7, PRKDC, HDAC1, CUL1, SMC3, EP300, SFN, E2F4, SKP2, SMAD4, TGFB1, SMAD3, GADD45B, GADD45A, SMC1A, SMC1B, RBX1, CCNA2, DBF4, STAG2, TFDP1, TFDP2, CDK4, CDK2, MDM2, MCM4, MCM2 | 25 |
| hsa04510:Focal adhesion | 10 | 3.13E-05 | PDGFRA, PIK3CA, ERBB2, PTEN, FN1, CTNNB1, BRAF, PIK3R1, SOS1, EGFR | 38 | 1.46E-08 | FLT1, ITGB4, SRC, ITGA2B, PDGFA, PIK3R3, LAMC2, LAMC1, THBS1, PIK3CG, RAP1B, PAK1, MAPK8, RAP1A, ERBB2, PDGFC, KDR, PAK6, RAC3, ITGAV, FYN, RAC1, PAK2, PAK4, JUN, LAMB3, EGF, FN1, RHOA, PTK2, PPP1CA, MAPK10, MYL2, CTNNB1, GRB2, SOS1, CRK, SOS2 | 34 |
| hsa04915:Estrogen signaling pathway | 6 | 0.001097833 | PIK3CA, KRAS, PIK3R1, SOS1, ESR1, EGFR | 25 | 1.50E-08 | HSP90AB1, SRC, GNAI3, PIK3R3, GNAI1, PIK3CG, HSP90B1, GNAI2, PRKACB, HSPA8, JUN, HSP90AA1, MAP2K2, MMP2, FOS, ESR2, GNAO1, PLCB3, PLCB4, GNAS, GRB2, PLCB1, SOS1, PLCB2, SOS2 | 24 |
| hsa05218:Melanoma | 9 | 7.12E-08 | RB1, PDGFRA, PIK3CA, PTEN, BRAF, KRAS, PIK3R1, TP53, EGFR | 21 | 1.57E-08 | RB1, MAP2K2, EGF, PDGFA, PIK3R3, FGF1, PIK3CG, FGF17, FGF6, FGF7, FGF8, FGF9, CDK4, FGF19, PDGFC, MDM2, FGF13, FGF23, FGF11, FGF10, FGFR1 | 20 |
| hsa04664:Fc epsilon RI signaling pathway | 7 | 1.48E-05 | LYN, MAP2K4, PIK3CA, KRAS, PLCG1, PIK3R1, SOS1 | 20 | 4.17E-08 | MAP2K4, MAP2K2, SYK, PIK3R3, GAB2, MAPK14, PIK3CG, MAPK12, MAPK13, MAPK10, MAPK8, PLCG2, RAC3, LCP2, GRB2, FYN, RAC1, MAP2K7, SOS1, SOS2 | 18 |
| hsa05161:Hepatitis B | 11 | 1.65E-07 | RB1, MAP2K4, MAP3K1, PIK3CA, STAT3, PTEN, EP300, KRAS, PIK3R1, TP53, TLR4 | 30 | 4.98E-08 | RB1, PCNA, SRC, PIK3R3, FASLG, PIK3CG, MAPK8, TBK1, EP300, JAK1, MAP2K4, JUN, SMAD4, TGFB1, MAP2K2, STAT3, NFATC2, NFATC1, FOS, TICAM1, TIRAP, NFATC4, MAPK10, CCNA2, CDK4, CDK2, IRF7, GRB2, MYD88, TLR2 | 26 |
| hsa04912:GnRH signaling pathway | 6 | 0.000749 | MAP2K4, MAP3K1, KRAS, SOS1, EGFR, MAP3K4 | 23 | 6.37E-08 | CAMK2B, MAP2K4, MAP3K3, JUN, CAMK2D, MAP2K2, SRC, MMP2, MAPK14, MAPK12, MAPK13, MAPK10, PLCB3, MAPK8, PLCB4, GNAS, GRB2, PLCB1, MAP2K7, SOS1, PLCB2, PRKACB, SOS2 | 21 |
| hsa04917:Prolactin signaling pathway | 6 | 0.000237 | PIK3CA, STAT3, KRAS, PIK3R1, SOS1, ESR1 | 20 | 8.96E-08 | MAP2K2, SRC, STAT3, PIK3R3, FOS, FOXO3, MAPK14, PRLR, PIK3CG, ESR2, MAPK12, MAPK13, INS, MAPK10, SOCS3, MAPK8, GRB2, SOS1, SOS2, SOCS5 | 18 |
| hsa05215:Prostate cancer | 14 | 9.26E-14 | RB1, PDGFRA, PTEN, BRAF, PIK3R1, EGFR, MTOR, PIK3CA, ERBB2, EP300, CTNNB1, KRAS, SOS1, TP53 | 21 | 7.45E-07 | RB1, HSP90AA1, MAP2K2, HSP90AB1, EGF, LEF1, PDGFA, PIK3R3, PIK3CG, INS, HSP90B1, PDGFC, ERBB2, CDK2, MDM2, EP300, CTNNB1, GRB2, SOS1, SOS2, FGFR1 | 16 |
| hsa05203:Viral carcinogenesis | 9 | 0.000198 | LYN, RB1, PIK3CA, STAT3, EP300, CHD4, KRAS, PIK3R1, TP53 | 34 | 1.26E-06 | HDAC4, RB1, GTF2A1, HDAC5, SP100, HDAC3, HDAC10, HDAC1, SRC, PIK3R3, RBPJ, HDAC9, PIK3CG, EP300, PMAIP1, RAC1, SKP2, PRKACB, JAK1, JUN, GSN, TBP, SYK, STAT3, GTF2H3, RHOA, NFKB2, CCNA2, SNW1, CDK4, CDK2, IRF7, MDM2, GRB2 | 31 |
| hsa04520:Adherens junction | 5 | 0.002390059 | SMAD2, ERBB2, EP300, CTNNB1, EGFR | 18 | 2.36E-06 | SMAD4, SMAD3, CSNK2A1, SRC, LEF1, CTNND1, IQGAP1, RHOA, ERBB2, EP300, RAC3, CTNNB1, SNAI2, FYN, PTPN6, RAC1, MAP3K7, FGFR1 | 15 |
| hsa05212:Pancreatic cancer | 11 | 5.80E-11 | RB1, SMAD2, PIK3CA, ERBB2, STAT3, BRAF, KRAS, PIK3R1, BRCA2, TP53, EGFR | 17 | 3.17E-06 | RB1, SMAD4, TGFB1, SMAD3, EGF, STAT3, PIK3R3, BRCA2, PIK3CG, MAPK10, MAPK8, RAD51, CDK4, ERBB2, RAC3, RAC1, JAK1 | 13 |
| hsa04550:Signaling pathways regulating pluripotency of stem cells | 8 | 0.000112 | SMAD2, PIK3CA, RIF1, STAT3, CTNNB1, KRAS, PIK3R1, TBX3 | 26 | 3.83E-06 | RIF1, ONECUT1, PIK3R3, PIK3CG, SOX2, DVL2, SKIL, JAK1, SMAD4, MAP2K2, SMAD3, STAT3, PAX6, INHBA, MAPK14, KLF4, TBX3, MAPK12, MAPK13, REST, MEIS1, ID2, CTNNB1, GRB2, NANOG, FGFR1 | 22 |
| hsa04670:Leukocyte transendothelial migration | 4 | 0.063820446 | PIK3CA, CTNNB1, PLCG1, PIK3R1 | 23 | 4.59E-06 | ITK, ITGAM, MMP2, CTNND1, GNAI3, RHOH, PIK3R3, ITGAL, MAPK14, RHOA, PIK3CG, GNAI1, PTK2, MAPK12, MAPK13, GNAI2, ICAM1, RAP1B, RAP1A, MYL2, PLCG2, CTNNB1, RAC1 | 22 |
| hsa03460:Fanconi anemia pathway | 3 | 0.066758323 | FANCA, BRCA2, ATR | 15 | 5.38E-06 | MUS81, BLM, WDR48, RMI1, TOP3A, RPA1, BRCA1, BRCA2, PALB2, BRIP1, RAD51, RAD51C, RPA3, HES1, ATRIP | 14 |
| hsa05210:Colorectal cancer | 7 | 8.61E-06 | SMAD2, PIK3CA, CTNNB1, BRAF, KRAS, PIK3R1, TP53 | 16 | 8.11E-06 | JUN, SMAD4, TGFB1, SMAD3, LEF1, PIK3R3, FOS, RHOA, PIK3CG, MAPK10, MSH6, MAPK8, MSH2, RAC3, CTNNB1, RAC1 | 15 |
| hsa04540:Gap junction | 4 | 0.032924884 | PDGFRA, KRAS, SOS1, EGFR | 19 | 1.30E-05 | MAP2K2, SRC, EGF, GNAI3, PDGFA, CSNK1D, GNAI1, GNAI2, PLCB3, PLCB4, PDGFC, GNAS, GRB2, PLCB1, SOS1, PLCB2, PRKACB, SOS2, MAP2K5 | 18 |
| hsa04024:cAMP signaling pathway | 5 | 0.072895552 | GRIN3A, PIK3CA, EP300, BRAF, PIK3R1 | 31 | 1.35E-05 | CAMK2B, CAMK2D, GNAI3, PIK3R3, GNAI1, PIK3CG, GNAI2, SLC9A1, RAP1B, PAK1, MAPK8, RAP1A, RRAS, EP300, RAC3, PLCE1, SOX9, RAC1, PRKACB, JUN, MAP2K2, RRAS2, NFATC1, FOS, GRIN2C, SSTR2, GRIN2B, RHOA, PPP1CA, MAPK10, GNAS | 30 |
| hsa04620:Toll-like receptor signaling pathway | 4 | 0.052398885 | MAP2K4, PIK3CA, PIK3R1, TLR4 | 21 | 1.55E-05 | MAP2K4, JUN, MAP2K2, PIK3R3, FOS, TICAM1, MAPK14, PIK3CG, TIRAP, MAPK12, MAPK13, MAPK10, MAPK8, TBK1, IL1B, IRF7, RAC1, MAP2K7, MAP3K7, MYD88, TLR2 | 20 |
| hsa04730:Long-term depression | 3 | 0.082803049 | LYN, BRAF, KRAS | 15 | 2.53E-05 | GNAZ, MAP2K2, GNAI3, GNAI1, GNAI2, GNA13, GNAO1, PPP2CB, PLCB3, PLCB4, PPP2R1A, GNAS, NOS1, PLCB1, PLCB2 | 15 |
| hsa04662:B cell receptor signaling pathway | 5 | 0.002151754 | LYN, PIK3CA, KRAS, PIK3R1, SOS1 | 16 | 3.22E-05 | JUN, MAP2K2, SYK, NFATC2, PIK3R3, NFATC1, FOS, PIK3CG, RASGRP3, PLCG2, RAC3, GRB2, PTPN6, RAC1, SOS1, SOS2 | 15 |
| hsa05160:Hepatitis C | 8 | 8.08E-05 | PIK3CA, STAT3, BRAF, KRAS, PIK3R1, SOS1, TP53, EGFR | 23 | 5.02E-05 | EGF, STAT3, PIK3R3, PPP2R2A, TICAM1, MAPK14, PIK3CG, MAPK12, MAPK13, MAPK10, PPP2CB, SOCS3, MAPK8, RXRA, TBK1, PPP2R1A, PSME3, IRF7, GRB2, SOS1, LDLR, SOS2, JAK1 | 21 |
| hsa05146:Amoebiasis | 4 | 0.052398885 | PIK3CA, FN1, PIK3R1, TLR4 | 20 | 5.30E-05 | TGFB1, ITGAM, LAMB3, FN1, HSPB1, PIK3R3, LAMC2, LAMC1, PIK3CG, PTK2, GNA14, GNA15, PLCB3, PLCB4, IL1B, GNAS, PLCB1, PLCB2, PRKACB, TLR2 | 19 |
| hsa05220:Chronic myeloid leukemia | 9 | 7.96E-08 | RB1, PIK3CA, MECOM, BRAF, KRAS, PIK3R1, SOS1, TP53, RUNX1 | 16 | 5.46E-05 | RB1, SMAD4, TGFB1, MAP2K2, CTBP1, HDAC1, PIK3R3, GAB2, PIK3CG, RUNX1, CDK4, MDM2, GRB2, SOS1, CRK, SOS2 | 13 |
| hsa05164:Influenza A | 5 | 0.04971707 | MAP2K4, PIK3CA, EP300, PIK3R1, TLR4 | 27 | 6.48E-05 | PIK3R3, FASLG, PIK3CG, ICAM1, SOCS3, MAPK8, TBK1, EP300, MAP2K7, JAK1, MAP2K4, HSPA8, IL33, JUN, MAP2K2, TNFRSF10B, TNFRSF10A, MAPK14, TICAM1, MAPK12, PML, MAPK13, MAPK10, IL1B, IRF7, HLA-DRA, MYD88 | 25 |
| hsa04720:Long-term potentiation | 3 | 0.097395275 | EP300, BRAF, KRAS | 15 | 7.83E-05 | CAMK2B, CAMK2D, MAP2K2, GRIN2C, GRIN2B, PPP1CA, RAP1B, PLCB3, RAP1A, PLCB4, RPS6KA2, EP300, PLCB1, PLCB2, PRKACB | 14 |
| hsa04650:Natural killer cell mediated cytotoxicity | 6 | 0.002769206 | PIK3CA, BRAF, KRAS, PLCG1, PIK3R1, SOS1 | 21 | 0.000125 | MAP2K2, SYK, NFATC2, PIK3R3, TNFRSF10B, FASLG, NFATC1, TNFRSF10A, ITGAL, PIK3CG, ICAM1, PAK1, PLCG2, RAC3, LCP2, GRB2, FYN, PTPN6, RAC1, SOS1, SOS2 | 20 |
| hsa04370:VEGF signaling pathway | 4 | 0.012551185 | PIK3CA, KRAS, PLCG1, PIK3R1 | 14 | 0.000134 | MAP2K2, SRC, NFATC2, HSPB1, PIK3R3, MAPK14, PIK3CG, PTK2, MAPK12, MAPK13, KDR, PLCG2, RAC3, RAC1 | 14 |
| hsa04914:Progesterone-mediated oocyte maturation | 4 | 0.031979368 | PIK3CA, BRAF, KRAS, PIK3R1 | 17 | 0.00015 | HSP90AA1, HSP90AB1, GNAI3, PIK3R3, MAPK14, PIK3CG, GNAI1, MAPK12, MAPK13, INS, GNAI2, MAPK10, CCNA2, MAPK8, RPS6KA2, CDK2, PRKACB | 17 |
| hsa04330:Notch signaling pathway | 3 | 0.056033759 | NOTCH1, EP300, PSEN1 | 12 | 0.000222 | NOTCH2, NCSTN, SNW1, MAML1, HDAC1, CTBP1, NOTCH4, DVL2, EP300, HES1, RBPJ, HES5 | 11 |
| hsa05223:Non-small cell lung cancer | 10 | 3.83E-10 | RB1, PIK3CA, ERBB2, BRAF, KRAS, PLCG1, PIK3R1, SOS1, TP53, EGFR | 13 | 0.000228 | RB1, MAP2K2, EGF, PIK3R3, FOXO3, PIK3CG, RXRA, CDK4, ERBB2, PLCG2, GRB2, SOS1, SOS2 | 10 |
| hsa05221:Acute myeloid leukemia | 8 | 2.42E-07 | PIK3CA, STAT3, BRAF, KRAS, PIK3R1, SOS1, MTOR, RUNX1 | 13 | 0.000228 | MAP2K2, JUP, LEF1, STAT3, PIK3R3, PIK3CG, PML, RUNX1, RARA, GRB2, SOS1, SOS2, PPARD | 10 |
| hsa04910:Insulin signaling pathway | 7 | 0.000756 | PIK3CA, PRKAR1A, BRAF, KRAS, PIK3R1, SOS1, MTOR | 22 | 0.000251 | PRKCI, PRKAA1, PRKAB2, MAP2K2, PRKAA2, RPS6, IRS4, PIK3R3, PRKAG2, TSC1, IRS2, PIK3CG, INS, PPP1CA, MAPK10, SOCS3, MAPK8, GRB2, SOS1, CRK, PRKACB, SOS2 | 21 |
| hsa05214:Glioma | 12 | 1.92E-12 | RB1, PDGFRA, PIK3CA, PTEN, BRAF, KRAS, PLCG1, PIK3R1, SOS1, TP53, EGFR, MTOR | 14 | 0.000262 | RB1, CAMK2B, CAMK2D, MAP2K2, EGF, PDGFA, PIK3R3, PIK3CG, CDK4, MDM2, PLCG2, GRB2, SOS1, SOS2 | 12 |
| hsa05166:HTLV-I infection | 15 | 6.89E-09 | RB1, SMAD2, PDGFRA, MAP2K4, MAP3K1, PIK3R1, PIK3CA, CHEK2, MYB, EP300, CTNNB1, KRAS, POLE, TP53, ATR | 33 | 0.000274 | RB1, PCNA, PDGFA, PIK3R3, ITGAL, ETS1, PIK3CG, ICAM1, ZFP36, RRAS, POLD2, DVL2, EP300, PRKACB, JAK1, MAP2K4, EGR1, MAP3K3, JUN, SMAD4, TGFB1, SMAD3, TBP, RRAS2, NFATC2, NFATC1, FOS, NFATC4, NFKB2, CDK4, IL2RA, CTNNB1, HLA-DRA | 29 |
| hsa04062:Chemokine signaling pathway | 7 | 0.003476694 | LYN, PIK3CA, STAT3, BRAF, KRAS, PIK3R1, SOS1 | 26 | 0.000483 | ITK, GSK3A, SRC, GNAI3, PIK3R3, FOXO3, GNAI1, PIK3CG, GNAI2, RAP1B, PAK1, RAP1A, RAC1, PRKACB, STAT3, RHOA, PTK2, PLCB3, PLCB4, GNB1, GRB2, PLCB1, SOS1, PLCB2, CRK, SOS2 | 24 |
| hsa05231:Choline metabolism in cancer | 8 | 1.36E-05 | PDGFRA, PIK3CA, KRAS, PLCG1, PIK3R1, SOS1, EGFR, MTOR | 17 | 0.00086 | JUN, MAP2K2, EGF, PDGFA, PIK3R3, TSC1, FOS, PIK3CG, MAPK10, MAPK8, PDGFC, RAC3, GRB2, PIP5K1B, RAC1, SOS1, SOS2 | 16 |
| hsa05162:Measles | 5 | 0.021302398 | PIK3CA, STAT3, PIK3R1, TP53, TLR4 | 20 | 0.00108191 | HSPA8, CSNK2A1, STAT3, PIK3R3, TNFRSF10B, FASLG, TNFRSF10A, PIK3CG, TBK1, CDK4, IL1B, IL2RA, CDK2, IRF7, FYN, PRKCQ, MAP3K7, MYD88, JAK1, TLR2 | 19 |
| hsa04150:mTOR signaling pathway | 5 | 0.001126853 | PIK3CA, PTEN, BRAF, PIK3R1, MTOR | 12 | 0.001228971 | PRKAA1, STK11, RRAGA, PRKAA2, RRAGB, RPS6KA2, RPS6, PIK3R3, TSC1, RICTOR, PIK3CG, INS | 12 |
| hsa04115:p53 signaling pathway | 4 | 0.016155406 | CHEK2, PTEN, TP53, ATR | 13 | 0.001265098 | GADD45B, GADD45A, IGFBP3, SIAH1, SERPINE1, PPM1D, THBS1, CDK4, CDK2, MDM2, PMAIP1, MDM4, SFN | 13 |
| hsa04066:HIF-1 signaling pathway | 9 | 7.61E-07 | PIK3CA, ERBB2, STAT3, EP300, PLCG1, PIK3R1, TLR4, EGFR, MTOR | 16 | 0.001428784 | CAMK2B, CAMK2D, EDN1, MAP2K2, FLT1, EGF, RPS6, STAT3, SERPINE1, PIK3R3, PIK3CG, INS, RBX1, ERBB2, PLCG2, EP300 | 13 |
| hsa05213:Endometrial cancer | 10 | 1.91E-10 | PIK3CA, ERBB2, PTEN, CTNNB1, BRAF, KRAS, PIK3R1, SOS1, TP53, EGFR | 11 | 0.001820115 | MAP2K2, EGF, ERBB2, LEF1, PIK3R3, CTNNB1, GRB2, FOXO3, SOS1, SOS2, PIK3CG | 8 |
| hsa05321:Inflammatory bowel disease (IBD) | 3 | 0.092452065 | SMAD2, STAT3, TLR4 | 12 | 0.002806064 | JUN, TGFB1, SMAD3, IL4R, IL1B, STAT3, HLA-DRA, NFATC1, RORA, NOD2, IL12RB1, TLR2 | 11 |
| hsa05222:Small cell lung cancer | 6 | 0.000548 | RB1, PIK3CA, PTEN, FN1, PIK3R1, TP53 | 14 | 0.003528729 | RB1, LAMB3, ITGA2B, FN1, PIK3R3, LAMC2, LAMC1, PIK3CG, PTK2, RXRA, CDK4, CDK2, ITGAV, SKP2 | 12 |
| hsa04931:Insulin resistance | 5 | 0.010606037 | PIK3CA, STAT3, PTEN, PIK3R1, MTOR | 16 | 0.004619936 | PRKAA1, PRKAB2, PRKAA2, PRKCE, STAT3, PIK3R3, PRKAG2, IRS2, PIK3CG, INS, PPP1CA, MAPK10, SOCS3, MAPK8, RPS6KA2, PRKCQ | 15 |
| hsa05219:Bladder cancer | 6 | 1.63E-05 | RB1, ERBB2, BRAF, KRAS, TP53, EGFR | 9 | 0.00467454 | RB1, MAP2K2, SRC, CDK4, EGF, MMP2, ERBB2, MDM2, THBS1 | 7 |
| hsa05100:Bacterial invasion of epithelial cells | 4 | 0.024129714 | PIK3CA, FN1, CTNNB1, PIK3R1 | 13 | 0.004740374 | SRC, RHOG, GAB1, FN1, PIK3R3, RHOA, PIK3CG, PTK2, DNM2, CTTN, CTNNB1, RAC1, CRK | 11 |
| hsa05120:Epithelial cell signaling in Helicobacter pylori infection | 4 | 0.016155406 | LYN, MAP2K4, PLCG1, EGFR | 11 | 0.011784695 | MAPK10, MAP2K4, PAK1, JUN, MAPK8, SRC, PLCG2, RAC1, MAPK14, MAPK12, MAPK13 | 10 |
| hsa04930:Type II diabetes mellitus | 3 | 0.056033759 | PIK3CA, PIK3R1, MTOR | 9 | 0.012328249 | MAPK10, SOCS3, MAPK8, PRKCE, IRS4, PIK3R3, IRS2, PIK3CG, INS | 9 |
| hsa04070:Phosphatidylinositol signaling system | 4 | 0.043176103 | PIK3CA, PTEN, PLCG1, PIK3R1 | 13 | 0.027043885 | PIK3R3, PIK3CG, PLCB3, PLCB4, PLCG2, PLCE1, PIP5K1B, PIP4K2C, PLCD3, PLCB1, PLCD4, PLCB2, PLCD1 | 13 |
| hsa04630:Jak-STAT signaling pathway | 5 | 0.028170152 | PIK3CA, STAT3, EP300, PIK3R1, SOS1 | 17 | 0.028945445 | IL4R, STAT3, PIK3R3, PRLR, PIK3CG, SOCS3, IL7, IL2RA, EP300, GRB2, PTPN6, IL12RB1, IL7R, SOS1, SOS2, JAK1, SOCS5 | 14 |
| hsa04320:Dorso-ventral axis formation | 4 | 0.001235005 | NOTCH1, KRAS, SOS1, EGFR | 6 | 0.029548354 | NOTCH2, NOTCH4, GRB2, SOS1, ETS1, SOS2 | 5 |
| hsa04666:Fc gamma R-mediated phagocytosis | 4 | 0.029230576 | LYN, PIK3CA, PLCG1, PIK3R1 | 11 | 0.048789435 | PAK1, GSN, SYK, PRKCE, PLCG2, PIK3R3, PIP5K1B, GAB2, RAC1, CRK, PIK3CG | 11 |
| hsa05206:MicroRNAs in cancer | 13 | 1.87E-06 | PDGFRA, NOTCH1, STAT3, DNMT3A, PTEN, EGFR, MTOR, ERBB2, EP300, KRAS, PLCG1, SOS1, TP53 | 27 | 0.058705108 | NOTCH2, DNMT1, NOTCH4, PDGFA, IRS2, BRCA1, THBS1, ERBB2, PLCG2, DNMT3B, CYP1B1, EP300, PAK4, MAP2K2, PRKCE, STAT3, DNMT3A, SIRT1, RHOA, ZEB1, MDM2, GRB2, MDM4, SOS1, CRK, SOS2, EZH2 | 22 |
| hsa04020:Calcium signaling pathway | 5 | 0.05414965 | PDGFRA, ERBB4, ERBB2, PLCG1, EGFR | 18 | 0.081473275 | CAMK2B, CAMK2D, GRIN2C, GNA14, GNA15, PLCB3, PLCB4, ERBB2, PLCG2, GNAS, PLCE1, NOS1, PLCD3, PLCB1, PLCD4, PLCB2, PRKACB, PLCD1 | 17 |

**Table 5. The pathway intersection of driver genes and downstream genes in breast cancer of Normal subtype**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Term | drivers\_count | driver\_pvalue | drivers | Out\_count | Out\_pvalue | Outs | Outs\_drivers\_count |
| hsa05200:Pathways in cancer | 23 | 6.31E-12 | RB1, SMAD2, PDGFRA, CDKN1B, STAT3, PTEN, FN1, BRAF, PIK3R1, EGFR, MTOR, RUNX1, PIK3CA, CCND1, CDH1, TPR, ERBB2, EP300, CTNNB1, KRAS, PLCG1, SOS1, TP53 | 118 | 2.60E-39 | RB1, SPI1, FGF1, FGF2, FGF3, IGF1R, FGF5, FGF6, CCND1, MYC, PRKACG, EP300, SKP2, PRKACA, PDGFRB, PRKCG, PDGFRA, MAP2K1, MAP2K2, HGF, PRKCA, RBX1, MSH2, RAF1, TP53, EPAS1, PDGFB, PDGFA, TGFA, KLK3, RASGRP1, FOXO1, HSP90B1, PIK3R5, DVL1, FGF20, PLCG2, DVL3, PLCG1, FGF23, FGF21, SMAD2, FZD3, CREBBP, JUN, SMAD4, TGFB1, JUP, FZD4, FN1, BRAF, PTK2, NFKB1, NFKB2, FGF17, FGF14, CDK6, GNB1, CDK2, FGF13, FGF11, FGF10, FGFR1, CDKN1A, PIK3CD, LAMC2, PIK3CB, GLI1, PIK3CG, GLI3, CKS1B, GLI2, RAC2, RAC3, ITGAV, IKBKG, RAC1, HRAS, JAK1, HSP90AA1, CHUK, ITGA2, MMP2, RHOA, PLCB3, PIK3CA, RARB, ITGA6, PPARG, PLCB2, SOS2, BIRC2, PPARD, LAMA5, HDAC2, LAMA3, LEF1, CXCR4, CBL, RELA, EGFR, GNAI2, GNA13, MAPK9, NRAS, ERBB2, E2F1, CTNNA1, E2F2, E2F3, NTRK1, CDKN2B, LAMB3, CDKN2A, EGF, KITLG, FAS, KRAS | 105 |
| hsa05218:Melanoma | 11 | 1.11E-09 | RB1, PDGFRA, CCND1, PIK3CA, CDH1, PTEN, BRAF, KRAS, PIK3R1, TP53, EGFR | 44 | 1.37E-29 | RB1, CDKN1A, PDGFB, PDGFA, PIK3CD, PIK3CB, FGF1, FGF2, FGF3, EGFR, PIK3CG, IGF1R, PIK3R5, FGF5, FGF6, NRAS, CCND1, PDGFC, E2F1, FGF20, E2F2, E2F3, HRAS, FGF23, FGF21, PDGFRB, PDGFRA, MAP2K1, MAP2K2, CDKN2A, EGF, HGF, BRAF, FGF17, FGF14, CDK6, PIK3CA, KRAS, RAF1, FGF13, TP53, FGF11, FGF10, FGFR1 | 36 |
| hsa04014:Ras signaling pathway | 8 | 0.006129538 | PDGFRA, PIK3CA, NF1, KRAS, PLCG1, PIK3R1, SOS1, EGFR | 72 | 2.96E-25 | FLT1, PIK3CD, PIK3CB, FGF1, FGF2, PIK3CG, FGF3, IGF1R, FGF5, FGF6, PRKACG, RAC2, RAC3, IKBKG, RAC1, PRKACA, HRAS, PDGFRB, PRKCG, PDGFRA, MAP2K1, MAP2K2, CHUK, HGF, PLA2G4A, PRKCA, RHOA, MRAS, PIK3CA, RASA1, RAF1, SOS2, SHC4, SHC2, PDGFB, PDGFA, FOXO4, RASAL2, PLD1, RASGRP1, EGFR, RELA, PIK3R5, MAPK9, NRAS, PAK1, RRAS, PDGFC, FGF20, PLCG2, PLCG1, PAK3, FGF23, FGF21, PAK4, BRAP, EGF, GRIN2B, NFKB1, GRIN1, EFNA1, FGF17, KITLG, FGF14, GNB1, NF1, KRAS, FGF13, LAT, FGF11, FGF10, FGFR1 | 66 |
| hsa04151:PI3K-Akt signaling pathway | 16 | 7.52E-07 | PDGFRA, CDKN1B, PTEN, FN1, TSC2, PIK3R1, EGFR, MTOR, CREB1, PIK3CA, CCND1, MYB, KRAS, SOS1, TP53, TLR4 | 90 | 1.13E-24 | CDKN1A, CRTC2, FLT1, IRS1, YWHAB, ITGB4, ITGB3, PIK3CD, LAMC2, PIK3CB, FGF1, FGF2, PIK3CG, FGF3, IGF1R, FGF5, FGF6, CCND2, CCND1, PPP2R5E, MYC, MYB, ITGAV, IKBKG, RAC1, HRAS, JAK1, PDGFRB, PDGFRA, MAP2K1, HSP90AA1, MAP2K2, IL4R, SYK, ITGA4, CHUK, PDPK1, HGF, ITGA2, RPS6, PPP2R5A, PRKCA, PRLR, PIK3CA, ITGA6, RAF1, TP53, SOS2, LAMA5, PRKAA2, LAMA3, PDGFB, PDGFA, IL2RG, EGFR, RELA, HSP90B1, PIK3R5, PPP2CA, PPP2CB, NRAS, PDGFC, FGF20, FGF23, FGF21, MCL1, LAMB3, IFNB1, EGF, FN1, NFKB1, IL2, PTK2, GH2, EFNA1, IL4, FGF17, KITLG, FGF14, CDK6, RHEB, IL2RA, GNB1, CDK2, KRAS, FGF13, IL7R, FGF11, FGF10, FGFR1 | 82 |
| hsa05215:Prostate cancer | 17 | 8.03E-17 | RB1, PDGFRA, CDKN1B, PTEN, BRAF, PIK3R1, EGFR, MTOR, CREB1, PIK3CA, CCND1, ERBB2, EP300, CTNNB1, KRAS, SOS1, TP53 | 44 | 2.00E-24 | RB1, CDKN1A, LEF1, PDGFB, PDGFA, PIK3CD, TGFA, KLK3, PIK3CB, FOXO1, RELA, EGFR, PIK3CG, HSP90B1, IGF1R, PIK3R5, NRAS, CCND1, ERBB2, PDGFC, E2F1, E2F2, EP300, E2F3, IKBKG, HRAS, PDGFRB, PDGFRA, MAP2K1, CREBBP, HSP90AA1, MAP2K2, CHUK, EGF, PDPK1, BRAF, NFKB1, PIK3CA, CDK2, KRAS, RAF1, TP53, SOS2, FGFR1 | 34 |
| hsa05205:Proteoglycans in cancer | 18 | 3.61E-12 | STAT3, FN1, BRAF, PIK3R1, ESR1, EGFR, MTOR, PIK3CA, CCND1, ERBB4, ERBB2, FLNA, CTNNB1, KRAS, PLCG1, SOS1, TP53, TLR4 | 65 | 2.62E-23 | CDKN1A, ITGB3, PIK3CD, PIK3CB, FGF2, PIK3CG, IGF1R, PPP1CB, PPP1CC, CCND1, MYC, PRKACG, ITGAV, RAC1, PRKACA, HRAS, PRKCG, MAP2K1, MAP2K2, PDPK1, HGF, MMP2, ITGA2, RPS6, PRKCA, RHOA, DCN, MRAS, PIK3CA, CTTN, HCLS1, RAF1, TP53, SOS2, HBEGF, CAMK2D, SDC2, ITPR1, IQGAP1, CBL, HOXD10, EGFR, PIK3R5, NRAS, PAK1, ERBB3, RRAS, ERBB4, ERBB2, PLCG2, PLCG1, FZD3, TGFB1, FZD4, FN1, BRAF, ESR1, MAPK12, PTK2, PDCD4, FAS, KRAS, PTPN6, NANOG, FGFR1 | 54 |
| hsa05214:Glioma | 13 | 7.01E-13 | RB1, PDGFRA, PTEN, BRAF, PIK3R1, EGFR, MTOR, PIK3CA, CCND1, KRAS, PLCG1, SOS1, TP53 | 37 | 4.62E-23 | SHC4, RB1, CDKN1A, SHC2, CAMK2D, PDGFB, PDGFA, PIK3CD, TGFA, PIK3CB, EGFR, PIK3CG, IGF1R, PIK3R5, NRAS, CCND1, E2F1, PLCG2, E2F2, E2F3, PLCG1, HRAS, PRKCG, PDGFRB, PDGFRA, MAP2K1, MAP2K2, CDKN2A, EGF, PRKCA, BRAF, CDK6, PIK3CA, KRAS, RAF1, TP53, SOS2 | 28 |
| hsa04010:MAPK signaling pathway | 11 | 0.000148 | MAP2K4, PDGFRA, MAP3K1, NF1, FLNA, BRAF, KRAS, SOS1, TP53, EGFR, MAP3K4 | 73 | 9.99E-23 | HSPB1, FGF1, FGF2, FGF3, FGF5, RPS6KA3, FGF6, RPS6KA6, RPS6KA5, MYC, RPS6KA2, PRKACG, RAC2, RAC3, IKBKG, RAC1, PRKACA, HRAS, PDGFRB, MAP4K1, PRKCG, MAP2K4, PDGFRA, MAP2K1, MAP2K2, CHUK, PLA2G4A, PRKCA, PPM1A, MRAS, RASA1, MAPKAPK2, RAF1, TP53, SOS2, PDGFB, PDGFA, RASGRP1, EGFR, RELA, MAPK9, NRAS, PAK1, MAPK7, RRAS, NTF3, FGF20, FGF23, FGF21, MAP2K6, NTRK1, NTRK2, HSPA8, MAP3K3, JUN, TGFB1, MAP3K1, EGF, GADD45A, BRAF, NFATC1, MAPK12, NFKB1, NFKB2, FGF17, FGF14, NF1, FAS, KRAS, FGF13, FGF11, FGF10, FGFR1 | 65 |
| hsa04012:ErbB signaling pathway | 12 | 5.01E-10 | MAP2K4, CDKN1B, PIK3CA, ERBB4, ERBB2, BRAF, KRAS, PLCG1, PIK3R1, SOS1, EGFR, MTOR | 42 | 1.43E-22 | SHC4, CDKN1A, SHC2, CAMK2D, PIK3CD, TGFA, PIK3CB, CBL, EGFR, PIK3CG, PIK3R5, MAPK9, PAK1, NRAS, ERBB3, ERBB4, MYC, ERBB2, PLCG2, PLCG1, PAK3, HRAS, NCK1, PAK4, PRKCG, MAP2K4, JUN, MAP2K1, MAP2K2, EGF, PRKCA, NRG1, BRAF, NRG2, PTK2, EREG, PIK3CA, NRG4, KRAS, RAF1, SOS2, HBEGF | 34 |
| hsa05166:HTLV-I infection | 15 | 1.04E-07 | RB1, SMAD2, PDGFRA, MAP2K4, MAP3K1, PIK3R1, CREB1, PIK3CA, CCND1, MYB, EP300, CTNNB1, KRAS, POLE, TP53 | 70 | 1.48E-20 | RB1, CDKN1A, CRTC2, SPI1, PIK3CD, PIK3CB, PIK3CG, ICAM1, POLB, CCND2, CCND1, MYC, PRKACG, MYB, EP300, IKBKG, PRKACA, HRAS, JAK1, PDGFRB, MAP2K4, PDGFRA, MSX2, CHUK, MRAS, PIK3CA, LCK, TP53, PCNA, PDGFB, CREM, PDGFA, GPS2, IL2RG, RELA, PIK3R5, NRAS, RRAS, TERT, POLD2, DVL1, E2F1, DVL3, E2F2, E2F3, SMAD2, EGR1, MAP3K3, CDKN2B, JUN, FZD3, CREBBP, SMAD4, TGFB1, MAP3K1, FZD4, CDKN2A, NFYB, NFATC2, NFATC1, NFKB1, IL2, NFATC4, NFKB2, FOSL1, DLG1, IL2RA, HLA-DPB1, KRAS, MAD2L1 | 59 |
| hsa04919:Thyroid hormone signaling pathway | 16 | 1.47E-13 | NOTCH1, NCOA3, TSC2, PIK3R1, ESR1, MTOR, MED12, NCOR1, MED13, PIK3CA, CCND1, EP300, CTNNB1, KRAS, PLCG1, TP53 | 45 | 9.83E-20 | NOTCH3, HDAC2, NOTCH1, ITGB3, NOTCH4, PIK3CD, PIK3CB, MED16, FOXO1, PIK3CG, MED17, PIK3R5, MED14, NRAS, MED13, PLCZ1, CCND1, MED30, PRKACG, MYC, PLCG2, EP300, ITGAV, PLCG1, PRKACA, HRAS, PRKCG, NCOA2, MED1, MAP2K1, CREBBP, MAP2K2, PDPK1, NCOA3, PRKCA, ESR1, PLCB3, NCOR1, PIK3CA, RHEB, KRAS, RAF1, PLCB2, TP53, PLCD1 | 34 |
| hsa04015:Rap1 signaling pathway | 9 | 0.000915 | PDGFRA, PIK3CA, CDH1, CTNNB1, BRAF, KRAS, PLCG1, PIK3R1, EGFR | 61 | 3.80E-19 | FLT1, ITGB3, PIK3CD, PIK3CB, FGF1, FGF2, PIK3CG, FGF3, IGF1R, FGF5, FGF6, RAC2, RAC3, RAC1, HRAS, PDGFRB, PRKCG, PDGFRA, PRKCI, MAP2K1, MAP2K2, HGF, MAGI3, PRKCA, RHOA, PLCB3, MRAS, PIK3CA, LCP2, RAF1, PLCB2, PDGFB, PDGFA, EGFR, GNAI2, PIK3R5, NRAS, PARD6A, RRAS, PDGFC, FGF20, PLCG1, FGF23, FGF21, MAP2K6, EGF, BRAF, GRIN2B, MAPK12, GRIN1, EFNA1, GNAO1, FGF17, KITLG, FGF14, KRAS, FGF13, LAT, FGF11, FGF10, FGFR1 | 55 |
| hsa05223:Non-small cell lung cancer | 11 | 9.59E-11 | RB1, CCND1, PIK3CA, ERBB2, BRAF, KRAS, PLCG1, PIK3R1, SOS1, TP53, EGFR | 31 | 7.43E-19 | RB1, PIK3CD, TGFA, PIK3CB, EGFR, PIK3CG, PIK3R5, NRAS, CCND1, ERBB2, E2F1, PLCG2, E2F2, E2F3, PLCG1, HRAS, PRKCG, MAP2K1, MAP2K2, CDKN2A, EGF, PDPK1, PRKCA, BRAF, CDK6, PIK3CA, RARB, KRAS, RAF1, TP53, SOS2 | 22 |
| hsa05212:Pancreatic cancer | 11 | 4.50E-10 | RB1, SMAD2, CCND1, PIK3CA, ERBB2, STAT3, BRAF, KRAS, PIK3R1, TP53, EGFR | 33 | 1.38E-18 | RB1, PIK3CD, TGFA, PIK3CB, RELA, EGFR, PIK3CG, PIK3R5, MAPK9, CCND1, ERBB2, E2F1, RAC2, E2F2, RAC3, E2F3, IKBKG, RAC1, JAK1, SMAD2, MAP2K1, SMAD4, TGFB1, CHUK, CDKN2A, EGF, BRAF, NFKB1, CDK6, PIK3CA, KRAS, RAF1, TP53 | 24 |
| hsa05169:Epstein-Barr virus infection | 8 | 0.000167 | LYN, RB1, MAP2K4, CDKN1B, PIK3CA, STAT3, PIK3R1, TP53 | 45 | 1.43E-18 | RB1, CDKN1A, HDAC2, PSMD11, PSMD13, PIK3CD, PIK3CB, RBPJ, RELA, PIK3CG, PIK3R5, ICAM1, PSMD8, MAPK9, PSMD6, PSMD7, IRAK1, PSMD4, MYC, PSMD2, PLCG2, PSMD1, RIPK1, IKBKG, SKP2, JAK1, MAP2K6, LYN, MAP2K4, JUN, SYK, CHUK, MAPK12, NFKB1, NFKB2, NCOR2, PSMC5, PSMC3, PIK3CA, PSMC1, NEDD4, PSMC2, CDK2, HLA-DPB1, TP53 | 40 |
| hsa05161:Hepatitis B | 14 | 9.03E-10 | RB1, MAP2K4, CDKN1B, MAP3K1, STAT3, PTEN, PIK3R1, CREB1, PIK3CA, CCND1, EP300, KRAS, TP53, TLR4 | 49 | 2.19E-18 | RB1, CDKN1A, DDX3X, YWHAB, PIK3CD, PIK3CB, PIK3CG, CCND1, CASP10, MYC, EP300, IKBKG, HRAS, JAK1, PRKCG, MAP2K4, MAP2K1, MAP2K2, CHUK, PRKCA, TICAM1, TIRAP, DDB1, PIK3CA, RAF1, TP53, PCNA, RELA, PIK3R5, MAPK9, NRAS, E2F1, PTK2B, E2F2, E2F3, JUN, CREBBP, SMAD4, TGFB1, MAP3K1, IFNB1, NFATC2, NFATC1, NFKB1, NFATC4, CDK6, CDK2, FAS, KRAS | 41 |
| hsa04660:T cell receptor signaling pathway | 5 | 0.016020726 | PIK3CA, KRAS, PLCG1, PIK3R1, SOS1 | 40 | 5.84E-18 | ITK, PIK3CD, PIK3CB, RASGRP1, RELA, PIK3CG, PIK3R5, PAK1, NRAS, GRAP2, FYN, IKBKG, PLCG1, PAK3, HRAS, NCK1, PAK4, JUN, MAP2K1, MAP2K2, CHUK, PDPK1, NFATC2, NFATC1, RHOA, MAPK12, IL2, NFKB1, IL4, DLG1, PTPRC, PIK3CA, LCK, KRAS, PTPN6, PRKCQ, LCP2, RAF1, SOS2, LAT | 37 |
| hsa04722:Neurotrophin signaling pathway | 9 | 1.87E-05 | MAP3K1, PIK3CA, BRAF, KRAS, PLCG1, PSEN1, PIK3R1, SOS1, TP53 | 43 | 3.16E-17 | SHC4, SHC2, CAMK2D, IRS1, PIK3CD, PIK3CB, RELA, PIK3CG, PIK3R5, MAPK9, RPS6KA3, RPS6KA6, NRAS, MAPK7, RPS6KA5, IRAK1, RPS6KA2, NTF3, PLCG2, PLCG1, RAC1, HRAS, NTRK1, NTRK2, MAP3K3, JUN, MAP2K1, MAP2K2, MAP3K1, SORT1, PDPK1, NTRK3, BRAF, IRAK4, RHOA, MAPK12, NFKB1, PIK3CA, MAPKAPK2, KRAS, RAF1, TP53, SOS2 | 37 |
| hsa04810:Regulation of actin cytoskeleton | 8 | 0.004112837 | PDGFRA, PIK3CA, FN1, BRAF, KRAS, PIK3R1, SOS1, EGFR | 58 | 4.17E-17 | ITGB4, ITGB3, PIK3CD, PIK3CB, FGF1, FGF2, PIK3CG, FGF3, FGF5, PPP1CB, FGF6, PPP1CC, RAC2, PIP4K2A, RAC3, ITGAV, RAC1, HRAS, GIT1, PDGFRB, PDGFRA, MAP2K1, MAP2K2, ITGA4, ITGA2, RHOA, MRAS, PIK3CA, ITGA6, RAF1, SOS2, PDGFB, PDGFA, IQGAP1, EGFR, PIK3R5, GNA13, NRAS, PAK1, RRAS, PDGFC, FGF20, PIP5K1A, PAK3, FGF23, FGF21, PAK4, EGF, FN1, BRAF, PTK2, FGF17, FGF14, KRAS, FGF13, FGF11, FGF10, FGFR1 | 52 |
| hsa05220:Chronic myeloid leukemia | 10 | 2.38E-08 | RB1, CDKN1B, CCND1, PIK3CA, BRAF, KRAS, PIK3R1, SOS1, TP53, RUNX1 | 33 | 6.19E-17 | SHC4, RB1, CDKN1A, SHC2, HDAC2, PIK3CD, PIK3CB, CBL, RELA, PIK3CG, PIK3R5, NRAS, CCND1, MYC, E2F1, E2F2, E2F3, IKBKG, HRAS, MAP2K1, SMAD4, TGFB1, MAP2K2, CHUK, CDKN2A, BRAF, NFKB1, CDK6, PIK3CA, KRAS, RAF1, TP53, SOS2 | 27 |
| hsa04664:Fc epsilon RI signaling pathway | 7 | 4.64E-05 | LYN, MAP2K4, PIK3CA, KRAS, PLCG1, PIK3R1, SOS1 | 31 | 8.71E-16 | PIK3CD, PIK3CB, PIK3CG, PIK3R5, MAPK9, NRAS, PLCG2, RAC2, RAC3, FYN, PLCG1, RAC1, HRAS, MAP2K6, LYN, MAP2K4, MAP2K1, MAP2K2, SYK, PDPK1, PLA2G4A, PRKCA, MAPK12, IL4, PIK3CA, KRAS, LCP2, RAF1, MS4A2, SOS2, LAT | 26 |
| hsa04068:FoxO signaling pathway | 12 | 5.15E-08 | SMAD2, CDKN1B, CCND1, PIK3CA, STAT3, PTEN, EP300, BRAF, KRAS, PIK3R1, SOS1, EGFR | 43 | 3.37E-15 | CDKN1A, PRKAA2, IRS1, IRS4, PRKAG2, PIK3CD, IRS2, FOXO4, PIK3CB, FOXO1, EGFR, PIK3CG, IGF1R, PIK3R5, MAPK9, NRAS, CCND2, CCND1, EP300, SKP2, HRAS, SMAD2, CDKN2B, MAP2K1, CREBBP, SMAD4, PRKAB2, TGFB1, MAP2K2, CHUK, EGF, GADD45A, PDPK1, PLK1, BRAF, SIRT1, MAPK12, PIK3CA, CDK2, KRAS, RAF1, IL7R, SOS2 | 36 |
| hsa04110:Cell cycle | 9 | 2.38E-05 | RB1, SMAD2, CDKN1B, MCM7, CCND1, RAD21, EP300, SMC1A, TP53 | 41 | 5.31E-15 | CDKN1C, RB1, CDKN1A, HDAC2, PCNA, MCM7, PRKDC, YWHAB, FZR1, CCND2, CCND1, MYC, RAD21, E2F1, E2F2, EP300, E2F3, E2F4, E2F5, SKP2, SMAD2, CDKN2B, CREBBP, SMAD4, TGFB1, CDKN2A, GADD45A, PLK1, SMC1B, RBX1, STAG1, CDK7, RBL1, STAG2, TFDP1, CDK6, TFDP2, CDK2, TP53, MAD1L1, MAD2L1 | 34 |
| hsa04510:Focal adhesion | 12 | 3.93E-06 | PDGFRA, CCND1, PIK3CA, ERBB2, PTEN, FN1, CTNNB1, FLNA, BRAF, PIK3R1, SOS1, EGFR | 54 | 8.34E-15 | FLT1, ITGB4, ITGB3, ILK, PIK3CD, LAMC2, PIK3CB, PIK3CG, IGF1R, PPP1CB, PPP1CC, CCND2, CCND1, RAC2, RAC3, ITGAV, RAC1, HRAS, PDGFRB, PRKCG, PDGFRA, MAP2K1, ITGA4, PDPK1, HGF, ITGA2, PRKCA, RHOA, PIK3CA, ITGA6, RAF1, SOS2, BIRC2, SHC4, LAMA5, SHC2, LAMA3, PDGFB, PDGFA, EGFR, PIK3R5, MAPK9, PAK1, ERBB2, PDGFC, FYN, PAK3, PAK4, JUN, LAMB3, EGF, FN1, BRAF, PTK2 | 47 |
| hsa05222:Small cell lung cancer | 8 | 1.64E-05 | RB1, CDKN1B, CCND1, PIK3CA, PTEN, FN1, PIK3R1, TP53 | 32 | 1.57E-13 | RB1, LAMA5, LAMA3, PIK3CD, LAMC2, PIK3CB, RELA, PIK3CG, CKS1B, PIK3R5, CCND1, MYC, E2F1, E2F2, E2F3, ITGAV, IKBKG, SKP2, CDKN2B, LAMB3, CHUK, ITGA2, FN1, PTK2, NFKB1, CDK6, PIK3CA, CDK2, RARB, ITGA6, TP53, BIRC2 | 27 |
| hsa05219:Bladder cancer | 8 | 1.04E-07 | RB1, CCND1, CDH1, ERBB2, BRAF, KRAS, TP53, EGFR | 22 | 4.95E-13 | RB1, CDKN1A, MAP2K1, MAP2K2, CDKN2A, EGF, MMP2, BRAF, EGFR, NRAS, RPS6KA5, CCND1, MYC, ERBB2, E2F1, E2F2, KRAS, E2F3, RAF1, HRAS, TP53, HBEGF | 15 |
| hsa04071:Sphingolipid signaling pathway | 5 | 0.029069762 | PIK3CA, PTEN, KRAS, PIK3R1, TP53 | 37 | 1.51E-12 | SGMS1, PIK3CD, PIK3CB, PLD1, RELA, PIK3CG, GNAI2, PIK3R5, PPP2CA, GNA13, PPP2CB, MAPK9, NRAS, PPP2R5E, SMPD1, RAC2, RAC3, FYN, RAC1, HRAS, PRKCG, MAP2K1, MAP2K2, PDPK1, PRKCE, PPP2R5A, PRKCA, RHOA, MAPK12, NFKB1, PLCB3, PIK3CA, KRAS, RAF1, MS4A2, PLCB2, TP53 | 34 |
| hsa05231:Choline metabolism in cancer | 9 | 5.21E-06 | PDGFRA, PIK3CA, TSC2, KRAS, PLCG1, PIK3R1, SOS1, EGFR, MTOR | 33 | 5.32E-12 | PDGFB, PDGFA, PIK3CD, PIK3CB, PLD1, EGFR, PIK3CG, PIK3R5, MAPK9, NRAS, PDGFC, RAC2, PIP5K1A, RAC3, PLCG1, RAC1, HRAS, PRKCG, PDGFRB, PDGFRA, JUN, MAP2K1, MAP2K2, EGF, PDPK1, PLA2G4A, PRKCA, PIK3CA, SP1, RHEB, KRAS, RAF1, SOS2 | 28 |
| hsa05203:Viral carcinogenesis | 11 | 2.50E-05 | LYN, RB1, CDKN1B, CREB1, CCND1, PIK3CA, STAT3, EP300, KRAS, PIK3R1, TP53 | 49 | 7.14E-12 | RB1, CDKN1A, DDX3X, YWHAB, PIK3CD, PIK3CB, RBPJ, PIK3CG, POLB, CCND2, CCND1, PRKACG, EP300, IKBKG, RAC1, PRKACA, SKP2, HRAS, JAK1, SYK, RHOA, DDB1, RBL1, PIK3CA, MAPKAPK2, TP53, IRF9, MAD1L1, HDAC4, GTF2A1, SP100, HDAC2, RELA, PIK3R5, NRAS, LYN, CDKN2B, JUN, CREBBP, CDKN2A, GTF2H3, NFKB1, NFKB2, HIST1H4A, DLG1, CDK6, PSMC1, CDK2, KRAS | 42 |
| hsa04650:Natural killer cell mediated cytotoxicity | 6 | 0.006497053 | PIK3CA, BRAF, KRAS, PLCG1, PIK3R1, SOS1 | 36 | 1.30E-11 | SHC4, SHC2, PIK3CD, PIK3CB, PIK3CG, PIK3R5, ICAM1, PAK1, NRAS, KLRK1, PLCG2, RAC2, PTK2B, RAC3, FYN, PLCG1, RAC1, HRAS, PRKCG, MAP2K1, MAP2K2, SYK, IFNB1, NFATC2, PRKCA, BRAF, NFATC1, PIK3CA, LCK, FAS, KRAS, PTPN6, LCP2, RAF1, SOS2, LAT | 32 |
| hsa04370:VEGF signaling pathway | 4 | 0.021268797 | PIK3CA, KRAS, PLCG1, PIK3R1 | 25 | 1.39E-11 | SHC2, PIK3CD, HSPB1, PIK3CB, PIK3CG, PIK3R5, NRAS, PLCG2, RAC2, RAC3, PLCG1, RAC1, HRAS, PRKCG, MAP2K1, MAP2K2, PLA2G4A, NFATC2, PRKCA, MAPK12, PTK2, PIK3CA, MAPKAPK2, KRAS, RAF1 | 22 |
| hsa05211:Renal cell carcinoma | 6 | 0.000426 | PIK3CA, EP300, BRAF, KRAS, PIK3R1, SOS1 | 26 | 1.40E-11 | EPAS1, PDGFB, PIK3CD, TGFA, PIK3CB, PIK3CG, PIK3R5, PAK1, NRAS, EP300, RAC1, PAK3, HRAS, PAK4, JUN, MAP2K1, CREBBP, TGFB1, MAP2K2, HGF, BRAF, RBX1, PIK3CA, KRAS, RAF1, SOS2 | 22 |
| hsa05213:Endometrial cancer | 12 | 1.41E-12 | CCND1, PIK3CA, CDH1, ERBB2, PTEN, CTNNB1, BRAF, KRAS, PIK3R1, SOS1, TP53, EGFR | 23 | 1.79E-11 | MAP2K1, MAP2K2, PDPK1, EGF, LEF1, PIK3CD, ILK, BRAF, PIK3CB, EGFR, PIK3CG, PIK3R5, NRAS, PIK3CA, CCND1, MYC, ERBB2, CTNNA1, KRAS, RAF1, HRAS, TP53, SOS2 | 16 |
| hsa04662:B cell receptor signaling pathway | 5 | 0.004419634 | LYN, PIK3CA, KRAS, PIK3R1, SOS1 | 26 | 4.39E-11 | PIK3CD, PIK3CB, RELA, PIK3CG, PIK3R5, NRAS, PLCG2, RAC2, RAC3, IKBKG, RAC1, HRAS, LYN, JUN, MAP2K1, MAP2K2, SYK, CHUK, NFATC2, NFATC1, NFKB1, PIK3CA, KRAS, PTPN6, RAF1, SOS2 | 23 |
| hsa04915:Estrogen signaling pathway | 7 | 0.000375 | CREB1, PIK3CA, KRAS, PIK3R1, SOS1, ESR1, EGFR | 31 | 8.75E-11 | SHC4, SHC2, ITPR1, PIK3CD, PIK3CB, EGFR, PIK3CG, HSP90B1, GNAI2, PIK3R5, NRAS, PRKACG, PRKACA, HRAS, HSPA8, JUN, MAP2K1, HSP90AA1, MAP2K2, MMP2, ESR1, ESR2, GNAO1, PLCB3, PIK3CA, SP1, KRAS, RAF1, PLCB2, SOS2, HBEGF | 27 |
| hsa04917:Prolactin signaling pathway | 7 | 5.93E-05 | CCND1, PIK3CA, STAT3, KRAS, PIK3R1, SOS1, ESR1 | 26 | 9.02E-11 | SHC4, SHC2, PIK3CD, PIK3CB, RELA, PIK3CG, PIK3R5, SOCS2, MAPK9, NRAS, SOCS1, CCND2, CCND1, HRAS, SOCS7, MAP2K1, MAP2K2, PRLR, ESR1, MAPK12, ESR2, NFKB1, PIK3CA, KRAS, RAF1, SOS2 | 22 |
| hsa05221:Acute myeloid leukemia | 9 | 5.18E-08 | CCND1, PIK3CA, STAT3, BRAF, KRAS, PIK3R1, SOS1, MTOR, RUNX1 | 23 | 1.04E-10 | MAP2K1, SPI1, MAP2K2, JUP, CHUK, LEF1, PIK3CD, BRAF, PIK3CB, PIK3CG, RELA, NFKB1, PIK3R5, NRAS, PIK3CA, CCND1, MYC, KRAS, IKBKG, RAF1, HRAS, SOS2, PPARD | 19 |
| hsa04310:Wnt signaling pathway | 6 | 0.010787142 | CCND1, TBL1XR1, EP300, CTNNB1, PSEN1, TP53 | 36 | 5.59E-10 | CAMK2D, LEF1, LRP6, MAPK9, CCND2, CCND1, PRKACG, MYC, RUVBL1, DVL1, RAC2, DVL3, EP300, RAC3, RAC1, PRKACA, PRKCG, JUN, FZD3, CREBBP, SMAD4, FZD4, FBXW11, SIAH1, NFATC2, PRKCA, NFATC1, DKK1, RHOA, NFATC4, RBX1, FOSL1, PLCB3, PLCB2, TP53, PPARD | 33 |
| hsa05210:Colorectal cancer | 8 | 1.95E-06 | SMAD2, CCND1, PIK3CA, CTNNB1, BRAF, KRAS, PIK3R1, TP53 | 23 | 1.04E-09 | SMAD2, MAP2K1, JUN, SMAD4, TGFB1, LEF1, PIK3CD, BRAF, PIK3CB, RHOA, PIK3CG, PIK3R5, MAPK9, PIK3CA, CCND1, MSH2, MYC, RAC2, RAC3, KRAS, RAC1, RAF1, TP53 | 17 |
| hsa04912:GnRH signaling pathway | 6 | 0.001836635 | MAP2K4, MAP3K1, KRAS, SOS1, EGFR, MAP3K4 | 28 | 1.32E-09 | CAMK2D, ITPR1, PLD1, EGFR, MAPK9, NRAS, MAPK7, PRKACG, PTK2B, PRKACA, HRAS, MAP2K6, MAP2K4, MAP3K3, JUN, MAP2K1, MAP2K2, MAP3K1, MMP2, PLA2G4A, PRKCA, MAPK12, PLCB3, KRAS, RAF1, PLCB2, SOS2, HBEGF | 24 |
| hsa05206:MicroRNAs in cancer | 15 | 4.50E-07 | PDGFRA, CDKN1B, NOTCH1, STAT3, DNMT3A, PTEN, EGFR, MTOR, CCND1, ERBB2, EP300, KRAS, PLCG1, SOS1, TP53 | 55 | 2.01E-09 | CDKN1A, IRS1, ITGB3, IRS2, RPS6KA5, CCND2, CCND1, MYC, DNMT3B, CYP1B1, EP300, HRAS, PDGFRB, PRKCG, PDGFRA, MAP2K1, MAP2K2, PRKCE, DNMT3A, PRKCA, SIRT1, RHOA, SERPINB5, ZEB1, RAF1, TP53, SOS2, SHC4, NOTCH3, NOTCH1, NOTCH4, PDGFB, PDGFA, HOXD10, EGFR, NRAS, SOCS1, MAPK7, ERBB3, ERBB2, E2F1, PLCG2, E2F2, E2F3, PLCG1, PAK4, MCL1, FZD3, CREBBP, UBE2I, CDKN2A, NFKB1, CDK6, PDCD4, KRAS | 45 |
| hsa04550:Signaling pathways regulating pluripotency of stem cells | 8 | 0.000391 | SMAD2, PIK3CA, RIF1, STAT3, CTNNB1, KRAS, PIK3R1, TBX3 | 35 | 3.38E-09 | DLX5, PIK3CD, PIK3CB, FGF2, PIK3CG, IGF1R, PIK3R5, SOX2, NRAS, MYC, DVL1, DVL3, HRAS, JAK1, SMAD2, SMAD1, MAP2K1, FZD3, SMAD4, MAP2K2, FZD4, PCGF2, PAX6, INHBA, KLF4, SMAD5, POU5F1, MAPK12, REST, MEIS1, PIK3CA, KRAS, NANOG, RAF1, FGFR1 | 32 |
| hsa04910:Insulin signaling pathway | 8 | 0.000358 | PIK3CA, PRKAR1A, TSC2, BRAF, KRAS, PIK3R1, SOS1, MTOR | 34 | 8.79E-09 | SHC4, SHC2, PRKAA2, IRS1, IRS4, PRKAG2, PIK3CD, IRS2, PIK3CB, CBL, FOXO1, PIK3CG, PIK3R5, SOCS2, PPP1CB, MAPK9, PPP1CC, NRAS, SOCS1, PRKACG, PRKACA, HRAS, PRKCI, MAP2K1, PRKAB2, MAP2K2, PDPK1, RPS6, BRAF, PIK3CA, RHEB, KRAS, RAF1, SOS2 | 31 |
| hsa04066:HIF-1 signaling pathway | 10 | 3.01E-07 | CDKN1B, PIK3CA, ERBB2, STAT3, EP300, PLCG1, PIK3R1, TLR4, EGFR, MTOR | 27 | 2.24E-08 | CDKN1A, CAMK2D, FLT1, TFRC, PIK3CD, PIK3CB, RELA, EGFR, PIK3CG, IGF1R, PIK3R5, ERBB2, PLCG2, EP300, PLCG1, PDK1, PRKCG, MAP2K1, CREBBP, EDN1, MAP2K2, EGF, RPS6, PRKCA, NFKB1, RBX1, PIK3CA | 22 |
| hsa05230:Central carbon metabolism in cancer | 9 | 1.52E-07 | PDGFRA, PIK3CA, ERBB2, PTEN, KRAS, PIK3R1, TP53, EGFR, MTOR | 21 | 7.17E-08 | PDGFRB, NTRK1, PDGFRA, MAP2K1, MAP2K2, NTRK3, PIK3CD, PIK3CB, EGFR, PIK3CG, PIK3R5, NRAS, PIK3CA, MYC, ERBB2, KRAS, RAF1, HRAS, TP53, PDK1, FGFR1 | 15 |
| hsa05142:Chagas disease (American trypanosomiasis) | 5 | 0.018252988 | SMAD2, MAP2K4, PIK3CA, PIK3R1, TLR4 | 27 | 1.32E-07 | PIK3CD, PIK3CB, RELA, PIK3CG, GNAI2, PIK3R5, PPP2CA, PPP2CB, MAPK9, IRAK1, IKBKG, SMAD2, MAP2K4, JUN, TGFB1, CHUK, IFNB1, IRAK4, TICAM1, MAPK12, IL2, NFKB1, GNAO1, PLCB3, PIK3CA, FAS, PLCB2 | 24 |
| hsa04914:Progesterone-mediated oocyte maturation | 4 | 0.052470284 | PIK3CA, BRAF, KRAS, PIK3R1 | 24 | 2.37E-07 | MAP2K1, HSP90AA1, PLK1, PIK3CD, BRAF, PIK3CB, PIK3CG, MAPK12, PIK3R5, GNAI2, IGF1R, MAPK9, RPS6KA3, RPS6KA6, FZR1, PIK3CA, PRKACG, RPS6KA2, CDK2, KRAS, RAF1, PRKACA, MAD1L1, MAD2L1 | 21 |
| hsa05160:Hepatitis C | 8 | 0.000286 | PIK3CA, STAT3, BRAF, KRAS, PIK3R1, SOS1, TP53, EGFR | 30 | 5.91E-07 | CDKN1A, PIK3CD, PIK3CB, RELA, EGFR, PIK3CG, PIK3R5, PPP2CA, PPP2CB, MAPK9, NRAS, RIPK1, IKBKG, HRAS, JAK1, CHUK, IFNB1, EGF, PDPK1, BRAF, TICAM1, MAPK12, NFKB1, PIK3CA, PSME3, KRAS, RAF1, TP53, SOS2, IRF9 | 25 |
| hsa04668:TNF signaling pathway | 4 | 0.085858956 | MAP2K4, CREB1, PIK3CA, PIK3R1 | 26 | 9.19E-07 | PIK3CD, PIK3CB, NOD2, RELA, PIK3CG, PIK3R5, ICAM1, MAPK9, RPS6KA5, CASP10, RIPK1, IKBKG, MAP2K6, MAP2K4, JUN, MAP2K1, EDN1, JAG1, RIPK3, CHUK, MAPK12, NFKB1, ITCH, PIK3CA, FAS, BIRC2 | 24 |
| hsa04024:cAMP signaling pathway | 6 | 0.043070157 | CREB1, PIK3CA, EP300, BRAF, SOX9, PIK3R1 | 38 | 1.02E-06 | GRIA1, CAMK2D, PIK3CD, PIK3CB, PLD1, GLI1, RELA, PIK3CG, GLI3, GNAI2, PIK3R5, PPP1CB, MAPK9, PPP1CC, PAK1, RRAS, PRKACG, RAC2, EP300, RAC3, SOX9, RAC1, PRKACA, GRIA3, JUN, MAP2K1, CREBBP, MAP2K2, BRAF, NFATC1, GRIN2C, SSTR2, GRIN2B, RHOA, NFKB1, GRIN1, PIK3CA, RAF1 | 34 |
| hsa04630:Jak-STAT signaling pathway | 6 | 0.013163022 | CCND1, PIK3CA, STAT3, EP300, PIK3R1, SOS1 | 31 | 1.23E-06 | IL24, PIK3CD, PIK3CB, IL2RG, PIK3CG, PIK3R5, SOCS2, SOCS1, CCND2, CCND1, MYC, LEPR, EP300, IL12RB1, SOCS7, JAK1, PIAS4, CREBBP, IL4R, IFNB1, PRLR, IL2, PIAS2, GH2, IL4, PIK3CA, IL2RA, PTPN6, IL7R, SOS2, IRF9 | 28 |
| hsa04540:Gap junction | 4 | 0.053955511 | PDGFRA, KRAS, SOS1, EGFR | 23 | 1.23E-06 | PDGFRB, PRKCG, PDGFRA, MAP2K1, MAP2K2, EGF, PDGFB, ITPR1, PDGFA, PRKCA, EGFR, GNAI2, PLCB3, NRAS, MAPK7, PRKACG, PDGFC, KRAS, RAF1, PRKACA, HRAS, PLCB2, SOS2 | 20 |
| hsa04150:mTOR signaling pathway | 6 | 0.000232 | PIK3CA, PTEN, TSC2, BRAF, PIK3R1, MTOR | 18 | 1.90E-06 | PRKCG, PRKAA2, PDPK1, IRS1, RPS6, PIK3CD, BRAF, PRKCA, PIK3CB, PIK3CG, PIK3R5, RPS6KA3, RPS6KA6, PIK3CA, RRAGC, RHEB, RPS6KA2, RICTOR | 16 |
| hsa04916:Melanogenesis | 4 | 0.073317117 | CREB1, EP300, CTNNB1, KRAS | 24 | 3.35E-06 | PRKCG, MAP2K1, FZD3, CREBBP, CAMK2D, EDN1, MAP2K2, FZD4, LEF1, PRKCA, GNAI2, GNAO1, PLCB3, NRAS, KITLG, PRKACG, DVL1, DVL3, EP300, KRAS, RAF1, PRKACA, HRAS, PLCB2 | 22 |
| hsa04062:Chemokine signaling pathway | 7 | 0.009171626 | LYN, PIK3CA, STAT3, BRAF, KRAS, PIK3R1, SOS1 | 35 | 4.71E-06 | SHC4, ITK, SHC2, CXCR4, PIK3CD, PIK3CB, RELA, PIK3CG, GNAI2, PIK3R5, PREX1, PAK1, NRAS, GRK5, PRKACG, RAC2, PTK2B, IKBKG, RAC1, PRKACA, HRAS, LYN, MAP2K1, CHUK, BRAF, RHOA, PTK2, NFKB1, PLCB3, PIK3CA, GNB1, KRAS, RAF1, PLCB2, SOS2 | 31 |
| hsa05216:Thyroid cancer | 7 | 2.71E-07 | CCND1, CDH1, TPR, CTNNB1, BRAF, KRAS, TP53 | 12 | 8.12E-06 | NTRK1, MAP2K1, NRAS, MAP2K2, CCND1, MYC, LEF1, BRAF, KRAS, PPARG, HRAS, TP53 | 8 |
| hsa04666:Fc gamma R-mediated phagocytosis | 4 | 0.048137113 | LYN, PIK3CA, PLCG1, PIK3R1 | 21 | 8.37E-06 | LYN, PRKCG, MAP2K1, SYK, PRKCE, PIK3CD, PRKCA, PIK3CB, PLD1, PIK3CG, PIK3R5, PAK1, PTPRC, PIK3CA, PLCG2, RAC2, PIP5K1A, PLCG1, RAC1, RAF1, LAT | 18 |
| hsa05202:Transcriptional misregulation in cancer | 6 | 0.022878609 | CDKN1B, NCOR1, JMJD1C, TP53, KDM6A, RUNX1 | 32 | 8.97E-06 | CDKN1A, HDAC2, FLT1, SPI1, SIX1, PDGFA, FOXO1, RELA, IGF1R, LYL1, CCND2, MYC, NFKBIZ, GRIA3, NTRK1, SMAD1, TAF15, JUP, H3F3A, LMO2, PAX5, ETV4, FLI1, SUPT3H, RUNX2, PTK2, NFKB1, MEIS1, NCOR1, SP1, PPARG, TP53 | 30 |
| hsa04520:Adherens junction | 6 | 0.000597 | SMAD2, CDH1, ERBB2, EP300, CTNNB1, EGFR | 19 | 9.29E-06 | SMAD2, CREBBP, SMAD4, LEF1, LMO7, IQGAP1, RHOA, EGFR, IGF1R, ERBB2, CTNNA1, RAC2, EP300, RAC3, SNAI2, FYN, PTPN6, RAC1, FGFR1 | 15 |
| hsa04620:Toll-like receptor signaling pathway | 4 | 0.084013804 | MAP2K4, PIK3CA, PIK3R1, TLR4 | 23 | 3.10E-05 | MAP2K4, MAP2K1, JUN, MAP2K2, CHUK, IFNB1, PIK3CD, PIK3CB, IRAK4, TICAM1, PIK3CG, TIRAP, RELA, NFKB1, MAPK12, PIK3R5, MAPK9, IRAK1, PIK3CA, RIPK1, IKBKG, RAC1, MAP2K6 | 21 |
| hsa04152:AMPK signaling pathway | 6 | 0.006722159 | CREB1, CCND1, PIK3CA, TSC2, PIK3R1, MTOR | 25 | 4.00E-05 | CRTC2, PRKAA2, IRS1, IRS4, PRKAG2, PIK3CD, IRS2, PIK3CB, ELAVL1, FOXO1, PIK3CG, IGF1R, PIK3R5, PPP2CA, PPP2CB, CCND1, PPP2R5E, LEPR, PRKAB2, PDPK1, PPP2R5A, SIRT1, PIK3CA, RHEB, PPARG | 23 |
| hsa04931:Insulin resistance | 6 | 0.00387773 | CREB1, PIK3CA, STAT3, PTEN, PIK3R1, MTOR | 23 | 4.20E-05 | CRTC2, PRKAB2, PRKAA2, PDPK1, IRS1, PRKCE, PIK3CD, PRKAG2, IRS2, PIK3CB, FOXO1, PIK3CG, RELA, NFKB1, PIK3R5, PPP1CB, MAPK9, RPS6KA3, PPP1CC, RPS6KA6, PIK3CA, RPS6KA2, PRKCQ | 22 |
| hsa05162:Measles | 7 | 0.001771653 | CDKN1B, CCND1, PIK3CA, STAT3, PIK3R1, TP53, TLR4 | 26 | 5.33E-05 | PIK3CD, PIK3CB, IL2RG, RELA, PIK3CG, PIK3R5, CCND2, IRAK1, CCND1, FYN, JAK1, HSPA8, CHUK, IFNB1, IRAK4, IL2, NFKB1, IL4, CDK6, PIK3CA, IL2RA, CDK2, FAS, PRKCQ, TP53, IRF9 | 23 |
| hsa05120:Epithelial cell signaling in Helicobacter pylori infection | 4 | 0.027171348 | LYN, MAP2K4, PLCG1, EGFR | 16 | 0.000234 | LYN, MAP2K4, JUN, CHUK, EGFR, RELA, NFKB1, MAPK12, MAPK9, PAK1, PLCG2, IKBKG, PLCG1, RAC1, GIT1, HBEGF | 12 |
| hsa05146:Amoebiasis | 4 | 0.084013804 | PIK3CA, FN1, PIK3R1, TLR4 | 21 | 0.000279 | PRKCG, LAMA5, TGFB1, LAMB3, LAMA3, FN1, PIK3CD, HSPB1, PRKCA, LAMC2, PIK3CB, PIK3CG, RELA, PTK2, NFKB1, PIK3R5, PLCB3, PIK3CA, PRKACG, PRKACA, PLCB2 | 19 |
| hsa05164:Influenza A | 6 | 0.026743772 | MAP2K4, PIK3CA, EP300, NUP98, PIK3R1, TLR4 | 29 | 0.000322 | PIK3CD, PIK3CB, RELA, PIK3CG, PIK3R5, ICAM1, MAPK9, NXF1, EP300, JAK1, MAP2K6, KPNA1, MAP2K4, HSPA8, JUN, MAP2K1, CREBBP, MAP2K2, IFNB1, PRKCA, IRAK4, TICAM1, MAPK12, NFKB1, PIK3CA, HLA-DPB1, FAS, RAF1, IRF9 | 26 |
| hsa04330:Notch signaling pathway | 3 | 0.079189222 | NOTCH1, EP300, PSEN1 | 13 | 0.000332 | NOTCH3, CREBBP, HDAC2, NOTCH1, JAG1, NOTCH4, RBPJ, NCOR2, DVL1, DVL3, EP300, HES1, HES5 | 11 |
| hsa05100:Bacterial invasion of epithelial cells | 5 | 0.006831682 | PIK3CA, CDH1, FN1, CTNNB1, PIK3R1 | 17 | 0.000425 | SHC4, SHC2, RHOG, FN1, PIK3CD, ILK, PIK3CB, CBL, RHOA, PIK3CG, PTK2, PIK3R5, CTTN, PIK3CA, CTNNA1, HCLS1, RAC1 | 15 |
| hsa04725:Cholinergic synapse | 4 | 0.09341161 | CREB1, PIK3CA, KRAS, PIK3R1 | 21 | 0.000524 | PRKCG, MAP2K1, CAMK2D, ITPR1, PIK3CD, PRKCA, PIK3CB, PIK3CG, PIK3R5, GNAI2, GNAO1, PLCB3, NRAS, PIK3CA, PRKACG, GNB1, KRAS, FYN, PRKACA, HRAS, PLCB2 | 19 |
| hsa04960:Aldosterone-regulated sodium reabsorption | 3 | 0.054974276 | PIK3CA, KRAS, PIK3R1 | 11 | 0.000835 | PRKCG, PIK3CA, PDPK1, IRS1, PIK3CD, NEDD4L, KRAS, PRKCA, PIK3CB, PIK3CG, PIK3R5 | 9 |
| hsa04930:Type II diabetes mellitus | 3 | 0.079189222 | PIK3CA, PIK3R1, MTOR | 12 | 0.001281467 | SOCS2, MAPK9, SOCS1, PIK3CA, IRS1, PRKCE, IRS4, PIK3CD, IRS2, PIK3CB, PIK3CG, PIK3R5 | 11 |
| hsa04070:Phosphatidylinositol signaling system | 4 | 0.069898009 | PIK3CA, PTEN, PLCG1, PIK3R1 | 17 | 0.005140187 | PRKCG, ITPR1, PIK3CD, PRKCA, PIK3CB, PIK3C2A, PIK3CG, PIK3R5, PLCB3, PIK3CA, PLCZ1, PLCG2, PIP5K1A, PIP4K2A, PLCG1, PLCB2, PLCD1 | 15 |
| hsa04115:p53 signaling pathway | 4 | 0.027171348 | CCND1, PTEN, TSC2, TP53 | 13 | 0.006939302 | CDKN1A, CDKN2A, GADD45A, SIAH1, SERPINB5, CDK6, CCND2, CCND1, RRM2B, PERP, CDK2, FAS, TP53 | 11 |
| hsa04320:Dorso-ventral axis formation | 4 | 0.002185536 | NOTCH1, KRAS, SOS1, EGFR | 7 | 0.018845657 | NOTCH3, MAP2K1, NOTCH1, NOTCH4, KRAS, SOS2, EGFR | 4 |
| hsa04020:Calcium signaling pathway | 5 | 0.096247856 | PDGFRA, ERBB4, ERBB2, PLCG1, EGFR | 21 | 0.087741389 | PDGFRB, PRKCG, PDGFRA, CAMK2D, ITPR1, PRKCA, GRIN2C, EGFR, GRIN1, PLCB3, PLCZ1, ERBB3, ERBB4, PRKACG, ERBB2, PLCG2, PTK2B, PLCG1, PRKACA, PLCB2, PLCD1 | 16 |

**Table 6. The pathway intersection of driver genes and downstream genes in lung cancer of Basal subtype**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Term | drivers\_count | driver\_pvalue | drivers | Out\_count | Out\_pvalue | Outs | Outs\_drivers\_count |
| hsa05200:Pathways in cancer | 44 | 1.13E-18 | RB1, HSP90AB1, FLT3, MAX, PTEN, PIK3CB, PIK3R1, BRCA2, GNAI1, EGFR, PIK3CG, RXRA, MECOM, CCND1, CDH1, TPR, ERBB2, EP300, PLCG1, HRAS, SMAD2, TCF7L2, PDGFRA, SMAD4, CDKN2A, HGF, MMP2, NCOA4, FN1, BRAF, MTOR, TGFBR2, RUNX1, AR, PIK3CA, KIT, GNAS, CTNNB1, KRAS, ITGA6, SOS1, FGFR3, TP53, FGFR2 | 134 | 4.71E-31 | RB1, ITGA2B, ETS1, IGF1R, FGF5, FGF6, FGF7, CCND1, CDH1, PRKACG, EP300, PRKACA, PDGFRB, PRKCG, MITF, PRKCA, PGF, RUNX1, RBX1, MSH6, MSH2, CCNE1, CTBP2, EPAS1, CUL2, PDGFB, PDGFA, PIK3R3, TGFA, PIK3R2, PIK3R1, RASGRP1, HSP90B1, PIK3R5, DVL1, DVL2, PLCG2, DVL3, FADD, FGF21, SMAD2, CREBBP, TGFB2, JUN, SMAD4, TGFB1, JUP, FZD5, TGFB3, FN1, GNG12, GNG11, PTK2, NFKB1, GNG13, NFKB2, NFKBIA, CDK6, CDK4, GNAQ, GNB2, GNB1, CDK2, GNAS, GRB2, GNB5, FGFR3, FGFR1, ITGB1, GSK3B, CDKN1A, CDKN1B, HSP90AB1, PTEN, LAMC2, LAMC1, PIK3CB, GLI3, IKBKB, GNGT1, CASP8, CASP3, RAC2, ITGAV, IKBKG, RAC1, HSP90AA1, MMP1, MMP2, FOS, RHOA, TGFBR1, PLCB3, PLCB4, PIK3CA, RARA, RARB, PLCB1, CRK, BIRC2, PPARD, CEBPA, LAMA5, RALA, HDAC2, GSTP1, LAMA3, GNAI3, CBL, RELA, EGFR, RXRB, GNA13, MAPK9, NRAS, MAPK8, GNG5, GNG4, GNA11, GNG7, E2F1, CTNNA1, MAPK1, E2F3, CTNNA2, MAPK3, CDKN2B, EGLN3, LAMB3, STAT3, MLH1, PML, RAD51, CTNNB1 | 116 |
| hsa05169:Epstein-Barr virus infection | 11 | 0.00049 | LYN, RB1, NCOR2, PSMD11, PIK3CA, HLA-B, HLA-A, PIK3CB, PIK3R1, TP53, PIK3CG | 59 | 3.25E-22 | RB1, CDKN1A, CDKN1B, PIK3CB, RBPJ, ICAM1, PSMD8, IKBKB, PSMD6, TBK1, PSMD7, PSMD4, PSMD3, PSMD1, IKBKG, JAK3, MAP3K7, MAP2K3, SYK, DDX58, HLA-A, NCOR2, PIK3CA, IRF3, HLA-DQB1, RBPJL, PSMD12, HDAC2, PSMD14, PSMD13, PIK3R3, PIK3R2, PIK3R1, RELA, PIK3R5, MAPK9, MAPK8, IRAK1, PLCG2, RIPK1, LYN, JUN, STAT3, EIF2AK2, MAPK12, NFKB1, NFKB2, NFKBIA, MAPK11, PSMC5, SNW1, PSMC6, PSMC3, PSMC4, PSMC1, NEDD4, PSMC2, CDK2, NFKBIB | 52 |
| hsa04151:PI3K-Akt signaling pathway | 31 | 1.80E-10 | HSP90AB1, PTEN, BRCA1, PIK3CB, PIK3R1, EGFR, PIK3CG, STK11, RXRA, CCND1, PPP2R1A, MYB, JAK2, HRAS, PDGFRA, HGF, FN1, TSC2, MTOR, CREB1, PIK3CA, RHEB, KIT, KRAS, ITGA6, SGK1, SOS1, FGFR3, TP53, TLR4, FGFR2 | 103 | 6.69E-19 | CHRM2, ATF2, EPO, IRS1, ITGA2B, PPP2R2A, IGF1R, FGF5, FGF6, STK11, FGF7, CCND1, PDGFRB, IL4R, RPS6, PRKCA, PRLR, PGF, CCNE1, IFNAR1, PDGFB, PDGFA, PIK3R3, PIK3R2, PIK3R1, FOXO3, HSP90B1, PIK3R5, PDGFD, PDGFC, FGF21, PCK2, NGFR, FN1, GNG12, GNG11, PTK2, NFKB1, IL2, GNG13, IL4, CDK6, RHEB, IL7, CDK4, GNB2, GNB1, CDK2, GRB2, GNB5, FGFR3, FGFR1, ITGB1, GSK3B, CDKN1A, CDKN1B, FLT1, HSP90AB1, YWHAB, ITGB4, ITGB3, PTEN, LAMC2, LAMC1, BRCA1, PIK3CB, PRL, IKBKB, GNGT1, ITGAV, IKBKG, RAC1, JAK3, HSP90AA1, ITGA4, SYK, PPP2R5B, PPP2R5D, PPP2R5C, PIK3CA, LAMA5, PRKAA1, LAMA3, IL2RG, RELA, EGFR, INS, PPP2CA, PPP2CB, NRAS, GNG5, GNG4, GNG7, MAPK1, EIF4E, EIF4B, MAPK3, LAMB3, IFNB1, NOS3, RPS6KB1, IL2RB, PKN2 | 91 |
| hsa05161:Hepatitis B | 16 | 1.05E-06 | RB1, SMAD4, DDX3X, MAP3K1, PTEN, PIK3CB, PIK3R1, PIK3CG, CREB1, PIK3CA, CCND1, EP300, KRAS, HRAS, TP53, TLR4 | 60 | 1.79E-18 | RB1, ATF2, CDKN1A, CDKN1B, YWHAB, PTEN, PIK3CB, IFIH1, IKBKB, TBK1, CASP8, CCND1, CASP10, CASP3, EP300, IKBKG, IKBKE, PRKCG, DDX58, PRKCA, FOS, TGFBR1, DDB2, PIK3CA, IRF3, CCNE1, IFNAR1, PCNA, SRC, PIK3R3, PIK3R2, PIK3R1, RELA, PIK3R5, MAPK9, NRAS, MAPK8, E2F1, PTK2B, MAPK1, E2F3, FADD, MAPK3, TGFB2, JUN, CREBBP, SMAD4, TGFB1, MAP3K1, IFNB1, TGFB3, STAT3, NFATC1, NFKB1, NFKBIA, CDK6, CDK4, CDK2, GRB2, MYD88 | 51 |
| hsa04014:Ras signaling pathway | 17 | 6.07E-05 | PDGFRA, HGF, PTPN11, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, RASA1, KIT, NF1, KRAS, PLCG1, SOS1, HRAS, FGFR3, FGFR2 | 77 | 9.43E-18 | FLT1, PIK3CB, ETS1, ETS2, IGF1R, FGF5, IKBKB, GNGT1, FGF6, FGF7, TBK1, PRKACG, RAC2, PLCE1, IKBKG, RAC1, PRKACA, PDGFRB, PRKCG, KSR1, PLA2G4B, PRKCA, RHOA, PGF, PIK3CA, RASA1, RALA, SHC2, SHC3, PDGFB, PDGFA, PIK3R3, PIK3R2, PIK3R1, RASAL2, RASGRP1, EGFR, RELA, INS, PLD2, PIK3R5, MAPK9, NRAS, GRIN2A, MAPK8, RAP1A, RRAS, GNG5, GNG4, PDGFD, GNG7, PDGFC, PLCG2, MAPK1, PAK6, PAK3, PAK2, FGF21, MAPK3, BRAP, NGFR, PTPN11, GNG12, GNG11, NFKB1, GNG13, GRIN1, GNB2, GNB1, NF1, REL, CALM3, GRB2, GNB5, FGFR3, LAT, FGFR1 | 69 |
| hsa05203:Viral carcinogenesis | 19 | 9.74E-07 | LYN, RB1, DDX3X, CDKN2A, HLA-B, CHD4, GTF2H1, HLA-A, PIK3CB, PIK3R1, PIK3CG, CREB1, PIK3CA, CCND1, EP300, KRAS, HRAS, TP53, HIST1H2BD | 72 | 1.97E-17 | RB1, ATF2, CDKN1A, CDKN1B, YWHAB, GTF2B, HDAC11, CHD4, PIK3CB, RBPJ, CASP8, CCND1, PRKACG, CASP3, CHEK1, EP300, IKBKG, RAC1, PRKACA, JAK3, TBP, SYK, HLA-A, RHOA, PIK3CA, IRF3, CCNE1, MAPKAPK2, HIST1H2BB, IL6ST, HIST1H2BC, HDAC4, RBPJL, HDAC5, GTF2A2, SP100, HDAC2, HDAC3, SRC, HPN, PXN, PIK3R3, PIK3R2, PIK3R1, HDAC9, GTF2E1, GTF2E2, RELA, PIK3R5, NRAS, MAPK1, PMAIP1, MAPK3, LYN, CDKN2B, JUN, CREBBP, STAT3, EIF2AK2, GTF2H1, GTF2H4, NFKB1, NFKB2, NFKBIA, SNW1, CDK6, CDK4, PSMC1, CDK2, REL, GRB2, LTBR | 62 |
| hsa04919:Thyroid hormone signaling pathway | 21 | 1.01E-12 | NOTCH1, NCOA3, TSC2, PIK3CB, PIK3R1, ESR1, MTOR, PIK3CG, MED12, NCOR1, RXRA, PIK3CA, CCND1, SIN3A, RHEB, EP300, CTNNB1, KRAS, PLCG1, HRAS, TP53 | 48 | 5.82E-15 | NOTCH2, GSK3B, NOTCH3, HDAC2, HDAC3, NOTCH1, THRA, SRC, ITGB3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, MED16, SLC9A1, MED17, PIK3R5, MED12, RXRB, MED14, NRAS, MED13, CCND1, PRKACG, PLCG2, MAPK1, EP300, PLCE1, ITGAV, PRKACA, MAPK3, PRKCG, NCOA2, MED1, CREBBP, PRKCA, MED4, MED27, ESR1, MED13L, PLCB3, MED24, NCOR1, PLCB4, PIK3CA, RHEB, CTNNB1, PLCB1 | 37 |
| hsa05215:Prostate cancer | 23 | 1.81E-17 | RB1, PDGFRA, TCF7L2, HSP90AB1, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, AR, CREB1, PIK3CA, CCND1, ERBB2, EP300, CTNNB1, KRAS, SOS1, HRAS, TP53, FGFR2 | 41 | 8.54E-15 | RB1, GSK3B, CDKN1A, CDKN1B, HSP90AB1, PTEN, PDGFB, PDGFA, PIK3R3, TGFA, PIK3R2, PIK3CB, PIK3R1, RELA, EGFR, HSP90B1, IGF1R, PIK3R5, INS, IKBKB, NRAS, CCND1, PDGFD, PDGFC, E2F1, MAPK1, EP300, E2F3, IKBKG, MAPK3, PDGFRB, CREBBP, HSP90AA1, NFKB1, NFKBIA, PIK3CA, CCNE1, CDK2, CTNNB1, GRB2, FGFR1 | 31 |
| hsa05142:Chagas disease (American trypanosomiasis) | 10 | 0.000632 | SMAD2, PIK3CA, PPP2R1A, GNAS, PIK3CB, PIK3R1, TLR4, GNAI1, PIK3CG, TGFBR2 | 45 | 9.62E-15 | SERPINE1, GNAI3, PIK3R3, PPP2R2A, PIK3R2, PIK3CB, PIK3R1, CD3E, RELA, PIK3R5, PPP2CA, IKBKB, PPP2CB, MAPK9, MAPK8, CASP8, IRAK1, GNA11, MAPK1, FADD, IKBKG, MAPK3, SMAD2, TGFB2, JUN, TGFB1, IFNB1, TGFB3, FOS, TGFBR1, MAPK12, IL2, NFKB1, NFKBIA, MAPK11, PLCB3, PLCB4, IFNG, PIK3CA, GNAQ, IL1B, GNAS, CALR, PLCB1, MYD88 | 40 |
| hsa05220:Chronic myeloid leukemia | 17 | 4.19E-12 | RB1, SMAD4, CDKN2A, BRAF, PTPN11, PIK3CB, PIK3R1, PIK3CG, TGFBR2, RUNX1, MECOM, PIK3CA, CCND1, KRAS, SOS1, HRAS, TP53 | 36 | 3.33E-14 | RB1, CDKN1A, SHC2, HDAC2, CDKN1B, SHC3, CTBP2, PIK3R3, PIK3R2, PIK3CB, PIK3R1, CBL, RELA, PIK3R5, IKBKB, NRAS, CCND1, E2F1, MAPK1, E2F3, IKBKG, MAPK3, TGFB2, SMAD4, TGFB1, TGFB3, PTPN11, TGFBR1, NFKB1, RUNX1, NFKBIA, CDK6, PIK3CA, CDK4, GRB2, CRK | 28 |
| hsa05212:Pancreatic cancer | 16 | 1.13E-11 | RB1, SMAD2, SMAD4, CDKN2A, BRAF, PIK3CB, PIK3R1, BRCA2, EGFR, PIK3CG, TGFBR2, PIK3CA, CCND1, ERBB2, KRAS, TP53 | 33 | 2.73E-13 | RB1, RALA, PIK3R3, TGFA, PIK3R2, PIK3CB, PIK3R1, RELA, EGFR, PIK3R5, IKBKB, MAPK9, MAPK8, CCND1, E2F1, RAC2, MAPK1, E2F3, IKBKG, RAC1, MAPK3, SMAD2, TGFB2, SMAD4, TGFB1, TGFB3, STAT3, TGFBR1, NFKB1, RAD51, CDK6, PIK3CA, CDK4 | 25 |
| hsa04068:FoxO signaling pathway | 18 | 8.95E-09 | SMAD2, SMAD4, PTEN, BRAF, IRS2, PIK3CB, PIK3R1, EGFR, PIK3CG, TGFBR2, STK11, PIK3CA, CCND1, EP300, KRAS, SGK1, SOS1, HRAS | 49 | 1.10E-12 | CDKN1A, CDKN1B, IRS1, IRS4, PRKAG1, PTEN, PRKAG2, IRS2, PIK3CB, IGF1R, IKBKB, STK11, CCND1, EP300, PRKAB2, PRMT1, CSNK1E, SIRT1, TGFBR1, PIK3CA, PRKAA1, PIK3R3, PIK3R2, PIK3R1, FOXO3, NLK, EGFR, INS, PIK3R5, MAPK9, NRAS, MAPK8, MAPK1, MAPK3, PCK2, SMAD2, PLK3, TGFB2, CDKN2B, CREBBP, SMAD4, TGFB1, GADD45B, TGFB3, STAT3, MAPK12, MAPK11, CDK2, GRB2 | 38 |
| hsa04012:ErbB signaling pathway | 13 | 6.09E-07 | BRAF, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, ERBB4, ERBB2, KRAS, PLCG1, SOS1, HRAS | 38 | 1.11E-12 | GSK3B, CDKN1A, SHC2, CDKN1B, SHC3, SRC, PIK3R3, TGFA, PIK3R2, PIK3CB, PIK3R1, CBL, EGFR, PIK3R5, MAPK9, NRAS, MAPK8, ERBB3, ERBB4, PLCG2, NCK2, MAPK1, PAK6, PAK3, PAK2, CAMK2G, MAPK3, PRKCG, JUN, PRKCA, NRG1, PTK2, EREG, PIK3CA, RPS6KB1, GRB2, CRK, HBEGF | 33 |
| hsa05166:HTLV-I infection | 25 | 2.90E-09 | RB1, CRTC3, CRTC1, PIK3CB, PIK3R1, PIK3CG, CCND1, MYB, EP300, HRAS, POLE, SMAD2, PDGFRA, SMAD4, RANBP3, MAP3K1, CDKN2A, HLA-B, HLA-A, TGFBR2, CREB1, PIK3CA, CTNNB1, KRAS, TP53 | 73 | 1.81E-12 | RB1, ATF2, GSK3B, CDKN1A, CRTC3, CRTC1, PIK3CB, CD3E, ETS1, ETS2, ICAM1, IKBKB, ZFP36, PTTG1, CCND1, PRKACG, CHEK1, EP300, IKBKG, PRKACA, JAK3, PDGFRB, TBP, HLA-A, FOS, TGFBR1, PIK3CA, TLN1, ATF3, HLA-DQB1, PCNA, PDGFB, CREM, PDGFA, PIK3R3, GPS2, PIK3R2, PIK3R1, IL2RG, RELA, PIK3R5, NRAS, RRAS, DVL1, DVL2, E2F1, DVL3, E2F3, SMAD2, EGR1, TGFB2, CDKN2B, JUN, CREBBP, SMAD4, TGFB1, CDKN2C, MAP3K1, FZD5, TGFB3, NFYB, NFATC1, NFKB1, IL2, NFKB2, NFKBIA, FOSL1, CDK4, IL2RB, CTNNB1, CALR, LTBR, RAN | 60 |
| hsa05205:Proteoglycans in cancer | 26 | 2.82E-12 | DDX5, PIK3CB, PIK3R1, EGFR, PIK3CG, CCND1, ERBB4, ERBB2, FLNA, PLCG1, HRAS, HGF, MMP2, FN1, MSN, PTPN11, BRAF, ESR1, MTOR, CTTN, PIK3CA, CTNNB1, KRAS, SOS1, TP53, TLR4 | 61 | 1.06E-11 | ITGB1, CDKN1A, ITGB3, PIK3CB, IGF1R, PPP1CB, PPP1CC, CCND1, PRKACG, CASP3, PLCE1, ITGAV, RAC1, PRKACA, PRKCG, MMP2, RPS6, ANK2, PRKCA, RHOA, DCN, PIK3CA, CTTN, HBEGF, SRC, PXN, PIK3R3, PIK3R2, PIK3R1, IQGAP1, CBL, EGFR, SLC9A1, PIK3R5, NRAS, ERBB3, RRAS, ERBB4, PLCG2, MAPK1, CAMK2G, EIF4B, MAPK3, TGFB2, TGFB1, FZD5, STAT3, IGF2, FN1, MSN, PTPN11, ESR1, MAPK12, PTK2, MAPK11, RPS6KB1, PDCD4, CTNNB1, NANOG, GRB2, FGFR1 | 48 |
| hsa05214:Glioma | 17 | 7.59E-13 | RB1, PDGFRA, CDKN2A, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, CCND1, KRAS, PLCG1, SOS1, HRAS, TP53 | 31 | 1.26E-11 | RB1, CDKN1A, SHC2, SHC3, PTEN, PDGFB, PDGFA, PIK3R3, TGFA, PIK3R2, PIK3CB, PIK3R1, EGFR, IGF1R, PIK3R5, NRAS, CCND1, E2F1, PLCG2, MAPK1, E2F3, CAMK2G, MAPK3, PRKCG, PDGFRB, PRKCA, CDK6, PIK3CA, CDK4, GRB2, CALM3 | 24 |
| hsa04722:Neurotrophin signaling pathway | 15 | 5.64E-07 | MAP3K1, PRKCD, MATK, BRAF, PTPN11, PIK3CB, PIK3R1, PSEN1, PIK3CG, PIK3CA, KRAS, PLCG1, SOS1, HRAS, TP53 | 44 | 1.68E-11 | GSK3B, SHC2, SHC3, IRS1, PIK3R3, PIK3R2, PIK3CB, PIK3R1, FOXO3, RELA, PIK3R5, IKBKB, MAPK9, NRAS, MAPK8, RAP1A, MAPK7, RPS6KA5, IRAK1, RPS6KA2, NTF3, PLCG2, MAPK1, RAC1, CAMK2G, MAPK3, MAP3K5, NGFR, JUN, MAP3K1, SORT1, NTRK3, PTPN11, RHOA, MAPK12, NFKB1, NFKBIA, MAPK11, PIK3CA, MAPKAPK2, GRB2, CALM3, CRK, NFKBIB | 39 |
| hsa05162:Measles | 10 | 0.003546856 | HSPA8, CCND1, PIK3CA, MSN, PIK3CB, PIK3R1, JAK2, TP53, TLR4, PIK3CG | 46 | 5.34E-11 | GSK3B, CDKN1B, PIK3R3, PIK3R2, PIK3CB, PIK3R1, CD3E, IL2RG, RELA, PIK3R5, IFIH1, TBK1, IRAK1, CCND1, JAK3, MAP3K7, IKBKE, HSPA8, CSNK2A1, IFNB1, DDX58, IL13, STAT3, TNFRSF10B, EIF2AK2, MSN, HSPA2, IL2, NFKB1, TNFRSF10D, IL4, NFKBIA, IL1A, CDK6, IFNG, IRF3, PIK3CA, CCNE1, CDK4, IL1B, IL2RB, CDK2, PRKCQ, MYD88, NFKBIB, IFNAR1 | 40 |
| hsa05222:Small cell lung cancer | 12 | 3.47E-06 | RB1, RXRA, CCND1, PIK3CA, MAX, PTEN, FN1, ITGA6, PIK3CB, PIK3R1, TP53, PIK3CG | 35 | 7.24E-11 | RB1, ITGB1, LAMA5, CDKN1B, LAMA3, ITGA2B, PTEN, PIK3R3, LAMC2, PIK3R2, LAMC1, PIK3CB, PIK3R1, RELA, PIK3R5, IKBKB, RXRB, CCND1, E2F1, E2F3, ITGAV, IKBKG, CDKN2B, LAMB3, FN1, PTK2, NFKB1, NFKBIA, CDK6, PIK3CA, CCNE1, CDK4, CDK2, RARB, BIRC2 | 28 |
| hsa04015:Rap1 signaling pathway | 21 | 6.01E-08 | PDGFRA, DOCK4, HGF, CTNND1, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, GNAI1, ADORA2A, PIK3CA, CDH1, KIT, GNAS, CTNNB1, KRAS, PLCG1, HRAS, FGFR3, FGFR2 | 61 | 9.92E-11 | ITGB1, FLT1, ITGB3, ITGA2B, CTNND1, PIK3CB, IGF1R, FGF5, FGF6, FGF7, CDH1, RAC2, PLCE1, RAC1, MAGI1, PDGFRB, PRKCG, MAP2K3, PRKCI, PRKCA, RHOA, PGF, PLCB3, PLCB4, PIK3CA, PRKD2, TLN1, PLCB1, CRK, RALA, SRC, PDGFB, GNAI3, PDGFA, PIK3R3, PIK3R2, PIK3R1, EGFR, INS, PIK3R5, NRAS, GRIN2A, RAP1A, RRAS, PDGFD, PDGFC, MAPK1, DRD2, FGF21, MAPK3, NGFR, MAPK12, GRIN1, MAPK11, GNAQ, GNAS, CTNNB1, CALM3, FGFR3, LAT, FGFR1 | 52 |
| hsa05211:Renal cell carcinoma | 11 | 2.27E-06 | PIK3CA, HGF, EP300, BRAF, PTPN11, KRAS, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 30 | 1.23E-10 | EPAS1, CUL2, PDGFB, PIK3R3, TGFA, PIK3R2, PIK3CB, PIK3R1, ETS1, PIK3R5, NRAS, RAP1A, MAPK1, PAK6, EP300, RAC1, PAK3, PAK2, MAPK3, TGFB2, JUN, EGLN3, CREBBP, TGFB1, TGFB3, PTPN11, RBX1, PIK3CA, GRB2, CRK | 25 |
| hsa04510:Focal adhesion | 17 | 1.95E-05 | PDGFRA, HGF, PTEN, FN1, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, CCND1, ERBB2, FLNA, CTNNB1, ITGA6, SOS1, HRAS | 60 | 1.29E-10 | ITGB1, GSK3B, FLT1, ITGB4, ITGB3, ITGA2B, PTEN, ILK, LAMC2, PIK3CB, LAMC1, IGF1R, PPP1CB, PPP1CC, CCND1, RAC2, ITGAV, RAC1, PDGFRB, PRKCG, ITGA4, PRKCA, RHOA, PGF, MYL5, PIK3CA, MYL2, TLN1, CRK, BIRC2, LAMA5, SHC2, SHC3, SRC, PXN, LAMA3, PDGFB, PDGFA, PIK3R3, PIK3R2, PIK3R1, EGFR, PIK3R5, MAPK9, MAPK8, RAP1A, PDGFD, PDGFC, MAPK1, PAK6, PAK3, PAK2, MAPK3, JUN, LAMB3, FN1, PTK2, MYLPF, CTNNB1, GRB2 | 52 |
| hsa04660:T cell receptor signaling pathway | 8 | 0.008194409 | PIK3CA, KRAS, PLCG1, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 38 | 1.54E-10 | GSK3B, PIK3R3, PIK3R2, PIK3CB, PIK3R1, CD3E, RASGRP1, RELA, PIK3R5, IKBKB, NRAS, NCK2, MAPK1, PAK6, IKBKG, PAK3, PAK2, MAP3K7, MAPK3, JUN, NFATC1, FOS, RHOA, MAPK12, IL2, NFKB1, IL4, NFKBIA, MAPK11, CD4, IL5, IFNG, PIK3CA, CDK4, GRB2, PRKCQ, LAT, NFKBIB | 35 |
| hsa05218:Melanoma | 16 | 4.43E-11 | RB1, PDGFRA, CDKN2A, HGF, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, CCND1, CDH1, KRAS, HRAS, TP53 | 31 | 1.93E-10 | RB1, CDKN1A, PTEN, PDGFB, PDGFA, PIK3R3, PIK3R2, PIK3CB, PIK3R1, EGFR, IGF1R, PIK3R5, FGF5, FGF6, FGF7, NRAS, CCND1, CDH1, PDGFD, PDGFC, E2F1, MAPK1, E2F3, MAPK3, FGF21, PDGFRB, MITF, CDK6, PIK3CA, CDK4, FGFR1 | 23 |
| hsa04917:Prolactin signaling pathway | 10 | 3.28E-05 | CCND1, PIK3CA, KRAS, PIK3CB, PIK3R1, JAK2, SOS1, HRAS, ESR1, PIK3CG | 31 | 1.93E-10 | GSK3B, SHC2, SHC3, SRC, PIK3R3, PIK3R2, PIK3CB, PIK3R1, PRL, FOXO3, RELA, PIK3R5, INS, MAPK9, SOCS3, NRAS, MAPK8, SOCS1, CCND1, MAPK1, MAPK3, STAT3, FOS, PRLR, ESR1, MAPK12, ESR2, NFKB1, MAPK11, PIK3CA, GRB2 | 26 |
| hsa04810:Regulation of actin cytoskeleton | 15 | 0.000333 | PDGFRA, FN1, MSN, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, KRAS, ITGA6, SOS1, HRAS, FGFR3, FGFR2 | 60 | 2.99E-10 | ITGB1, CHRM2, ITGB4, ITGB3, ARPC1A, ITGA2B, PIK3CB, FGF5, PPP1CB, FGF6, PPP1CC, FGF7, RAC2, PIP4K2B, ITGAV, PIP4K2C, RAC1, GIT1, PDGFRB, ITGA4, RHOA, MYL5, PIK3CA, MYL2, CRK, SRC, PXN, PDGFB, PDGFA, PIK3R3, PIK3R2, PIK3R1, IQGAP1, EGFR, SLC9A1, INS, PIK3R5, GNA13, NRAS, RRAS, PDGFD, PDGFC, PIP5K1A, MAPK1, PAK6, PIP5K1C, PAK3, PAK2, FGF21, MAPK3, FN1, MSN, ARPC4, ARPC5, GNG12, PTK2, MYLPF, ARPC2, FGFR3, FGFR1 | 53 |
| hsa04380:Osteoclast differentiation | 7 | 0.082432621 | CREB1, PIK3CA, PIK3CB, PIK3R1, PIK3CG, FOSL2, TGFBR2 | 44 | 4.34E-10 | NCF1, ITGB3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, PIK3R5, IKBKB, MAPK9, SOCS3, MAPK8, SOCS1, PLCG2, MAPK1, IKBKG, RAC1, JUNB, MAP3K7, MAPK3, TGFB2, JUN, TGFB1, JUND, SYK, IFNB1, NFATC1, MITF, FOS, TGFBR1, MAPK12, NFKB1, FOSL2, NFKB2, NFKBIA, FOSL1, MAPK11, IL1A, IFNG, PIK3CA, IL1B, GRB2, NOX1, IFNAR1 | 40 |
| hsa04915:Estrogen signaling pathway | 16 | 5.97E-09 | HSPA8, HSP90AB1, MMP2, PRKCD, PIK3CB, PIK3R1, ESR1, EGFR, PIK3CG, GNAI1, CREB1, PIK3CA, GNAS, KRAS, SOS1, HRAS | 37 | 4.82E-10 | ATF2, SHC2, SHC3, HSP90AB1, SRC, GNAI3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, EGFR, HSP90B1, PIK3R5, NRAS, PRKACG, MAPK1, PRKACA, MAPK3, HSPA8, JUN, HSP90AA1, NOS3, MMP2, HSPA2, FOS, ESR1, ESR2, PLCB3, PLCB4, PIK3CA, SP1, GNAQ, GNAS, GRB2, CALM3, PLCB1, HBEGF | 28 |
| hsa05210:Colorectal cancer | 13 | 1.22E-08 | SMAD2, TCF7L2, SMAD4, BRAF, PIK3CB, PIK3R1, PIK3CG, TGFBR2, PIK3CA, CCND1, CTNNB1, KRAS, TP53 | 28 | 6.93E-10 | GSK3B, PIK3R3, PIK3R2, PIK3CB, PIK3R1, PIK3R5, MAPK9, MAPK8, CCND1, CASP3, RAC2, MAPK1, RAC1, MAPK3, SMAD2, TGFB2, JUN, SMAD4, TGFB1, TGFB3, FOS, MLH1, RHOA, TGFBR1, MSH6, MSH2, PIK3CA, CTNNB1 | 21 |
| hsa04066:HIF-1 signaling pathway | 10 | 0.000349 | PIK3CA, ERBB2, EP300, PLCG1, PIK3CB, PIK3R1, TLR4, EGFR, MTOR, PIK3CG | 36 | 7.76E-10 | CDKN1A, CDKN1B, FLT1, TFRC, EPO, CUL2, SERPINE1, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, EGFR, IGF1R, PIK3R5, INS, PLCG2, MAPK1, EP300, CAMK2G, EIF4E, MAPK3, PRKCG, EGLN3, CREBBP, NOS3, RPS6, STAT3, PRKCA, NFKB1, RBX1, IFNG, PIK3CA, RPS6KB1, LTBR, GAPDH | 31 |
| hsa04010:MAPK signaling pathway | 19 | 1.92E-05 | PDGFRA, HSPA8, MAP3K1, MAX, BRAF, EGFR, MAPK8IP1, TGFBR2, MECOM, RASA1, NF1, FLNA, KRAS, SOS1, HRAS, FGFR3, TP53, FGFR2, MAP3K4 | 67 | 8.18E-10 | ATF2, FGF5, IKBKB, FGF6, FGF7, RPS6KA5, RPS6KA2, PRKACG, CASP3, RAC2, IKBKG, RAC1, PRKACA, MAP3K7, MAP3K5, PDGFRB, PRKCG, MAP2K3, PLA2G4B, PRKCA, FOS, TGFBR1, IL1A, CACNB4, RASA1, IL1B, MAPKAPK2, MAPKAPK5, CRK, PDGFB, PDGFA, NLK, RASGRP1, EGFR, RELA, MAPK9, NRAS, MAPK8, RAP1A, MAPK7, RRAS, NTF3, MAPK1, PAK2, FGF21, MAPK3, HSPA8, TGFB2, JUN, TGFB1, JUND, MAP3K1, GADD45B, TGFB3, NFATC1, HSPA2, GNG12, MAPK12, NFKB1, NFKB2, MAPK11, PPP5C, NF1, GRB2, FGFR3, MAP3K11, FGFR1 | 61 |
| hsa04910:Insulin signaling pathway | 13 | 7.56E-05 | TSC2, BRAF, IRS2, PIK3CB, PIK3R1, MTOR, PIK3CG, PIK3CA, PRKAR1A, RHEB, KRAS, SOS1, HRAS | 44 | 2.70E-09 | GSK3B, SHC2, PRKAA1, SHC3, IRS1, PRKAG1, IRS4, PRKAG2, PIK3R3, IRS2, PIK3R2, PIK3CB, PIK3R1, CBL, PIK3R5, INS, IKBKB, PPP1CB, MAPK9, SOCS3, PPP1CC, NRAS, MAPK8, SOCS1, PRKACG, MAPK1, PRKACA, PPARGC1A, EIF4E, MAPK3, PCK2, PRKCI, PRKAB2, RPS6, PRKAR1B, PIK3CA, RPS6KB1, PRKAR1A, RHEB, FASN, GRB2, CALM3, CRK, RHOQ | 38 |
| hsa05100:Bacterial invasion of epithelial cells | 10 | 7.00E-05 | CTTN, PIK3CA, CDH1, CLTCL1, CLTC, FN1, CTNNB1, PIK3CB, PIK3R1, PIK3CG | 31 | 2.94E-09 | ITGB1, SHC2, SHC3, SRC, PXN, ARPC1A, CLTC, CLTB, ILK, PIK3R3, PIK3R2, PIK3CB, PIK3R1, CBL, PIK3R5, CDH1, CLTCL1, CTNNA1, CTNNA2, RAC1, RHOG, FN1, ARPC4, ARPC5, RHOA, PTK2, CTTN, PIK3CA, ARPC2, CTNNB1, CRK | 22 |
| hsa05164:Influenza A | 10 | 0.019159507 | HSPA8, PIK3CA, EP300, NLRP3, NUP98, PIK3CB, PIK3R1, JAK2, TLR4, PIK3CG | 51 | 3.08E-09 | ATF2, GSK3B, NXT1, PIK3CB, ICAM1, IFIH1, IKBKB, TBK1, EP300, IKBKE, MAP2K3, DDX58, PRKCA, IL1A, IFNG, PIK3CA, IRF3, IL1B, HLA-DQB1, IFNAR1, PIK3R3, PIK3R2, FURIN, PIK3R1, RELA, PIK3R5, SOCS3, MAPK9, NXF1, MAPK8, PABPN1, MAPK1, RAE1, MAPK3, CPSF4, IL33, HSPA8, JUN, CREBBP, IFNB1, TNFRSF10B, EIF2AK2, HSPA2, MAPK12, NFKB1, PML, TNFRSF10D, NFKBIA, MAPK11, MYD88, NFKBIB | 46 |
| hsa04110:Cell cycle | 13 | 2.61E-05 | RB1, SMAD2, SMAD4, MCM7, CDKN2A, CUL1, SMC3, SMC1A, TFDP1, CCND1, RAD21, EP300, TP53 | 41 | 3.17E-09 | CDKN1C, RB1, GSK3B, CDKN1A, HDAC2, CDKN1B, PCNA, MCM7, CCNH, PRKDC, YWHAB, CUL1, SMC3, PTTG1, CCND1, CHEK1, E2F1, EP300, E2F3, E2F4, SMAD2, TGFB2, CDKN2B, CREBBP, SMAD4, TGFB1, CDKN2C, GADD45B, TGFB3, RBX1, STAG1, CDK7, TFDP1, CDK6, TFDP2, CCNE1, CDK4, CDK2, MCM3, MCM6, MCM2 | 32 |
| hsa04150:mTOR signaling pathway | 10 | 6.06E-06 | STK11, PIK3CA, RHEB, PTEN, TSC2, BRAF, PIK3CB, PIK3R1, MTOR, PIK3CG | 26 | 3.88E-09 | PRKAA1, IRS1, PTEN, PIK3R3, PIK3R2, PIK3CB, PIK3R1, PIK3R5, INS, IKBKB, STK11, RPS6KA2, MAPK1, EIF4E, EIF4B, MAPK3, PRKCG, RPS6, PRKCA, RRAGA, PIK3CA, RPS6KB1, RRAGC, RRAGB, RHEB, RRAGD | 20 |
| hsa04630:Jak-STAT signaling pathway | 11 | 0.001859783 | CCND1, PIK3CA, LEPR, EP300, PTPN11, LIFR, PIK3CB, PIK3R1, JAK2, SOS1, PIK3CG | 45 | 4.43E-09 | IL21, EPO, IL24, MPL, IL5RA, PIK3R3, PIK3R2, PIK3CB, PIK3R1, PRL, IL2RG, PIK3R5, SOCS3, SOCS1, CCND1, PIM1, EP300, IL12RB1, JAK3, IL12RB2, PIAS4, PIAS3, CREBBP, IL4R, IFNB1, IL13, STAT3, LIF, LIFR, PTPN11, STAM, PRLR, IL2, PIAS2, PIAS1, IL4, IL5, IFNG, PIK3CA, IL7, LEP, IL2RB, GRB2, IL6ST, IFNAR1 | 38 |
| hsa05202:Transcriptional misregulation in cancer | 14 | 0.000119 | DDX5, FLT3, MAX, H3F3C, JMJD1C, MLLT3, TGFBR2, RUNX1, NCOR1, RXRA, EWSR1, SIN3A, TP53, KDM6A | 49 | 6.36E-09 | CDKN1A, CDKN1B, CCNT2, FLT1, LDB1, BMI1, IGF1R, LYL1, MEN1, IGFBP3, LMO2, SUPT3H, MLF1, RUNX2, RUNX1, MYCN, NCOR1, MAF, EWSR1, RARA, ERG, CEBPA, CEBPB, HDAC2, PRCC, PDGFA, MLLT1, RELA, RXRB, HIST1H3A, GRIA3, NGFR, CDKN2C, TAF15, JUP, H3F3A, PBX3, FLI1, NFKB1, PBX1, PTK2, PML, CDK9, MEIS1, SP1, ID2, HIST3H3, IL2RB, REL | 46 |
| hsa04310:Wnt signaling pathway | 11 | 0.00128038 | TCF7L2, SMAD4, SOX17, CCND1, TBL1XR1, CHD8, CUL1, EP300, CTNNB1, PSEN1, TP53 | 42 | 2.95E-08 | GSK3B, CTBP2, CUL1, LRP5, NLK, MAPK9, MAPK8, CCND1, PRKACG, RUVBL1, DVL1, DVL2, RAC2, DVL3, EP300, RAC1, TBL1X, PRKACA, MAP3K7, CAMK2G, PRKCG, JUN, CREBBP, SMAD4, MMP7, FZD5, CSNK2A1, FBXW11, SIAH1, PRKCA, NFATC1, CSNK1E, DKK1, RHOA, RBX1, FOSL1, PLCB3, PLCB4, TBL1XR1, CTNNB1, PLCB1, PPARD | 36 |
| hsa04062:Chemokine signaling pathway | 13 | 0.00118933 | LYN, PRKCD, BRAF, PIK3CB, PIK3R1, PIK3CG, GNAI1, PIK3CA, KRAS, DOCK2, JAK2, SOS1, HRAS | 51 | 3.48E-08 | GSK3B, GSK3A, NCF1, PIK3CB, IKBKB, GNGT1, PRKACG, RAC2, IKBKG, RAC1, PRKACA, JAK3, RHOA, PLCB3, PLCB4, PIK3CA, PLCB1, CRK, SHC2, SHC3, SRC, PXN, GNAI3, PIK3R3, PIK3R2, PIK3R1, FOXO3, RELA, PIK3R5, NRAS, RAP1A, GRK5, GNG5, GNG4, GNG7, PTK2B, MAPK1, MAPK3, LYN, STAT3, GNG12, GNG11, NFKB1, PTK2, GNG13, NFKBIA, GNB2, GNB1, GRB2, GNB5, NFKBIB | 47 |
| hsa04664:Fc epsilon RI signaling pathway | 9 | 0.000156 | LYN, PIK3CA, KRAS, PLCG1, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 27 | 3.88E-08 | PIK3R3, PIK3R2, PIK3CB, PIK3R1, PIK3R5, MAPK9, NRAS, MAPK8, PLCG2, RAC2, MAPK1, RAC1, MAPK3, LYN, MAP2K3, SYK, PLA2G4B, IL13, PRKCA, MAPK12, IL4, MAPK11, IL5, PIK3CA, GRB2, MS4A2, LAT | 23 |
| hsa04550:Signaling pathways regulating pluripotency of stem cells | 14 | 1.87E-05 | SMAD2, SMAD4, RIF1, LIFR, PIK3CB, PIK3R1, PIK3CG, PIK3CA, CTNNB1, KRAS, JAK2, HRAS, FGFR3, FGFR2 | 42 | 4.63E-08 | GSK3B, RIF1, ONECUT1, PIK3R3, PIK3R2, PIK3CB, PIK3R1, BMI1, IGF1R, PIK3R5, SOX2, NRAS, DVL1, DVL2, DVL3, MAPK1, JARID2, JAK3, SKIL, MAPK3, SMAD2, SMAD4, FZD5, PCGF2, STAT3, LIF, SMAD9, LIFR, PAX6, INHBA, SMAD5, MAPK12, MAPK11, MEIS1, PIK3CA, ID2, CTNNB1, GRB2, NANOG, IL6ST, FGFR3, FGFR1 | 33 |
| hsa04912:GnRH signaling pathway | 9 | 0.001141708 | MAP3K1, MMP2, PRKCD, GNAS, KRAS, SOS1, HRAS, EGFR, MAP3K4 | 32 | 4.63E-08 | SRC, EGFR, PLD2, MAPK9, NRAS, MAPK8, MAPK7, PRKACG, GNA11, PTK2B, MAPK1, PRKACA, CAMK2G, MAPK3, MAP2K3, JUN, MAP3K1, MMP2, PLA2G4B, FSHB, PRKCA, MAPK12, MAPK11, PLCB3, MMP14, PLCB4, GNAQ, GNAS, GRB2, CALM3, PLCB1, HBEGF | 28 |
| hsa04071:Sphingolipid signaling pathway | 10 | 0.001757692 | PIK3CA, PPP2R1A, PTEN, KRAS, PIK3CB, PIK3R1, HRAS, TP53, GNAI1, PIK3CG | 38 | 4.80E-08 | GNAI3, PTEN, PIK3R3, PPP2R2A, PIK3R2, PIK3CB, PIK3R1, RELA, PLD2, PIK3R5, PPP2CA, GNA13, PPP2CB, MAPK9, NRAS, MAPK8, RAC2, MAPK1, RAC1, MAPK3, MAP3K5, PRKCG, NOS3, PPP2R5B, PRKCA, PPP2R5D, PPP2R5C, RHOA, MAPK12, NFKB1, MAPK11, PLCB3, PLCB4, PIK3CA, GNAQ, PLCB1, MS4A2, NSMAF | 34 |
| hsa05223:Non-small cell lung cancer | 16 | 1.06E-12 | RB1, CDKN2A, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, RXRA, PIK3CA, CCND1, ERBB2, KRAS, PLCG1, SOS1, HRAS, TP53 | 24 | 4.95E-08 | RB1, PRKCG, PIK3R3, TGFA, PRKCA, PIK3R2, PIK3CB, PIK3R1, FOXO3, EGFR, PIK3R5, RXRB, NRAS, CDK6, PIK3CA, CCND1, CDK4, E2F1, PLCG2, MAPK1, RARB, GRB2, E2F3, MAPK3 | 18 |
| hsa05221:Acute myeloid leukemia | 14 | 2.63E-10 | TCF7L2, FLT3, BRAF, PIK3CB, PIK3R1, MTOR, PIK3CG, RUNX1, PIK3CA, CCND1, KIT, KRAS, SOS1, HRAS | 24 | 4.95E-08 | CEBPA, JUP, STAT3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, NFKB1, PML, PIK3R5, RUNX1, IKBKB, NRAS, PIK3CA, CCND1, RPS6KB1, PIM1, RARA, MAPK1, GRB2, IKBKG, PPARD, MAPK3 | 19 |
| hsa04730:Long-term depression | 7 | 0.002478466 | LYN, PPP2R1A, GNAS, BRAF, KRAS, HRAS, GNAI1 | 24 | 2.25E-07 | LYN, GRIA1, PRKCG, GRIA2, GNAZ, PLA2G4B, GNAI3, PRKCA, IGF1R, PPP2CA, GNA13, PPP2CB, PLCB3, NRAS, PLCB4, GNA11, GNAQ, CRH, GNAS, MAPK1, NOS1, PLCB1, GRIA3, MAPK3 | 22 |
| hsa04350:TGF-beta signaling pathway | 7 | 0.012805453 | SMAD2, SMAD4, TFDP1, PPP2R1A, CUL1, EP300, TGFBR2 | 29 | 3.48E-07 | CUL1, PPP2CA, PPP2CB, MAPK1, EP300, E2F4, PITX2, MAPK3, SMAD2, TGFB2, CDKN2B, CREBBP, SMAD4, TGFB1, SMURF1, TGFB3, SMAD9, INHBA, SMAD5, RHOA, TGFBR1, DCN, RBX1, SMAD7, TFDP1, IFNG, RPS6KB1, SP1, ID2 | 24 |
| hsa05160:Hepatitis C | 13 | 5.26E-05 | BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, RXRA, PIK3CA, PPP2R1A, PSME3, KRAS, SOS1, HRAS, TP53 | 38 | 8.66E-07 | GSK3B, CDKN1A, PIK3R3, PPP2R2A, PIK3R2, PIK3CB, PIK3R1, RELA, EGFR, PIK3R5, PPP2CA, IKBKB, PPP2CB, MAPK9, SOCS3, NRAS, MAPK8, TBK1, MAPK1, RIPK1, IKBKG, IKBKE, MAPK3, IFNB1, DDX58, STAT3, EIF2AK2, MAPK12, NFKB1, PIAS1, NFKBIA, MAPK11, IRF3, PIK3CA, PSME3, GRB2, EIF3E, IFNAR1 | 33 |
| hsa04662:B cell receptor signaling pathway | 8 | 0.00100099 | LYN, PIK3CA, KRAS, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 25 | 9.99E-07 | GSK3B, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, PIK3R5, IKBKB, NRAS, PLCG2, RAC2, MAPK1, IKBKG, RAC1, MAPK3, LYN, JUN, SYK, NFATC1, FOS, NFKB1, NFKBIA, PIK3CA, GRB2, NFKBIB | 21 |
| hsa04931:Insulin resistance | 10 | 0.000832 | CREB1, PIK3CA, PRKCD, PTEN, IRS2, PTPN11, PIK3CB, PIK3R1, MTOR, PIK3CG | 33 | 1.05E-06 | GSK3B, PRKAA1, IRS1, PRKAG1, PTEN, PRKAG2, PIK3R3, IRS2, PIK3R2, PIK3CB, PIK3R1, RELA, PIK3R5, INS, IKBKB, PPP1CB, MAPK9, SOCS3, PPP1CC, MAPK8, RPS6KA2, PPARGC1A, PCK2, PRKAB2, NOS3, STAT3, PTPN11, NFKB1, NFKBIA, PIK3CA, RPS6KB1, PRKCQ, OGT | 27 |
| hsa05213:Endometrial cancer | 16 | 3.17E-13 | TCF7L2, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, CCND1, CDH1, ERBB2, CTNNB1, KRAS, SOS1, HRAS, TP53 | 21 | 1.30E-06 | GSK3B, PTEN, PIK3R3, ILK, PIK3R2, PIK3CB, PIK3R1, MLH1, FOXO3, EGFR, PIK3R5, NRAS, PIK3CA, CCND1, CDH1, CTNNA1, MAPK1, CTNNB1, GRB2, CTNNA2, MAPK3 | 13 |
| hsa04370:VEGF signaling pathway | 7 | 0.002697319 | PIK3CA, KRAS, PLCG1, PIK3CB, PIK3R1, HRAS, PIK3CG | 23 | 1.40E-06 | PRKCG, SHC2, NOS3, SRC, PLA2G4B, PXN, PIK3R3, PRKCA, PIK3R2, PIK3CB, PIK3R1, PTK2, MAPK12, PIK3R5, MAPK11, NRAS, PIK3CA, MAPKAPK2, PLCG2, RAC2, MAPK1, RAC1, MAPK3 | 20 |
| hsa04520:Adherens junction | 10 | 3.28E-05 | SMAD2, TCF7L2, SMAD4, CDH1, ERBB2, CTNND1, EP300, CTNNB1, EGFR, TGFBR2 | 25 | 1.80E-06 | SRC, CTNND1, IQGAP1, NLK, EGFR, IGF1R, CDH1, CTNNA1, RAC2, MAPK1, EP300, CTNNA2, RAC1, MAP3K7, MAPK3, SMAD2, CREBBP, SMAD4, CSNK2A1, LMO7, RHOA, TGFBR1, SNAI1, CTNNB1, FGFR1 | 18 |
| hsa05146:Amoebiasis | 7 | 0.035661242 | PIK3CA, GNAS, FN1, PIK3CB, PIK3R1, TLR4, PIK3CG | 32 | 2.11E-06 | LAMA5, LAMA3, PIK3R3, LAMC2, PIK3R2, LAMC1, PIK3CB, PIK3R1, RELA, PIK3R5, PRKACG, CASP3, GNA11, PRKACA, PRKCG, TGFB2, TGFB1, LAMB3, TGFB3, FN1, PRKCA, PTK2, NFKB1, PLCB3, PLCB4, IFNG, PIK3CA, GNAQ, IL1B, GNAS, PLCB1, RAB7A | 27 |
| hsa05231:Choline metabolism in cancer | 13 | 3.09E-06 | PDGFRA, TSC2, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, RHEB, KRAS, PLCG1, SOS1, HRAS | 31 | 2.15E-06 | PDGFB, PDGFA, PIK3R3, PIK3R2, PIK3CB, PIK3R1, EGFR, PLD2, PIK3R5, MAPK9, NRAS, MAPK8, PDGFD, PDGFC, RAC2, PIP5K1A, MAPK1, PIP5K1C, RAC1, MAPK3, PRKCG, PDGFRB, JUN, PLA2G4B, PRKCA, FOS, PIK3CA, RPS6KB1, SP1, RHEB, GRB2 | 26 |
| hsa04152:AMPK signaling pathway | 13 | 2.41E-05 | TSC2, IRS2, PIK3CB, PIK3R1, MTOR, PIK3CG, STK11, CREB1, PIK3CA, CCND1, PPP2R1A, RHEB, LEPR | 35 | 2.82E-06 | PRKAA1, IRS1, PRKAG1, IRS4, PRKAG2, PIK3R3, PPP2R2A, IRS2, PIK3R2, PIK3CB, PIK3R1, FOXO3, ELAVL1, IGF1R, PIK3R5, INS, PPP2CA, PPP2CB, STK11, CCND1, PPARGC1A, MAP3K7, RAB8A, PCK2, PRKAB2, PPP2R5B, PPP2R5D, PPP2R5C, SIRT1, PIK3CA, RPS6KB1, RHEB, FASN, LEP, CFTR | 28 |
| hsa04070:Phosphatidylinositol signaling system | 8 | 0.007357658 | INPP4A, PIK3CA, PTEN, PLCG1, PIK3CB, PIK3R1, PIK3CG, MTM1 | 30 | 3.46E-06 | MTMR1, MTMR2, PTEN, PIK3R3, PIK3C2G, PIK3R2, PIK3CB, PIK3R1, MTMR4, MTMR6, PIK3C2B, PIK3R5, MTM1, INPP5B, INPP5A, INPP5E, PLCG2, PIP5K1A, PLCE1, PIP4K2B, PIP4K2C, PIP5K1C, PRKCG, PRKCA, PLCB3, PLCB4, PIK3CA, CALM3, PLCB1, PI4K2A | 25 |
| hsa04750:Inflammatory mediator regulation of TRP channels | 7 | 0.025530792 | PIK3CA, PRKCD, GNAS, PLCG1, PIK3CB, PIK3R1, PIK3CG | 30 | 3.46E-06 | SRC, PIK3R3, PIK3R2, IL1RAP, PIK3CB, PIK3R1, PIK3R5, PPP1CB, MAPK9, PPP1CC, MAPK8, PRKACG, PLCG2, PRKACA, CAMK2G, PRKCG, MAP2K3, PLA2G4B, PRKCA, MAPK12, MAPK11, PLCB3, PLCB4, PIK3CA, GNAQ, IL1B, GNAS, PRKCQ, CALM3, PLCB1 | 26 |
| hsa04670:Leukocyte transendothelial migration | 11 | 0.000304 | PIK3CA, MMP2, CTNND1, CTNNB1, MSN, PTPN11, PLCG1, PIK3CB, PIK3R1, GNAI1, PIK3CG | 33 | 4.72E-06 | ITGB1, NCF1, PXN, CTNND1, GNAI3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, PIK3R5, ICAM1, RAP1A, CTNNA1, PLCG2, RAC2, PTK2B, CTNNA2, RAC1, PRKCG, ITGA4, MMP2, MSN, PRKCA, PTPN11, RHOA, MAPK12, PTK2, MYLPF, MYL5, MAPK11, PIK3CA, MYL2, CTNNB1 | 25 |
| hsa04920:Adipocytokine signaling pathway | 7 | 0.005373817 | STK11, RXRA, LEPR, IRS2, PTPN11, JAK2, MTOR | 24 | 5.12E-06 | PRKAA1, PRKAB2, IRS1, STAT3, PRKAG1, IRS4, PRKAG2, IRS2, PTPN11, RELA, NFKB1, RXRB, NFKBIA, IKBKB, MAPK9, SOCS3, STK11, MAPK8, LEP, PRKCQ, IKBKG, PPARGC1A, PCK2, NFKBIB | 21 |
| hsa04725:Cholinergic synapse | 9 | 0.004022362 | CREB1, PIK3CA, KRAS, PIK3CB, PIK3R1, JAK2, HRAS, GNAI1, PIK3CG | 32 | 6.11E-06 | CHRM2, GNAI3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, PIK3R5, GNGT1, NRAS, GNG5, GNG4, PRKACG, GNA11, GNG7, MAPK1, PRKACA, CAMK2G, MAPK3, PRKCG, PRKCA, FOS, GNG12, GNG11, GNG13, PLCB3, PLCB4, PIK3CA, GNAQ, GNB2, GNB1, GNB5, PLCB1 | 29 |
| hsa04330:Notch signaling pathway | 4 | 0.098713389 | NCOR2, NOTCH1, EP300, PSEN1 | 19 | 6.75E-06 | NOTCH2, RBPJL, NOTCH3, CREBBP, HDAC2, NOTCH1, JAG1, CTBP2, MAML1, RBPJ, NCOR2, NCSTN, SNW1, DVL1, DVL2, NUMB, DVL3, EP300, HES1 | 16 |
| hsa04024:cAMP signaling pathway | 12 | 0.005990751 | CREB1, GRIN3A, ADORA2A, PIK3CA, GNAS, EP300, BRAF, SOX9, PIK3CB, PIK3R1, GNAI1, PIK3CG | 47 | 1.02E-05 | GRIA1, CHRM2, GRIA2, GNAI3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RELA, GLI3, SLC9A1, PLD2, PIK3R5, PPP1CB, MAPK9, PPP1CC, GRIN2A, MAPK8, RAP1A, RRAS, PRKACG, RAC2, MAPK1, EP300, PLCE1, TNNI3, SOX9, RAC1, DRD2, PRKACA, CAMK2G, GRIA3, MAPK3, JUN, CREBBP, FSHB, NFATC1, FOS, RHOA, NFKB1, GRIN1, GRIN2D, NFKBIA, PIK3CA, GNAS, CALM3, CFTR | 41 |
| hsa04611:Platelet activation | 7 | 0.080109666 | LYN, PIK3CA, GNAS, PIK3CB, PIK3R1, GNAI1, PIK3CG | 35 | 1.06E-05 | ITGB1, SRC, ITGB3, ITGA2B, GNAI3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, RASGRP1, PIK3R5, GNA13, PPP1CB, PPP1CC, RAP1A, PRKACG, PLCG2, MAPK1, PRKACA, MAPK3, LYN, PRKCI, SYK, NOS3, PLA2G4B, RHOA, MAPK12, MAPK11, PLCB3, PLCB4, PIK3CA, GNAQ, GNAS, PLCB1, TLN1 | 30 |
| hsa04961:Endocrine and other factor-regulated calcium reabsorption | 4 | 0.085047798 | CLTCL1, CLTC, GNAS, ESR1 | 18 | 1.08E-05 | PRKCG, CLTC, CLTB, PRKCA, AP2B1, AP2A2, ESR1, RAB11A, PLCB3, PLCB4, PRKACG, GNAQ, CLTCL1, AP2S1, GNAS, PLCB1, PRKACA, AP2M1 | 14 |
| hsa05219:Bladder cancer | 12 | 1.24E-09 | RB1, CCND1, CDKN2A, CDH1, MMP2, ERBB2, BRAF, KRAS, HRAS, FGFR3, TP53, EGFR | 17 | 1.21E-05 | RB1, CDKN1A, MMP1, SRC, MMP2, EGFR, NRAS, RPS6KA5, CCND1, CDH1, CDK4, E2F1, MAPK1, E2F3, FGFR3, HBEGF, MAPK3 | 11 |
| hsa04666:Fc gamma R-mediated phagocytosis | 9 | 0.000671 | LYN, PIK3CA, PRKCD, AMPH, PLCG1, PIK3CB, PIK3R1, DOCK2, PIK3CG | 26 | 1.45E-05 | NCF1, ARPC1A, PIK3R3, PIK3R2, PIK3CB, PIK3R1, PLD2, PIK3R5, PLCG2, RAC2, PIP5K1A, MAPK1, PIP5K1C, RAC1, MAPK3, PRKCG, LYN, SYK, PRKCA, ARPC4, ARPC5, PIK3CA, RPS6KB1, ARPC2, CRK, LAT | 22 |
| hsa00562:Inositol phosphate metabolism | 7 | 0.005760271 | INPP4A, PIK3CA, PTEN, PLCG1, PIK3CB, PIK3CG, MTM1 | 23 | 2.34E-05 | MTMR1, MTMR2, PTEN, PIK3C2G, PIK3CB, MTMR4, MTMR6, PIK3C2B, MTM1, INPP5B, PLCB3, INPP5A, PLCB4, PIK3CA, INPP5E, PLCG2, PIP5K1A, PLCE1, PIP4K2B, PIP5K1C, PIP4K2C, PLCB1, PI4K2A | 19 |
| hsa05034:Alcoholism | 11 | 0.007721852 | CREB1, GRIN3A, ADORA2A, H3F3C, GNAS, BRAF, KRAS, SOS1, HRAS, GNAI1, HIST1H2BD | 41 | 7.46E-05 | HDAC4, HDAC5, ATF2, SHC2, HDAC2, HDAC3, SHC3, HDAC11, GNAI3, HDAC9, GNGT1, PPP1CB, PPP1CC, GRIN2A, NRAS, HIST1H3A, GNG5, GNG4, GNG7, MAPK1, DRD2, HIST1H2AC, MAPK3, H2AFZ, H2AFX, H3F3A, GNG12, GNG11, GRIN1, GRIN2D, GNG13, GNB2, GNB1, HIST3H3, GNAS, CRH, GRB2, CALM3, GNB5, HIST1H2BB, HIST1H2BC | 40 |
| hsa04540:Gap junction | 7 | 0.01584081 | PDGFRA, GNAS, KRAS, SOS1, HRAS, GNAI1, EGFR | 25 | 0.000102 | SRC, GNAI3, PDGFB, PDGFA, EGFR, GJA1, NRAS, MAPK7, PRKACG, GNA11, PDGFD, PDGFC, MAPK1, DRD2, PRKACA, MAPK3, PRKCG, PDGFRB, PRKCA, PLCB3, PLCB4, GNAQ, GNAS, GRB2, PLCB1 | 23 |
| hsa04930:Type II diabetes mellitus | 7 | 0.000763 | PIK3CA, PRKCD, IRS2, PIK3CB, PIK3R1, MTOR, PIK3CG | 17 | 0.000115 | IRS1, IRS4, PIK3R3, PIK3R2, IRS2, PIK3CB, PIK3R1, PIK3R5, INS, IKBKB, MAPK9, SOCS3, MAPK8, SOCS1, PIK3CA, MAPK1, MAPK3 | 13 |
| hsa04960:Aldosterone-regulated sodium reabsorption | 7 | 0.000241 | PIK3CA, NEDD4L, KRAS, PIK3CB, PIK3R1, SGK1, PIK3CG | 15 | 0.000124 | PRKCG, IRS1, PIK3R3, PRKCA, PIK3R2, PIK3CB, PIK3R1, PIK3R5, INS, NR3C2, PIK3CA, SCNN1B, SCNN1A, MAPK1, MAPK3 | 12 |
| hsa04650:Natural killer cell mediated cytotoxicity | 10 | 0.001971421 | PIK3CA, BRAF, PTPN11, KRAS, PLCG1, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 30 | 0.00029 | SHC2, SHC3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, PIK3R5, ICAM1, NRAS, KLRK1, CASP3, PLCG2, RAC2, PTK2B, MAPK1, RAC1, MAPK3, PRKCG, SYK, IFNB1, TNFRSF10B, PRKCA, PTPN11, NFATC1, TNFRSF10D, IFNG, PIK3CA, GRB2, LAT, IFNAR1 | 26 |
| hsa04210:Apoptosis | 5 | 0.054548275 | PIK3CA, PIK3CB, PIK3R1, TP53, PIK3CG | 19 | 0.000319 | PIK3R3, TNFRSF10B, PIK3R2, PIK3CB, PIK3R1, RELA, NFKB1, PIK3R5, TNFRSF10D, NFKBIA, IKBKB, CASP8, PIK3CA, CASP10, CASP3, RIPK1, FADD, IKBKG, BIRC2 | 16 |
| hsa04120:Ubiquitin mediated proteolysis | 7 | 0.097151309 | MAP3K1, FBXW7, CUL1, HUWE1, KEAP1, NEDD4L, BRCA1 | 32 | 0.000459 | CUL5, UBE2D2, CUL2, UBE2D3, CUL1, UBE2D1, BRCA1, PRPF19, CBL, RHOBTB1, SOCS3, SOCS1, PIAS4, PIAS3, UBE2I, MAP3K1, SMURF1, FBXW11, FBXO2, SIAH1, HUWE1, PIAS2, PML, PIAS1, DDB2, RBX1, CUL4A, ITCH, NEDD4, ERCC8, TRIP12, BIRC2 | 28 |
| hsa03460:Fanconi anemia pathway | 5 | 0.033512562 | BLM, TOP3A, FANCA, BRCA1, BRCA2 | 16 | 0.001320253 | MUS81, BLM, RMI1, RPA1, BRCA1, FANCE, MLH1, PALB2, FANCG, FANCF, RAD51, RAD51C, ERCC4, RPA3, RPA4, HES1 | 14 |
| hsa04144:Endocytosis | 14 | 0.003709379 | SMAD2, PDGFRA, HSPA8, CLTC, HLA-B, NEDD4L, HLA-A, EGFR, TGFBR2, CLTCL1, AMPH, HRAS, FGFR3, FGFR2 | 47 | 0.001329788 | TFRC, SRC, ARPC1A, CLTC, CLTB, CBL, IL2RG, AP2A2, EGFR, IGF1R, PLD2, CAPZB, GRK5, KIF5B, CLTCL1, AP2S1, PIP5K1A, PIP5K1C, AP2M1, GIT1, RAB8A, SMAD2, HSPA8, PRKCI, SMURF1, ARPC4, STAM, HLA-A, AP2B1, HSPA2, ARPC5, RHOA, TGFBR1, EPN1, PML, RAB11A, EPN2, EPN3, EHD1, DAB2, ITCH, ARPC2, NEDD4, IL2RB, CAPZA2, FGFR3, RAB7A | 40 |
| hsa04914:Progesterone-mediated oocyte maturation | 8 | 0.003835821 | HSP90AB1, PIK3CA, BRAF, KRAS, PIK3CB, PIK3R1, GNAI1, PIK3CG | 22 | 0.001561851 | HSP90AA1, HSP90AB1, GNAI3, PIK3R3, PIK3R2, PIK3CB, PIK3R1, MAPK12, PIK3R5, INS, IGF1R, MAPK11, MAPK9, MAPK8, PIK3CA, PRKACG, RPS6KA2, CDK2, MAPK1, PGR, PRKACA, MAPK3 | 18 |
| hsa04916:Melanogenesis | 9 | 0.002098555 | TCF7L2, CREB1, KIT, GNAS, EP300, CTNNB1, KRAS, HRAS, GNAI1 | 24 | 0.001906762 | PRKCG, GSK3B, CREBBP, FZD5, GNAI3, PRKCA, MITF, PLCB3, NRAS, PLCB4, PRKACG, GNAQ, DVL1, DVL2, GNAS, DVL3, EP300, MAPK1, CTNNB1, CALM3, PLCB1, PRKACA, CAMK2G, MAPK3 | 21 |
| hsa04115:p53 signaling pathway | 5 | 0.068713677 | CCND1, CDKN2A, PTEN, TSC2, TP53 | 17 | 0.006066136 | CDKN1A, GADD45B, IGFBP3, SIAH1, SERPINE1, PTEN, PPM1D, DDB2, CASP8, CDK6, CCND1, CCNE1, CDK4, CASP3, CHEK1, CDK2, PMAIP1 | 15 |
| hsa04923:Regulation of lipolysis in adipocytes | 7 | 0.001733896 | PIK3CA, GNAS, IRS2, PIK3CB, PIK3R1, GNAI1, PIK3CG | 15 | 0.006505914 | IRS1, GNAI3, IRS4, PIK3R3, PIK3R2, IRS2, PIK3CB, PIK3R1, PIK3R5, INS, FABP4, PIK3CA, PRKACG, GNAS, PRKACA | 10 |
| hsa04390:Hippo signaling pathway | 9 | 0.02339447 | SMAD2, TCF7L2, SMAD4, CCND1, CDH1, PPP2R1A, CTNNB1, AJUBA, TGFBR2 | 30 | 0.008921711 | GSK3B, YWHAB, SERPINE1, PPP2R2A, SOX2, PPP2CA, PPP1CB, PPP2CB, PPP1CC, CCND1, CDH1, DVL1, DVL2, CTNNA1, DVL3, CTNNA2, SMAD2, TGFB2, PRKCI, SMAD4, TGFB1, FZD5, TGFB3, FBXW11, CSNK1E, TGFBR1, DLG4, ID2, CTNNB1, NF2 | 25 |
| hsa04612:Antigen processing and presentation | 7 | 0.008003075 | HSPA8, CREB1, HSP90AB1, PSME3, HLA-B, HLA-A, B2M | 18 | 0.009455672 | HSPA8, HSP90AA1, HSP90AB1, NFYA, NFYB, NFYC, KIR3DL1, HLA-A, HSPA2, CD4, IFNG, PSME3, RFX5, PSME1, PSME2, CALR, CTSB, HLA-DQB1 | 14 |
| hsa04320:Dorso-ventral axis formation | 4 | 0.023607081 | NOTCH1, KRAS, SOS1, EGFR | 9 | 0.013087386 | NOTCH2, NOTCH3, NOTCH1, MAPK1, GRB2, ETS1, ETS2, EGFR, MAPK3 | 7 |
| hsa05230:Central carbon metabolism in cancer | 16 | 8.88E-12 | PDGFRA, FLT3, PTEN, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, KIT, ERBB2, KRAS, HRAS, FGFR3, TP53, FGFR2 | 15 | 0.021210498 | PDGFRB, NTRK3, PTEN, PIK3R3, PIK3R2, PIK3CB, PIK3R1, EGFR, PIK3R5, NRAS, PIK3CA, MAPK1, FGFR3, FGFR1, MAPK3 | 9 |
| hsa05206:MicroRNAs in cancer | 19 | 9.68E-05 | PDGFRA, NOTCH1, CDKN2A, DNMT3A, PTEN, IRS2, BRCA1, EGFR, MTOR, CCND1, ERBB2, EP300, KRAS, PLCG1, SOS1, HRAS, FGFR3, TP53, EZH2 | 46 | 0.045764257 | NOTCH2, NOTCH3, CDKN1A, DNMT1, CDKN1B, NOTCH1, IRS1, ITGB3, PTEN, PDGFB, PDGFA, IRS2, BRCA1, BMI1, EGFR, IKBKB, NRAS, SOCS1, MAPK7, RPS6KA5, ERBB3, CCND1, CASP3, E2F1, PLCG2, PIM1, EP300, E2F3, PRKCG, PDGFRB, TGFB2, CREBBP, UBE2I, STAT3, DNMT3A, PRKCA, SIRT1, RHOA, NFKB1, CDK6, CCNE1, PDCD4, GRB2, FGFR3, CRK, EZH2 | 36 |

**Table 7. The pathway intersection of driver genes and downstream genes in lung cancer of Classical subtype**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Term | drivers\_count | driver\_pvalue | drivers | Out\_count | Out\_pvalue | Outs | Outs\_drivers\_count |
| hsa05200:Pathways in cancer | 44 | 4.05E-18 | RB1, HSP90AB1, FLT3, MAX, PTEN, PIK3CB, PIK3R1, BRCA2, GNAI1, EGFR, PIK3CG, RXRA, MECOM, CCND1, CDH1, TPR, ERBB2, EP300, PLCG1, HRAS, SMAD2, TCF7L2, PDGFRA, SMAD4, CDKN2A, HGF, MMP2, NCOA4, FN1, BRAF, MTOR, TGFBR2, RUNX1, AR, PIK3CA, KIT, GNAS, CTNNB1, KRAS, ITGA6, SOS1, FGFR3, TP53, FGFR2 | 139 | 7.75E-33 | RB1, SPI1, ITGA2B, FGF1, FGF2, IGF1R, FGF6, FGF7, CCND1, PRKACG, EP300, SKP2, PRKACB, PDGFRB, PRKCG, MAP2K1, MAP2K2, MITF, PRKCA, PGF, RUNX1, RBX1, MSH6, MSH2, CCNE1, RAF1, TP53, MAX, CTBP1, CUL2, PDGFB, PIK3R3, KLK3, PIK3R2, PIK3R1, HIF1A, RASGRP1, HSP90B1, PIK3R5, DVL1, DVL2, PLCG2, DVL3, FADD, FGF23, FGF22, FGF21, STAT5B, FZD3, CREBBP, SMAD4, TGFB1, JUP, FN1, IGF1, GNG12, GNG11, NFKB1, NFKB2, FGF17, BMP2, IL6, FGF14, CDK4, GNAQ, GNB1, CDK2, MDM2, GNB3, GNB5, FGF13, FGF12, FGFR2, ITGB1, GSK3B, CDKN1A, CDKN1B, PTEN, FASLG, BRCA2, GLI1, GLI2, IKBKB, GNGT1, SHH, CASP3, RAC2, ITGAV, IKBKG, RAC1, JAK1, HSP90AA1, MMP1, ITGA2, MMP2, RHOA, TGFBR1, PLCB3, PLCB4, PIK3CA, RARA, RARB, CRK, MET, PLCB2, PPARD, RALA, GSTP1, LAMA3, CXCR4, RELA, EGFR, GNAI1, GNAI2, RXRB, GNA13, CDC42, MAPK9, NRAS, RXRA, GNG4, GNA11, ERBB2, E2F1, E2F2, E2F3, BID, RXRG, MAPK3, NTRK1, CDKN2B, STAT1, EGF, MLH1, MAPK10, KITLG, RAD51, CTNNB1, KRAS | 119 |
| hsa04151:PI3K-Akt signaling pathway | 31 | 3.99E-10 | HSP90AB1, PTEN, BRCA1, PIK3CB, PIK3R1, EGFR, PIK3CG, STK11, RXRA, CCND1, PPP2R1A, MYB, JAK2, HRAS, PDGFRA, HGF, FN1, TSC2, MTOR, CREB1, PIK3CA, RHEB, KIT, KRAS, ITGA6, SGK1, SOS1, FGFR3, TP53, TLR4, FGFR2 | 116 | 4.60E-25 | CHRM2, ATF2, EPO, ITGA2B, PPP2R2A, FGF1, FGF2, IGF1R, FGF6, CCND3, STK11, FGF7, CCND2, CCND1, PPP2R1A, MYB, KDR, PDGFRB, MAP2K1, MAP2K2, RPS6, TSC1, PRKCA, PGF, CCNE1, RAF1, TP53, PDGFB, PIK3R3, PIK3R2, PIK3R1, FOXO3, HSP90B1, PIK3R5, PDGFC, FGF23, FGF22, MCL1, FGF21, PCK2, INSR, FN1, IGF1, GNG12, GNG11, NFKB1, IL2, FGF17, GH2, EFNA1, IL4, GH1, IL3, IL6, FGF14, RHEB, IL7, CDK4, GNB1, CDK2, MDM2, GNB3, GNB5, FGF13, FGFR4, FGF12, FGFR2, ITGB1, GSK3B, CDKN1A, CDKN1B, FLT1, ITGB5, YWHAB, ITGB4, PTEN, FASLG, BRCA1, IKBKB, GNGT1, PPP2R5E, ITGAV, IKBKG, RAC1, JAK3, JAK1, HSP90AA1, PDPK1, ITGA2, PPP2R5B, PPP2R5A, PPP2R5C, CREB1, PIK3CA, MET, PRKAA2, LAMA3, THBS1, RELA, EGFR, INS, PPP2CA, PPP2CB, NRAS, RXRA, GNG4, EIF4E, EIF4B, MAPK3, EGF, NOS3, KITLG, RPS6KB1, IL2RB, KRAS, PKN2 | 100 |
| hsa04014:Ras signaling pathway | 17 | 8.81E-05 | PDGFRA, HGF, PTPN11, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, RASA1, KIT, NF1, KRAS, PLCG1, SOS1, HRAS, FGFR3, FGFR2 | 86 | 1.39E-22 | FLT1, FASLG, FGF1, FGF2, IGF1R, IKBKB, GNGT1, FGF6, FGF7, TBK1, PRKACG, KDR, RAC2, IKBKG, RAC1, PRKACB, PDGFRB, PRKCG, MAP2K1, MAP2K2, KSR1, PLA2G4B, PLA2G4C, GAB1, PLA2G4A, PRKCA, RHOA, PGF, PIK3CA, RASA1, RAF1, MET, RALA, SHC2, SHC1, PDGFB, PIK3R3, PIK3R2, PIK3R1, RASAL2, PLD1, RASGRP1, EGFR, RELA, INS, PIK3R5, CDC42, MAPK9, NRAS, PAK1, RAP1A, RRAS, GNG4, PDGFC, PLCG2, FGF23, PAK2, FGF22, FGF21, PAK4, MAPK3, BRAP, EGF, INSR, PTPN11, IGF1, GNG12, GNG11, NFKB1, GRIN1, EFNA1, MAPK10, FGF17, KITLG, FGF14, GNB1, NF1, REL, GNB3, KRAS, GNB5, FGF13, FGFR4, FGF12, LAT, FGFR2 | 78 |
| hsa05169:Epstein-Barr virus infection | 11 | 0.000625 | LYN, RB1, NCOR2, PSMD11, PIK3CA, HLA-B, HLA-A, PIK3CB, PIK3R1, TP53, PIK3CG | 57 | 5.57E-20 | RB1, CDKN1A, CDKN1B, PSMD8, IKBKB, PSMD6, TBK1, PSMD4, PSMD2, PSMD3, PSMD1, IKBKG, SKP2, JAK3, MAP3K7, JAK1, HLA-DPA1, MAP2K3, MAP2K4, HLA-A, HLA-E, NCOR2, CCNA2, CCNA1, PIK3CA, IRF3, TP53, HLA-DQB1, RBPJL, PSMD12, PSMD11, PSMD14, PSMD13, PIK3R3, PIK3R2, PIK3R1, RELA, PIK3R5, MAPK9, IRAK1, PLCG2, RIPK1, MAP2K6, LYN, MAPK14, NFKB1, NFKB2, MAPK10, PSMC5, SNW1, PSMC4, CDK2, HLA-DPB1, MDM2, HLA-DRA, HLA-DRB1, NFKBIB | 49 |
| hsa05218:Melanoma | 16 | 6.92E-11 | RB1, PDGFRA, CDKN2A, HGF, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, CCND1, CDH1, KRAS, HRAS, TP53 | 41 | 1.18E-18 | RB1, CDKN1A, PTEN, PDGFB, PIK3R3, PIK3R2, PIK3R1, FGF1, FGF2, EGFR, IGF1R, PIK3R5, FGF6, FGF7, NRAS, CCND1, PDGFC, E2F1, E2F2, E2F3, FGF23, FGF22, MAPK3, FGF21, PDGFRB, MAP2K1, MAP2K2, EGF, MITF, IGF1, FGF17, FGF14, PIK3CA, CDK4, MDM2, KRAS, RAF1, FGF13, MET, FGF12, TP53 | 33 |
| hsa05215:Prostate cancer | 23 | 3.58E-17 | RB1, PDGFRA, TCF7L2, HSP90AB1, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, AR, CREB1, PIK3CA, CCND1, ERBB2, EP300, CTNNB1, KRAS, SOS1, HRAS, TP53, FGFR2 | 46 | 1.34E-18 | RB1, GSK3B, CDKN1A, CDKN1B, PTEN, PDGFB, PIK3R3, KLK3, PIK3R2, PIK3R1, RELA, EGFR, HSP90B1, IGF1R, PIK3R5, INS, IKBKB, NRAS, CCND1, ERBB2, PDGFC, E2F1, E2F2, EP300, E2F3, IKBKG, MAPK3, PDGFRB, MAP2K1, CREBBP, HSP90AA1, MAP2K2, EGF, PDPK1, IGF1, NFKB1, CREB1, PIK3CA, CCNE1, CDK2, MDM2, CTNNB1, KRAS, RAF1, TP53, FGFR2 | 33 |
| hsa04010:MAPK signaling pathway | 19 | 2.93E-05 | PDGFRA, HSPA8, MAP3K1, MAX, BRAF, EGFR, MAPK8IP1, TGFBR2, MECOM, RASA1, NF1, FLNA, KRAS, SOS1, HRAS, FGFR3, TP53, FGFR2, MAP3K4 | 85 | 2.39E-18 | ATF2, HSPB1, ARRB1, FASLG, ARRB2, FGF1, FGF2, IKBKB, RPS6KA3, FGF6, RPS6KA6, FGF7, PRKACG, CASP3, RPS6KA1, RAC2, IKBKG, RAC1, PRKACB, MAP3K7, MAP3K4, MAP3K5, PDGFRB, MAP4K1, PRKCG, MAP2K3, MAP2K4, MAP2K1, MEF2C, MAP2K2, PLA2G4B, PLA2G4C, PLA2G4A, PRKCA, TGFBR1, CACNB1, CACNB3, CACNB4, RASA1, IL1B, MAPKAPK2, RAF1, TP53, CRK, MAX, SRF, PDGFB, NLK, RASGRP1, EGFR, RELA, CDC42, MAPK9, NRAS, PAK1, RAP1A, RRAS, FGF23, PAK2, MAP2K5, FGF22, FGF21, MAPK3, MAP2K6, NTRK1, MAP3K3, TGFB1, GADD45B, EGF, NFATC1, HSPA2, MAPK14, GNG12, NFKB1, NFKB2, MAPK10, FGF17, FGF14, NF1, KRAS, FGF13, FGFR4, FGF12, MAP3K11, FGFR2 | 77 |
| hsa05166:HTLV-I infection | 28 | 3.57E-11 | RB1, CRTC3, CRTC1, BUB1B, PIK3CB, PIK3R1, PIK3CG, CCND1, MYB, EP300, HRAS, POLE, SMAD2, PDGFRA, SMAD4, RANBP3, MAP3K1, CDKN2A, HLA-B, HLA-A, TGFBR2, CREB1, PIK3CA, CTNNB1, KRAS, ATM, TP53, ATR | 84 | 1.15E-17 | RB1, ATF2, GSK3B, CDKN1A, CRTC3, SPI1, CRTC1, ITGB2, CD3G, CD3E, CD3D, CDC20, IKBKB, CCND3, CDC23, CCND2, PTTG1, CCND1, PRKACG, CHEK1, CDC27, MYB, EP300, IKBKG, JAK3, PRKACB, JAK1, HLA-DPA1, PDGFRB, MAP2K4, TBP, HLA-A, TGFBR1, HLA-E, CREB1, PIK3CA, LCK, CANX, TP53, HLA-DQB1, SRF, PDGFB, PIK3R3, GPS2, PIK3R2, PIK3R1, RELA, PIK3R5, NRAS, RRAS, POLD1, DVL1, DVL2, E2F1, DVL3, E2F2, E2F3, BUB3, RANBP1, MAP3K3, STAT5B, CDKN2B, FZD3, CREBBP, SMAD4, TGFB1, NFYB, NFATC1, NFKB1, IL2, NFKB2, FOSL1, IL6, CDK4, CDC16, IL2RB, HLA-DPB1, HLA-DRA, CTNNB1, KRAS, CALR, HLA-DRB1, ATR, MAD2L1 | 69 |
| hsa04919:Thyroid hormone signaling pathway | 21 | 1.83E-12 | NOTCH1, NCOA3, TSC2, PIK3CB, PIK3R1, ESR1, MTOR, PIK3CG, MED12, NCOR1, RXRA, PIK3CA, CCND1, SIN3A, RHEB, EP300, CTNNB1, KRAS, PLCG1, HRAS, TP53 | 51 | 9.34E-17 | GSK3B, MED17, MED12, MED14, MED13, CCND1, PRKACG, EP300, ITGAV, PRKACB, NCOA1, PRKCG, MED1, MAP2K1, MAP2K2, PDPK1, NCOA3, PRKCA, PLCB3, MED24, NCOR1, PLCB4, PIK3CA, RAF1, PLCB2, TP53, HDAC3, NOTCH1, NOTCH4, PIK3R3, PIK3R2, GATA4, PIK3R1, HIF1A, SLC9A1, PIK3R5, RXRB, NRAS, RXRA, PLCG2, RXRG, MAPK3, CREBBP, STAT1, ESR1, MED13L, RHEB, MDM2, CTNNB1, KRAS, PLCD1 | 37 |
| hsa04015:Rap1 signaling pathway | 20 | 4.85E-07 | PDGFRA, DOCK4, HGF, CTNND1, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, GNAI1, PIK3CA, CDH1, KIT, GNAS, CTNNB1, KRAS, PLCG1, HRAS, FGFR3, FGFR2 | 73 | 1.02E-16 | ITGB1, FLT1, ITGA2B, CTNND1, ITGB2, FGF1, FGF2, IGF1R, FGF6, FGF7, KDR, RAC2, RAC1, MAGI1, PDGFRB, PRKCG, MAP2K3, MAP2K1, MAP2K2, MAGI2, PRKCA, RHOA, PGF, PLCB3, PLCB4, PIK3CA, PRKD3, LCP2, PRKD1, RAF1, MET, PLCB2, CRK, RALA, PDGFB, PIK3R3, PIK3R2, PIK3R1, THBS1, EGFR, GNAI1, INS, GNAI2, PIK3R5, CDC42, NRAS, RAP1A, RRAS, PDGFC, DRD2, FGF23, FGF22, FGF21, MAPK3, MAP2K6, EGF, INSR, IGF1, MAPK14, GRIN1, EFNA1, FGF17, KITLG, FGF14, GNAQ, ID1, CTNNB1, KRAS, FGF13, FGFR4, FGF12, LAT, FGFR2 | 65 |
| hsa04110:Cell cycle | 16 | 2.02E-07 | RB1, SMAD2, SMAD4, MCM7, CDKN2A, CUL1, BUB1B, SMC3, SMC1A, TFDP1, CCND1, RAD21, EP300, ATM, TP53, ATR | 53 | 1.45E-16 | CDKN1C, RB1, GSK3B, CDKN1A, CDKN1B, YWHAB, CDC20, CCND3, CDC23, CCND2, PTTG1, CCND1, CHEK1, CDC27, EP300, SKP2, SMC1A, CDC25A, RBX1, CCNA2, CCNA1, DBF4, TFDP1, TFDP2, CCNE1, MCM3, MCM5, MCM6, TP53, PRKDC, FZR1, RAD21, E2F1, E2F2, E2F3, E2F4, BUB3, CDKN2B, CREBBP, SMAD4, TGFB1, GADD45B, PLK1, CDC6, STAG1, CDK7, STAG2, CDK4, CDC16, CDK2, MDM2, ATR, MAD2L1 | 44 |
| hsa05161:Hepatitis B | 15 | 8.00E-06 | RB1, SMAD4, MAP3K1, PTEN, PIK3CB, PIK3R1, PIK3CG, CREB1, PIK3CA, CCND1, EP300, KRAS, HRAS, TP53, TLR4 | 58 | 1.67E-16 | RB1, ATF2, CDKN1A, CDKN1B, YWHAB, PTEN, FASLG, IKBKB, TBK1, CCND1, CASP10, CASP3, EP300, IKBKG, JAK1, PRKCG, MAP2K4, MAP2K1, MAP2K2, PRKCA, TICAM1, TGFBR1, DDB2, CCNA2, CCNA1, CREB1, PIK3CA, IRF3, CCNE1, IRF7, RAF1, TP53, PIK3R3, PIK3R2, PIK3R1, RELA, PIK3R5, MAPK9, NRAS, E2F1, PTK2B, E2F2, E2F3, FADD, MAPK3, STAT5B, CREBBP, SMAD4, TGFB1, STAT1, NFATC1, NFKB1, MAPK10, IL6, CDK4, CDK2, KRAS, MYD88 | 48 |
| hsa05203:Viral carcinogenesis | 17 | 2.70E-05 | LYN, RB1, CDKN2A, HLA-B, CHD4, GTF2H1, HLA-A, PIK3CB, PIK3R1, PIK3CG, CREB1, PIK3CA, CCND1, EP300, KRAS, HRAS, TP53 | 71 | 4.64E-16 | RB1, ATF2, CDKN1A, CDKN1B, YWHAB, GTF2B, HDAC11, CHD4, CDC20, CCND3, CCND2, CCND1, PRKACG, CASP3, CHEK1, EP300, IKBKG, RAC1, SKP2, JAK3, PRKACB, JAK1, TBP, HLA-A, RHOA, HLA-E, CCNA2, CCNA1, CREB1, PIK3CA, IRF3, CCNE1, MAPKAPK2, IRF7, IL6ST, TP53, HDAC4, RBPJL, GTF2A1, HDAC5, GTF2A2, SP100, HDAC3, SRF, HPN, PIK3R3, PIK3R2, PIK3R1, GTF2E1, GTF2E2, RELA, PIK3R5, CDC42, NRAS, MAPK3, LYN, RANBP1, STAT5B, CDKN2B, CREBBP, GSN, GTF2H1, GTF2H4, NFKB1, NFKB2, SNW1, CDK4, CDK2, REL, MDM2, KRAS | 59 |
| hsa04810:Regulation of actin cytoskeleton | 15 | 0.000458 | PDGFRA, FN1, MSN, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, KRAS, ITGA6, SOS1, HRAS, FGFR3, FGFR2 | 72 | 5.00E-16 | ITGB1, CHRM2, ITGB5, ITGB4, ITGA2B, ITGB2, FGF1, FGF2, MYLK, PPP1CB, FGF6, PPP1CC, FGF7, RAC2, PIP4K2A, PIP4K2B, ITGAV, RAC1, GIT1, PDGFRB, MAP2K1, MAP2K2, ITGA2, RHOA, MYL5, MYL7, PIK3CA, MYL2, RAF1, MYL9, CRK, PDGFB, PIK3R3, PIK3R2, PIK3R1, IQGAP1, EGFR, SLC9A1, INS, PIK3R5, GNA13, CDC42, NRAS, PAK1, RRAS, PDGFC, PIP5K1A, PIP5K1B, PIP5K1C, FGF23, PAK2, FGF22, FGF21, PAK4, MAPK3, GSN, EGF, FN1, MSN, ARPC4, ARPC5, GNG12, PPP1CA, FGF17, DIAPH2, FGF14, ARPC3, KRAS, FGF13, FGFR4, FGF12, FGFR2 | 65 |
| hsa05212:Pancreatic cancer | 16 | 1.78E-11 | RB1, SMAD2, SMAD4, CDKN2A, BRAF, PIK3CB, PIK3R1, BRCA2, EGFR, PIK3CG, TGFBR2, PIK3CA, CCND1, ERBB2, KRAS, TP53 | 36 | 1.29E-15 | RB1, RALA, PIK3R3, PIK3R2, PIK3R1, BRCA2, RELA, EGFR, PIK3R5, IKBKB, CDC42, MAPK9, CCND1, ERBB2, E2F1, RAC2, E2F2, E2F3, IKBKG, RAC1, JAK1, MAPK3, MAP2K1, SMAD4, TGFB1, EGF, STAT1, TGFBR1, NFKB1, MAPK10, RAD51, PIK3CA, CDK4, KRAS, RAF1, TP53 | 26 |
| hsa04068:FoxO signaling pathway | 19 | 2.06E-09 | SMAD2, SMAD4, PTEN, BRAF, IRS2, PIK3CB, PIK3R1, EGFR, PIK3CG, TGFBR2, STK11, PIK3CA, CCND1, EP300, KRAS, ATM, SGK1, SOS1, HRAS | 54 | 1.78E-15 | CDKN1A, CDKN1B, IRS4, PRKAG1, PTEN, PRKAG2, IRS2, FASLG, IGF1R, IKBKB, STK11, CCND2, CCND1, EP300, SKP2, PRKAB2, MAP2K1, MAP2K2, PDPK1, PRMT1, PRKAB1, SIRT1, TGFBR1, PIK3CA, RAF1, PRKAA2, PIK3R3, PIK3R2, PIK3R1, FOXO3, NLK, EGFR, INS, PIK3R5, MAPK9, NRAS, MAPK3, PCK2, PLK4, CDKN2B, CREBBP, SMAD4, TGFB1, GADD45B, EGF, INSR, PLK1, IGF1, MAPK14, MAPK10, IL6, CDK2, MDM2, KRAS | 44 |
| hsa05205:Proteoglycans in cancer | 26 | 5.74E-12 | DDX5, PIK3CB, PIK3R1, EGFR, PIK3CG, CCND1, ERBB4, ERBB2, FLNA, PLCG1, HRAS, HGF, MMP2, FN1, MSN, PTPN11, BRAF, ESR1, MTOR, CTTN, PIK3CA, CTNNB1, KRAS, SOS1, TP53, TLR4 | 67 | 2.28E-14 | ITGB1, CDKN1A, ITGB5, FASLG, FGF2, IGF1R, PPP1CB, PPP1CC, CCND1, PRKACG, CASP3, KDR, ITGAV, RAC1, PRKACB, PRKCG, MAP2K1, MAP2K2, PDPK1, MMP2, ITGA2, RPS6, GAB1, FRS2, PRKCA, RHOA, PIK3CA, HCLS1, RAF1, MET, TP53, HBEGF, SDC2, CAMK2A, ITPR1, PIK3R3, PIK3R2, PIK3R1, IQGAP1, THBS1, HIF1A, EGFR, SLC9A1, PIK3R5, CDC42, NRAS, PAK1, RRAS, ERBB2, PLCG2, EIF4B, MAPK3, FZD3, TGFB1, FN1, MSN, PTPN11, IGF1, MAPK14, ESR1, PPP1CA, RPS6KB1, MDM2, PDCD4, CTNNB1, KRAS, NANOG | 54 |
| hsa04722:Neurotrophin signaling pathway | 15 | 8.24E-07 | MAP3K1, PRKCD, MATK, BRAF, PTPN11, PIK3CB, PIK3R1, PSEN1, PIK3CG, PIK3CA, KRAS, PLCG1, SOS1, HRAS, TP53 | 49 | 2.43E-14 | GSK3B, FASLG, IKBKB, RPS6KA3, RPS6KA6, RPS6KA1, RAC1, MAP3K5, MAP2K1, MAP2K2, PDPK1, GAB1, FRS2, IRAK4, RHOA, PIK3CA, MAPKAPK2, RAF1, TP53, CRK, ZNF274, SHC2, MAGED1, SHC1, CAMK2A, PIK3R3, PIK3R2, PIK3R1, FOXO3, RELA, PIK3R5, CDC42, MAPK9, NRAS, RAP1A, IRAK1, PLCG2, MAP2K5, MAPK3, NTRK1, MAP3K3, NTRK3, PTPN11, MAPK14, NFKB1, MAPK10, KRAS, NFKBIB, TP73 | 44 |
| hsa04660:T cell receptor signaling pathway | 8 | 0.009638148 | PIK3CA, KRAS, PLCG1, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 44 | 2.67E-14 | GSK3B, ITK, PIK3R3, CD3G, PIK3R2, PIK3R1, CD3E, RASGRP1, CD3D, RELA, PIK3R5, IKBKB, CDC42, PAK1, NRAS, GRAP2, NCK2, IKBKG, PAK2, MAP3K7, NCK1, MAPK3, PAK4, MAP2K1, MAP2K2, PDPK1, NFATC1, MAPK14, RHOA, IL2, NFKB1, IL4, IL5, IFNG, CD8B, PIK3CA, LCK, CDK4, KRAS, LCP2, CD247, RAF1, LAT, NFKBIB | 41 |
| hsa05142:Chagas disease (American trypanosomiasis) | 10 | 0.00079 | SMAD2, PIK3CA, PPP2R1A, GNAS, PIK3CB, PIK3R1, TLR4, GNAI1, PIK3CG, TGFBR2 | 45 | 2.71E-14 | SERPINE1, PIK3R3, PPP2R2A, CD3G, FASLG, PIK3R2, PIK3R1, CD3E, CD3D, GNAI1, RELA, GNAI2, PIK3R5, PPP2CA, IKBKB, PPP2CB, MAPK9, GNA15, IRAK1, PPP2R1A, GNA11, IL12A, FADD, IKBKG, MAPK3, MAP2K4, TGFB1, IRAK4, MAPK14, TICAM1, TGFBR1, IL2, NFKB1, MAPK10, PLCB3, IL6, PLCB4, IFNG, PIK3CA, GNAQ, IL1B, CD247, CALR, PLCB2, MYD88 | 41 |
| hsa05220:Chronic myeloid leukemia | 17 | 6.78E-12 | RB1, SMAD4, CDKN2A, BRAF, PTPN11, PIK3CB, PIK3R1, PIK3CG, TGFBR2, RUNX1, MECOM, PIK3CA, CCND1, KRAS, SOS1, HRAS, TP53 | 35 | 5.23E-13 | RB1, CDKN1A, SHC2, CDKN1B, SHC1, CTBP1, PIK3R3, PIK3R2, PIK3R1, RELA, PIK3R5, IKBKB, NRAS, CCND1, E2F1, E2F2, E2F3, IKBKG, MAPK3, STAT5B, MAP2K1, SMAD4, TGFB1, MAP2K2, PTPN11, TGFBR1, NFKB1, RUNX1, PIK3CA, CDK4, MDM2, KRAS, RAF1, TP53, CRK | 26 |
| hsa04071:Sphingolipid signaling pathway | 10 | 0.0021753 | PIK3CA, PPP2R1A, PTEN, KRAS, PIK3CB, PIK3R1, HRAS, TP53, GNAI1, PIK3CG | 47 | 5.38E-13 | PTEN, PIK3R3, PPP2R2A, PIK3R2, PIK3R1, PLD1, GNAI1, RELA, GNAI2, PIK3R5, PPP2CA, GNA13, PPP2CB, MAPK9, NRAS, PPP2R1A, PPP2R5E, SMPD1, RAC2, RAC1, BID, MAPK3, MAP3K5, PRKCG, MAP2K1, MAP2K2, NOS3, PDPK1, PRKCE, PPP2R5B, PPP2R5A, PRKCA, PPP2R5C, MAPK14, RHOA, NFKB1, MAPK10, PLCB3, PLCB4, PIK3CA, GNAQ, KRAS, RAF1, MS4A2, PLCB2, TP53, NSMAF | 40 |
| hsa05214:Glioma | 17 | 1.23E-12 | RB1, PDGFRA, CDKN2A, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, CCND1, KRAS, PLCG1, SOS1, HRAS, TP53 | 33 | 5.99E-13 | RB1, CDKN1A, SHC2, SHC1, CAMK2A, PTEN, PDGFB, PIK3R3, PIK3R2, PIK3R1, EGFR, IGF1R, PIK3R5, NRAS, CCND1, E2F1, PLCG2, E2F2, E2F3, MAPK3, PRKCG, PDGFRB, MAP2K1, MAP2K2, EGF, PRKCA, IGF1, PIK3CA, CDK4, MDM2, KRAS, RAF1, TP53 | 25 |
| hsa04350:TGF-beta signaling pathway | 8 | 0.0037406 | SMAD2, SMAD4, TFDP1, PPP2R1A, CUL1, EP300, ACVR2A, TGFBR2 | 38 | 7.15E-13 | BMPR2, THBS1, PPP2CA, PPP2CB, PPP2R1A, EP300, E2F4, MAPK3, SMAD1, CDKN2B, LEFTY1, CREBBP, SMAD4, TGFB1, SMURF2, BMP8A, BMP8B, SMAD9, INHBB, INHBA, ACVR2B, INHBC, SMAD5, RHOA, TGFBR1, BMP6, INHBE, RBX1, SMAD7, BMP2, TFDP1, IFNG, RPS6KB1, SP1, BAMBI, ID1, BMPR1B, BMPR1A | 34 |
| hsa04066:HIF-1 signaling pathway | 10 | 0.000439 | PIK3CA, ERBB2, EP300, PLCG1, PIK3CB, PIK3R1, TLR4, EGFR, MTOR, PIK3CG | 41 | 7.59E-13 | CDKN1A, CDKN1B, FLT1, EPO, CUL2, CAMK2A, SERPINE1, PIK3R3, PIK3R2, PIK3R1, HIF1A, RELA, EGFR, IGF1R, PIK3R5, INS, ERBB2, PLCG2, HMOX1, EP300, EIF4E, MAPK3, PDK1, PRKCG, MAP2K1, CREBBP, EDN1, MAP2K2, EGF, NOS3, INSR, RPS6, PRKCA, IGF1, NFKB1, RBX1, IL6, IFNG, PIK3CA, RPS6KB1, GAPDH | 36 |
| hsa04550:Signaling pathways regulating pluripotency of stem cells | 16 | 9.96E-07 | SMAD2, SMAD4, RIF1, LIFR, PIK3CB, PIK3R1, PIK3CG, TBX3, ACVR2A, PIK3CA, CTNNB1, KRAS, JAK2, HRAS, FGFR3, FGFR2 | 51 | 1.24E-12 | GSK3B, BMPR2, RIF1, BMI1, FGF2, IGF1R, JARID2, JAK3, JAK1, MAP2K1, MAP2K2, PAX6, PIK3CA, RAF1, IL6ST, PIK3R3, PIK3R2, PIK3R1, PIK3R5, NRAS, DVL1, DVL2, DVL3, SKIL, MAPK3, SMAD1, FZD3, SMAD4, PCGF2, LIF, SMAD9, INHBB, IGF1, INHBA, MAPK14, KLF4, INHBC, ACVR2B, SMAD5, INHBE, BMP2, MEIS1, ID1, CTNNB1, KRAS, NANOG, BMPR1B, FGFR4, FGFR2, MYF5, BMPR1A | 44 |
| hsa05223:Non-small cell lung cancer | 16 | 1.68E-12 | RB1, CDKN2A, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, RXRA, PIK3CA, CCND1, ERBB2, KRAS, PLCG1, SOS1, HRAS, TP53 | 30 | 1.42E-12 | RB1, PIK3R3, PIK3R2, PIK3R1, FOXO3, EGFR, PIK3R5, RXRB, NRAS, RXRA, CCND1, ERBB2, E2F1, PLCG2, E2F2, E2F3, RXRG, MAPK3, PRKCG, MAP2K1, MAP2K2, EGF, PDPK1, PRKCA, PIK3CA, CDK4, RARB, KRAS, RAF1, TP53 | 21 |
| hsa04664:Fc epsilon RI signaling pathway | 9 | 0.000193 | LYN, PIK3CA, KRAS, PLCG1, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 33 | 2.88E-12 | PIK3R3, PIK3R2, PIK3R1, PIK3R5, MAPK9, NRAS, PLCG2, RAC2, RAC1, MAPK3, MAP2K6, LYN, MAP2K3, MAP2K4, MAP2K1, MAP2K2, PDPK1, PLA2G4B, IL13, PLA2G4C, PLA2G4A, PRKCA, MAPK14, MAPK10, IL4, IL3, IL5, PIK3CA, KRAS, LCP2, RAF1, MS4A2, LAT | 29 |
| hsa04012:ErbB signaling pathway | 13 | 8.50E-07 | BRAF, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, ERBB4, ERBB2, KRAS, PLCG1, SOS1, HRAS | 37 | 1.39E-11 | GSK3B, CDKN1A, SHC2, CDKN1B, SHC1, CAMK2A, PIK3R3, PIK3R2, PIK3R1, EGFR, PIK3R5, MAPK9, PAK1, NRAS, ERBB2, PLCG2, NCK2, PAK2, NCK1, MAPK3, PAK4, PRKCG, MAP2K4, STAT5B, MAP2K1, MAP2K2, EGF, GAB1, PRKCA, NRG1, MAPK10, PIK3CA, RPS6KB1, KRAS, RAF1, CRK, HBEGF | 32 |
| hsa05162:Measles | 10 | 0.004353526 | HSPA8, CCND1, PIK3CA, MSN, PIK3CB, PIK3R1, JAK2, TP53, TLR4, PIK3CG | 46 | 1.38E-10 | GSK3B, CDKN1B, PIK3R3, CD3G, FASLG, PIK3R2, PIK3R1, CD3E, CD3D, RELA, PIK3R5, CCND3, TBK1, CCND2, IRAK1, CCND1, IL12A, JAK3, MAP3K7, JAK1, STAT5B, CSNK2A1, STAT1, IL13, TNFRSF10B, MSN, HSPA2, IRAK4, IL2, NFKB1, IL4, IL6, IFNG, IRF3, PIK3CA, CCNE1, CDK4, IL1B, IL2RB, CSNK2B, CDK2, IRF7, TP53, MYD88, NFKBIB, TP73 | 41 |
| hsa04510:Focal adhesion | 17 | 2.87E-05 | PDGFRA, HGF, PTEN, FN1, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, CCND1, ERBB2, FLNA, CTNNB1, ITGA6, SOS1, HRAS | 60 | 4.00E-10 | ITGB1, GSK3B, FLT1, ITGB5, ITGB4, ITGA2B, PTEN, ILK, IGF1R, MYLK, PPP1CB, PPP1CC, CCND3, CCND2, CCND1, KDR, RAC2, ITGAV, RAC1, PDGFRB, PRKCG, MAP2K1, PDPK1, ITGA2, PRKCA, RHOA, PGF, MYL5, MYL7, PIK3CA, MYL2, RAF1, MET, MYL9, CRK, SHC2, SHC1, LAMA3, PDGFB, PIK3R3, PIK3R2, PIK3R1, THBS1, EGFR, PIK3R5, CDC42, MAPK9, PAK1, RAP1A, ERBB2, PDGFC, PAK2, PAK4, MAPK3, EGF, FN1, IGF1, PPP1CA, MAPK10, CTNNB1 | 52 |
| hsa04152:AMPK signaling pathway | 13 | 3.28E-05 | TSC2, IRS2, PIK3CB, PIK3R1, MTOR, PIK3CG, STK11, CREB1, PIK3CA, CCND1, PPP2R1A, RHEB, LEPR | 43 | 4.17E-10 | PRKAA2, PRKAG1, IRS4, PRKAG2, PIK3R3, PPP2R2A, IRS2, PIK3R2, PIK3R1, FOXO3, ELAVL1, IGF1R, PIK3R5, INS, PPP2CA, PPP2CB, STK11, CCND1, PPP2R1A, PPP2R5E, LEPR, MAP3K7, RAB8A, PCK2, SREBF1, PRKAB2, PDPK1, INSR, PPP2R5B, PPP2R5A, TSC1, PPP2R5C, IGF1, EEF2, SIRT1, PRKAB1, CCNA2, CCNA1, CREB1, PIK3CA, RPS6KB1, RHEB, FASN | 34 |
| hsa04730:Long-term depression | 7 | 0.002894326 | LYN, PPP2R1A, GNAS, BRAF, KRAS, HRAS, GNAI1 | 28 | 5.29E-10 | GNAZ, ITPR1, GNAI1, GNAI2, IGF1R, PPP2CA, GNA13, PPP2CB, NRAS, PPP2R1A, GNA11, NOS1, MAPK3, PRKCG, LYN, MAP2K1, MAP2K2, PLA2G4B, PLA2G4C, PLA2G4A, PRKCA, IGF1, PLCB3, PLCB4, GNAQ, KRAS, RAF1, PLCB2 | 24 |
| hsa05202:Transcriptional misregulation in cancer | 15 | 4.00E-05 | DDX5, FLT3, MAX, DOT1L, JMJD1C, MLLT3, TGFBR2, RUNX1, NCOR1, RXRA, EWSR1, SIN3A, ATM, TP53, KDM6A | 52 | 5.42E-10 | CDKN1A, CDKN1B, CCNT2, FLT1, SPI1, CCNT1, LDB1, SIX1, BMI1, IGF1R, CCND2, MEF2C, IGFBP3, PAX5, ETV4, SUPT3H, MLF1, RUNX2, RUNX1, NCOR1, MAF, EWSR1, RARA, ERG, MET, TP53, CEBPB, MAX, PRCC, MLLT1, MLLT3, RELA, RXRB, RXRA, RXRG, NTRK1, SMAD1, TAF15, JUP, EYA1, FUS, IGF1, NFKB1, CDK9, IL3, IL6, MEIS1, SP1, HIST3H3, IL2RB, REL, MDM2 | 45 |
| hsa04910:Insulin signaling pathway | 13 | 0.000102 | TSC2, BRAF, IRS2, PIK3CB, PIK3R1, MTOR, PIK3CG, PIK3CA, PRKAR1A, RHEB, KRAS, SOS1, HRAS | 46 | 5.49E-10 | GSK3B, SHC2, PRKAA2, SHC1, PRKAG1, IRS4, INPPL1, PRKAG2, PIK3R3, IRS2, PIK3R2, PIK3R1, PIK3R5, INS, IKBKB, PPP1CB, MAPK9, SOCS3, PPP1CC, NRAS, PRKAR2B, PRKACG, EIF4E, PRKACB, MAPK3, PCK2, SREBF1, MAP2K1, PRKAB2, MAP2K2, PDPK1, INSR, RPS6, TSC1, PRKAB1, PPP1CA, MAPK10, PIK3CA, RPS6KB1, PRKAR1A, RHEB, FASN, KRAS, RAF1, CRK, RHOQ | 40 |
| hsa04931:Insulin resistance | 10 | 0.001037492 | CREB1, PIK3CA, PRKCD, PTEN, IRS2, PTPN11, PIK3CB, PIK3R1, MTOR, PIK3CG | 39 | 1.08E-09 | GSK3B, PRKAA2, PRKAG1, PTEN, PRKAG2, PIK3R3, IRS2, PIK3R2, PIK3R1, RELA, PIK3R5, INS, IKBKB, PPP1CB, MAPK9, RPS6KA3, SOCS3, PPP1CC, RPS6KA6, RPS6KA1, PCK2, SREBF1, PRKAB2, NOS3, PDPK1, PRKCE, INSR, PTPN11, PRKAB1, NFKB1, PPP1CA, MAPK10, MLXIPL, IL6, CREB1, PIK3CA, RPS6KB1, PPARA, OGT | 33 |
| hsa05219:Bladder cancer | 12 | 1.72E-09 | RB1, CCND1, CDKN2A, CDH1, MMP2, ERBB2, BRAF, KRAS, HRAS, FGFR3, TP53, EGFR | 22 | 2.40E-09 | RB1, CDKN1A, MAP2K1, MAP2K2, MMP1, EGF, MMP2, THBS1, EGFR, NRAS, CCND1, CDK4, ERBB2, MDM2, E2F1, E2F2, KRAS, E2F3, RAF1, TP53, HBEGF, MAPK3 | 15 |
| hsa05222:Small cell lung cancer | 12 | 4.70E-06 | RB1, RXRA, CCND1, PIK3CA, MAX, PTEN, FN1, ITGA6, PIK3CB, PIK3R1, TP53, PIK3CG | 33 | 3.33E-09 | RB1, ITGB1, CDKN1B, MAX, LAMA3, ITGA2B, PTEN, PIK3R3, PIK3R2, PIK3R1, RELA, PIK3R5, IKBKB, RXRB, RXRA, CCND1, E2F1, E2F2, E2F3, ITGAV, IKBKG, SKP2, RXRG, CDKN2B, ITGA2, FN1, NFKB1, PIK3CA, CCNE1, CDK4, CDK2, RARB, TP53 | 24 |
| hsa04310:Wnt signaling pathway | 11 | 0.001617621 | TCF7L2, SMAD4, SOX17, CCND1, TBL1XR1, CHD8, CUL1, EP300, CTNNB1, PSEN1, TP53 | 44 | 6.43E-09 | GSK3B, CTBP1, CHD8, CAMK2A, LRP5, NLK, LRP6, MAPK9, CCND3, CCND2, SOX17, CCND1, PRKACG, DVL1, DVL2, RAC2, DVL3, EP300, RAC1, MAP3K7, PRKACB, PRKCG, FZD3, CREBBP, SMAD4, MMP7, CSNK2A1, FBXW11, SIAH1, PRKCA, NFATC1, RHOA, RBX1, MAPK10, FOSL1, PLCB3, PLCB4, BAMBI, TBL1XR1, CSNK2B, CTNNB1, PLCB2, TP53, PPARD | 36 |
| hsa04914:Progesterone-mediated oocyte maturation | 8 | 0.004547561 | HSP90AB1, PIK3CA, BRAF, KRAS, PIK3CB, PIK3R1, GNAI1, PIK3CG | 33 | 6.53E-09 | PIK3R3, PIK3R2, PIK3R1, GNAI1, GNAI2, IGF1R, PIK3R5, INS, MAPK9, RPS6KA3, RPS6KA6, FZR1, CDC23, PRKACG, CDC27, RPS6KA1, PRKACB, MAPK3, MAP2K1, HSP90AA1, PLK1, IGF1, MAPK14, CDC25A, MAPK10, CCNA2, CCNA1, PIK3CA, CDC16, CDK2, KRAS, RAF1, MAD2L1 | 29 |
| hsa05211:Renal cell carcinoma | 11 | 3.01E-06 | PIK3CA, HGF, EP300, BRAF, PTPN11, KRAS, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 28 | 6.93E-09 | CUL2, PDGFB, PIK3R3, PIK3R2, PIK3R1, HIF1A, PIK3R5, CDC42, PAK1, NRAS, RAP1A, EP300, RAC1, PAK2, MAPK3, PAK4, MAP2K1, CREBBP, TGFB1, MAP2K2, GAB1, PTPN11, RBX1, PIK3CA, KRAS, RAF1, MET, CRK | 23 |
| hsa04150:mTOR signaling pathway | 10 | 7.81E-06 | STK11, PIK3CA, RHEB, PTEN, TSC2, BRAF, PIK3CB, PIK3R1, MTOR, PIK3CG | 26 | 6.97E-09 | PRKAA2, PTEN, PIK3R3, PIK3R2, PIK3R1, PIK3R5, INS, IKBKB, RPS6KA3, RPS6KA6, STK11, RPS6KA1, EIF4E, EIF4B, MAPK3, PRKCG, PDPK1, RPS6, PRKCA, TSC1, IGF1, PIK3CA, RPS6KB1, RRAGB, RHEB, RRAGD | 21 |
| hsa04917:Prolactin signaling pathway | 10 | 4.19E-05 | CCND1, PIK3CA, KRAS, PIK3CB, PIK3R1, JAK2, SOS1, HRAS, ESR1, PIK3CG | 29 | 9.67E-09 | GSK3B, SHC2, SHC1, PIK3R3, PIK3R2, PIK3R1, FOXO3, RELA, PIK3R5, INS, MAPK9, SOCS3, NRAS, CCND2, CCND1, MAPK3, STAT5B, MAP2K1, MAP2K2, STAT1, MAPK14, ESR1, ESR2, NFKB1, MAPK10, PIK3CA, IRF1, KRAS, RAF1 | 24 |
| hsa04912:GnRH signaling pathway | 9 | 0.001393811 | MAP3K1, MMP2, PRKCD, GNAS, KRAS, SOS1, HRAS, EGFR, MAP3K4 | 33 | 2.31E-08 | CAMK2A, ITPR1, PLD1, EGFR, CDC42, MAPK9, NRAS, PRKACG, GNA11, PTK2B, PRKACB, MAP3K4, MAPK3, MAP2K6, MAP2K3, MAP2K4, MAP3K3, MAP2K1, MAP2K2, MMP2, PLA2G4B, PLA2G4C, PLA2G4A, PRKCA, MAPK14, MAPK10, PLCB3, PLCB4, GNAQ, KRAS, RAF1, PLCB2, HBEGF | 29 |
| hsa04370:VEGF signaling pathway | 7 | 0.00314799 | PIK3CA, KRAS, PLCG1, PIK3CB, PIK3R1, HRAS, PIK3CG | 26 | 2.41E-08 | SHC2, HSPB1, PIK3R3, PIK3R2, PIK3R1, PIK3R5, CDC42, NRAS, KDR, PLCG2, RAC2, RAC1, MAPK3, PRKCG, MAP2K1, MAP2K2, NOS3, PLA2G4B, PLA2G4C, PLA2G4A, PRKCA, MAPK14, PIK3CA, MAPKAPK2, KRAS, RAF1 | 23 |
| hsa05231:Choline metabolism in cancer | 13 | 4.28E-06 | PDGFRA, TSC2, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, RHEB, KRAS, PLCG1, SOS1, HRAS | 35 | 2.97E-08 | PDGFB, PIK3R3, PIK3R2, PIK3R1, PLD1, HIF1A, EGFR, PIK3R5, MAPK9, NRAS, PDGFC, RAC2, PIP5K1A, PIP5K1B, PIP5K1C, RAC1, MAPK3, PRKCG, PDGFRB, MAP2K1, MAP2K2, EGF, PDPK1, PLA2G4B, PLA2G4C, PLA2G4A, PRKCA, TSC1, MAPK10, PIK3CA, RPS6KB1, SP1, RHEB, KRAS, RAF1 | 30 |
| hsa04062:Chemokine signaling pathway | 13 | 0.001554011 | LYN, PRKCD, BRAF, PIK3CB, PIK3R1, PIK3CG, GNAI1, PIK3CA, KRAS, DOCK2, JAK2, SOS1, HRAS | 52 | 3.17E-08 | GSK3B, ITK, GSK3A, ARRB1, ARRB2, IKBKB, GNGT1, PRKACG, RAC2, IKBKG, RAC1, JAK3, PRKACB, MAP2K1, RHOA, FGR, HCK, PLCB3, PLCB4, PIK3CA, RAF1, PLCB2, CRK, SHC2, SHC1, CXCR4, PIK3R3, PIK3R2, PIK3R1, FOXO3, GNAI1, RELA, GNAI2, PIK3R5, CDC42, NRAS, PAK1, RAP1A, GNG4, PTK2B, MAPK3, LYN, STAT5B, STAT1, GNG12, GNG11, NFKB1, GNB1, GNB3, KRAS, GNB5, NFKBIB | 47 |
| hsa04750:Inflammatory mediator regulation of TRP channels | 7 | 0.029149934 | PIK3CA, PRKCD, GNAS, PLCG1, PIK3CB, PIK3R1, PIK3CG | 34 | 4.71E-08 | CAMK2A, ITPR1, PIK3R3, PIK3R2, HTR2A, PIK3R1, PIK3R5, PPP1CB, MAPK9, PPP1CC, PRKACG, PLCG2, PRKACB, MAP2K6, PRKCG, MAP2K3, NTRK1, PRKCH, PRKCE, PLA2G4B, PLA2G4C, PLA2G4A, PRKCA, IGF1, MAPK14, PPP1CA, MAPK10, PLCB3, PLCB4, PIK3CA, GNAQ, IL1B, F2RL1, PLCB2 | 32 |
| hsa04915:Estrogen signaling pathway | 16 | 9.15E-09 | HSPA8, HSP90AB1, MMP2, PRKCD, PIK3CB, PIK3R1, ESR1, EGFR, PIK3CG, GNAI1, CREB1, PIK3CA, GNAS, KRAS, SOS1, HRAS | 34 | 6.23E-08 | ATF2, SHC2, SHC1, ITPR1, PIK3R3, PIK3R2, PIK3R1, GNAI1, EGFR, HSP90B1, GNAI2, PIK3R5, NRAS, PRKACG, PRKACB, MAPK3, MAP2K1, HSP90AA1, MAP2K2, NOS3, MMP2, HSPA2, ESR1, ESR2, PLCB3, PLCB4, CREB1, PIK3CA, SP1, GNAQ, KRAS, RAF1, PLCB2, HBEGF | 26 |
| hsa05164:Influenza A | 10 | 0.022925401 | HSPA8, PIK3CA, EP300, NLRP3, NUP98, PIK3CB, PIK3R1, JAK2, TLR4, PIK3CG | 49 | 6.62E-08 | ATF2, GSK3B, NXT1, FASLG, IKBKB, TBK1, EP300, IL12A, JAK1, HLA-DPA1, MAP2K3, MAP2K4, MAP2K1, MAP2K2, PRKCA, IRAK4, TICAM1, IFNG, PIK3CA, IRF3, IL1B, IRF7, RAF1, HLA-DQB1, PIK3R3, PIK3R2, FURIN, PIK3R1, RELA, PIK3R5, SOCS3, MAPK9, NXF1, PABPN1, MAPK3, MAP2K6, CREBBP, STAT1, TNFRSF10B, HSPA2, MAPK14, NFKB1, MAPK10, IL6, HLA-DPB1, HLA-DRA, MYD88, HLA-DRB1, NFKBIB | 46 |
| hsa05213:Endometrial cancer | 16 | 5.02E-13 | TCF7L2, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, CCND1, CDH1, ERBB2, CTNNB1, KRAS, SOS1, HRAS, TP53 | 23 | 8.49E-08 | GSK3B, MAP2K1, MAP2K2, PDPK1, EGF, PTEN, PIK3R3, ILK, PIK3R2, PIK3R1, MLH1, FOXO3, EGFR, PIK3R5, NRAS, PIK3CA, CCND1, ERBB2, CTNNB1, KRAS, RAF1, TP53, MAPK3 | 14 |
| hsa04666:Fc gamma R-mediated phagocytosis | 9 | 0.000823 | LYN, PIK3CA, PRKCD, AMPH, PLCG1, PIK3CB, PIK3R1, DOCK2, PIK3CG | 30 | 1.67E-07 | INPPL1, PIK3R3, PIK3R2, PIK3R1, PLD1, PIK3R5, CDC42, PAK1, PLCG2, RAC2, PIP5K1A, PIP5K1B, PIP5K1C, RAC1, MAPK3, PRKCG, LYN, MAP2K1, GSN, PRKCE, PRKCA, ARPC4, ARPC5, HCK, PIK3CA, RPS6KB1, ARPC3, RAF1, CRK, LAT | 27 |
| hsa05210:Colorectal cancer | 13 | 1.73E-08 | SMAD2, TCF7L2, SMAD4, BRAF, PIK3CB, PIK3R1, PIK3CG, TGFBR2, PIK3CA, CCND1, CTNNB1, KRAS, TP53 | 25 | 1.69E-07 | GSK3B, PIK3R3, PIK3R2, PIK3R1, PIK3R5, MAPK9, CCND1, CASP3, RAC2, RAC1, MAPK3, MAP2K1, SMAD4, TGFB1, MLH1, RHOA, TGFBR1, MSH6, MAPK10, MSH2, PIK3CA, CTNNB1, KRAS, RAF1, TP53 | 18 |
| hsa04630:Jak-STAT signaling pathway | 11 | 0.002339062 | CCND1, PIK3CA, LEPR, EP300, PTPN11, LIFR, PIK3CB, PIK3R1, JAK2, SOS1, PIK3CG | 42 | 2.95E-07 | IL21, IL22, EPO, MPL, IL5RA, PIK3R3, PIK3R2, PIK3R1, PIK3R5, SOCS3, CCND3, CCND2, CCND1, LEPR, EP300, IL12A, IL12RB1, JAK3, JAK1, PIAS4, PIAS3, STAT5B, CREBBP, STAT1, IL13, LIF, PTPN11, STAM, IL2, PIAS2, PIAS1, GH2, IL4, GH1, IL3, IL6, IL5, IFNG, PIK3CA, IL7, IL2RB, IL6ST | 36 |
| hsa05221:Acute myeloid leukemia | 14 | 3.88E-10 | TCF7L2, FLT3, BRAF, PIK3CB, PIK3R1, MTOR, PIK3CG, RUNX1, PIK3CA, CCND1, KIT, KRAS, SOS1, HRAS | 23 | 4.08E-07 | STAT5B, MAP2K1, SPI1, MAP2K2, JUP, PIK3R3, PIK3R2, PIK3R1, RELA, NFKB1, PIK3R5, RUNX1, IKBKB, NRAS, PIK3CA, CCND1, RPS6KB1, RARA, KRAS, IKBKG, RAF1, PPARD, MAPK3 | 18 |
| hsa05160:Hepatitis C | 13 | 7.12E-05 | BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, RXRA, PIK3CA, PPP2R1A, PSME3, KRAS, SOS1, HRAS, TP53 | 39 | 6.02E-07 | GSK3B, CDKN1A, PIK3R3, PPP2R2A, PIK3R2, PIK3R1, RELA, EGFR, PIK3R5, PPP2CA, IKBKB, PPP2CB, MAPK9, SOCS3, NRAS, RXRA, TBK1, PPP2R1A, RIPK1, IKBKG, JAK1, MAPK3, EGF, PDPK1, STAT1, MAPK14, TICAM1, NFKB1, PIAS1, MAPK10, IRF3, PIK3CA, IRF1, PSME3, IRF7, KRAS, RAF1, PPARA, TP53 | 31 |
| hsa04612:Antigen processing and presentation | 7 | 0.00925642 | HSPA8, CREB1, HSP90AB1, PSME3, HLA-B, HLA-A, B2M | 27 | 8.91E-07 | KIR2DL4, CTSS, CTSB, HLA-DPA1, HSP90AA1, NFYA, NFYB, KLRC3, NFYC, KIR3DL1, HLA-A, KIR3DL2, HSPA2, HLA-E, CREB1, IFNG, CD8B, PSME3, RFX5, CANX, HLA-DPB1, PSME2, HLA-DRA, KLRD1, CALR, HLA-DRB1, HLA-DQB1 | 24 |
| hsa04115:p53 signaling pathway | 7 | 0.005033162 | CCND1, CDKN2A, PTEN, TSC2, ATM, TP53, ATR | 25 | 9.04E-07 | CDKN1A, SERPINE1, PTEN, PPM1D, THBS1, CCND3, CCND2, CCND1, CASP3, CHEK1, BID, GADD45B, IGFBP3, SIAH1, IGF1, DDB2, CCNE1, CDK4, CCNG1, CDK2, MDM2, MDM4, TP53, ATR, TP73 | 21 |
| hsa04611:Platelet activation | 7 | 0.089827357 | LYN, PIK3CA, GNAS, PIK3CB, PIK3R1, GNAI1, PIK3CG | 38 | 9.39E-07 | ITGB1, SNAP23, ITGA2B, ITPR1, PIK3R3, PIK3R2, PIK3R1, RASGRP1, GNAI1, GNAI2, MYLK, PIK3R5, GNA13, PPP1CB, PPP1CC, RAP1A, PRKACG, PLCG2, PRKACB, MAPK3, LYN, NOS3, GP1BB, ITGA2, PLA2G4B, PLA2G4C, PLA2G4A, GP1BA, MAPK14, GP5, RHOA, PPP1CA, PLCB3, PLCB4, PIK3CA, GNAQ, LCP2, PLCB2 | 34 |
| hsa04380:Osteoclast differentiation | 7 | 0.09238132 | CREB1, PIK3CA, PIK3CB, PIK3R1, PIK3CG, FOSL2, TGFBR2 | 38 | 1.15E-06 | SPI1, FHL2, PIK3R3, PIK3R2, PIK3R1, RELA, PIK3R5, IKBKB, MAPK9, SOCS3, PLCG2, IKBKG, RAC1, JUNB, MAP3K7, JAK1, MAPK3, MAP2K6, MAP2K1, TGFB1, STAT1, NFATC1, MITF, CYBA, MAPK14, TGFBR1, NFKB1, FOSL2, NFKB2, MAPK10, FOSL1, CREB1, IFNG, PIK3CA, LCK, IL1B, NOX3, LCP2 | 34 |
| hsa03460:Fanconi anemia pathway | 6 | 0.008263971 | BLM, TOP3A, FANCA, BRCA1, BRCA2, ATR | 21 | 2.89E-06 | BLM, RMI1, TOP3A, RPA1, FANCA, FANCC, BRCA1, FANCE, BRCA2, MLH1, PALB2, FANCG, FANCF, BRIP1, RAD51, RAD51C, ERCC4, RPA3, ERCC1, RPA4, ATR | 15 |
| hsa04650:Natural killer cell mediated cytotoxicity | 10 | 0.002436707 | PIK3CA, BRAF, PTPN11, KRAS, PLCG1, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 35 | 4.34E-06 | SHC2, SHC1, ITGB2, PIK3R3, FASLG, PIK3R2, PIK3R1, KIR2DL4, PIK3R5, PAK1, NRAS, KLRK1, CASP3, PLCG2, RAC2, PTK2B, RAC1, BID, MAPK3, PRKCG, MAP2K1, MAP2K2, TNFRSF10B, PRKCA, PTPN11, NFATC1, IFNG, PIK3CA, LCK, KRAS, LCP2, KLRD1, CD247, RAF1, LAT | 31 |
| hsa05100:Bacterial invasion of epithelial cells | 11 | 1.40E-05 | DNM3, CTTN, PIK3CA, CDH1, CLTCL1, CLTC, FN1, CTNNB1, PIK3CB, PIK3R1, PIK3CG | 26 | 5.55E-06 | ITGB1, SHC2, SHC1, CLTB, ILK, PIK3R3, CLTA, PIK3R2, PIK3R1, PIK3R5, CDC42, CLTCL1, RAC1, RHOG, FN1, GAB1, ARPC4, ARPC5, RHOA, DNM1, PIK3CA, ARPC3, CTNNB1, HCLS1, MET, CRK | 21 |
| hsa04670:Leukocyte transendothelial migration | 11 | 0.00039 | PIK3CA, MMP2, CTNND1, CTNNB1, MSN, PTPN11, PLCG1, PIK3CB, PIK3R1, GNAI1, PIK3CG | 33 | 8.58E-06 | ITGB1, ITK, CTNND1, ITGB2, CXCR4, PIK3R3, PIK3R2, PIK3R1, GNAI1, GNAI2, PIK3R5, CDC42, CDH5, RAP1A, PLCG2, RAC2, PTK2B, RAC1, PRKCG, MMP2, RHOH, MSN, PRKCA, PTPN11, CYBA, MAPK14, RHOA, MYL5, MYL7, PIK3CA, MYL2, CTNNB1, MYL9 | 25 |
| hsa04540:Gap junction | 8 | 0.004843797 | PDGFRA, TUBA1A, GNAS, KRAS, SOS1, HRAS, GNAI1, EGFR | 27 | 1.88E-05 | PDGFB, ITPR1, HTR2A, GNAI1, EGFR, GNAI2, NRAS, PRKACG, GNA11, PDGFC, DRD1, DRD2, PRKACB, MAP2K5, MAPK3, PRKCG, PDGFRB, MAP2K1, MAP2K2, EGF, PRKCA, PLCB3, PLCB4, GNAQ, KRAS, RAF1, PLCB2 | 24 |
| hsa05230:Central carbon metabolism in cancer | 16 | 1.39E-11 | PDGFRA, FLT3, PTEN, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, KIT, ERBB2, KRAS, HRAS, FGFR3, TP53, FGFR2 | 22 | 2.08E-05 | PDGFRB, NTRK1, MAP2K1, MAP2K2, NTRK3, PTEN, PIK3R3, PIK3R2, PIK3R1, HIF1A, EGFR, PIK3R5, NRAS, PIK3CA, ERBB2, KRAS, RAF1, MET, TP53, FGFR2, PDK1, MAPK3 | 14 |
| hsa04662:B cell receptor signaling pathway | 8 | 0.001200018 | LYN, PIK3CA, KRAS, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 23 | 2.21E-05 | LYN, GSK3B, MAP2K1, MAP2K2, INPPL1, PIK3R3, NFATC1, PIK3R2, PIK3R1, RELA, NFKB1, PIK3R5, IKBKB, NRAS, PIK3CA, PLCG2, RAC2, KRAS, IKBKG, RAC1, RAF1, NFKBIB, MAPK3 | 19 |
| hsa04916:Melanogenesis | 9 | 0.002547463 | TCF7L2, CREB1, KIT, GNAS, EP300, CTNNB1, KRAS, HRAS, GNAI1 | 29 | 2.74E-05 | GSK3B, CAMK2A, GNAI1, GNAI2, NRAS, PRKACG, DVL1, DVL2, DVL3, EP300, PRKACB, MAPK3, PRKCG, MAP2K1, FZD3, CREBBP, EDN1, MAP2K2, PRKCA, MITF, PLCB3, KITLG, PLCB4, CREB1, GNAQ, CTNNB1, KRAS, RAF1, PLCB2 | 24 |
| hsa04920:Adipocytokine signaling pathway | 7 | 0.006237735 | STK11, RXRA, LEPR, IRS2, PTPN11, JAK2, MTOR | 23 | 2.85E-05 | PRKAB2, PRKAA2, PRKAG1, IRS4, PRKAG2, IRS2, PTPN11, PRKAB1, RELA, NFKB1, MAPK10, RXRB, IKBKB, MAPK9, SOCS3, STK11, RXRA, LEPR, IKBKG, PPARA, RXRG, PCK2, NFKBIB | 18 |
| hsa04725:Cholinergic synapse | 9 | 0.004849342 | CREB1, PIK3CA, KRAS, PIK3CB, PIK3R1, JAK2, HRAS, GNAI1, PIK3CG | 31 | 3.02E-05 | CHRM2, CAMK2A, ITPR1, PIK3R3, PIK3R2, PIK3R1, GNAI1, GNAI2, PIK3R5, GNGT1, NRAS, GNG4, PRKACG, GNA11, PRKACB, MAPK3, PRKCG, MAP2K1, PRKCA, GNG12, GNG11, PLCB3, PLCB4, CREB1, PIK3CA, GNAQ, GNB1, GNB3, KRAS, GNB5, PLCB2 | 26 |
| hsa04520:Adherens junction | 10 | 4.19E-05 | SMAD2, TCF7L2, SMAD4, CDH1, ERBB2, CTNND1, EP300, CTNNB1, EGFR, TGFBR2 | 23 | 3.64E-05 | CREBBP, SMAD4, CSNK2A1, INSR, CTNND1, LMO7, IQGAP1, NLK, RHOA, EGFR, TGFBR1, IGF1R, CDC42, ERBB2, CSNK2B, SNAI1, RAC2, EP300, CTNNB1, RAC1, MAP3K7, MET, MAPK3 | 17 |
| hsa04960:Aldosterone-regulated sodium reabsorption | 7 | 0.000285 | PIK3CA, NEDD4L, KRAS, PIK3CB, PIK3R1, SGK1, PIK3CG | 16 | 3.90E-05 | PRKCG, PDPK1, INSR, PIK3R3, NEDD4L, PRKCA, PIK3R2, PIK3R1, IGF1, PIK3R5, INS, PIK3CA, SCNN1B, SCNN1A, KRAS, MAPK3 | 12 |
| hsa04961:Endocrine and other factor-regulated calcium reabsorption | 5 | 0.021728749 | DNM3, CLTCL1, CLTC, GNAS, ESR1 | 17 | 6.67E-05 | PRKCG, CLTB, CLTA, PRKCA, AP2A2, ESR1, RAB11A, DNM1, PLCB3, PLCB4, PRKACG, GNAQ, CLTCL1, AP2S1, PLCB2, PRKACB, AP2M1 | 15 |
| hsa04390:Hippo signaling pathway | 8 | 0.068689095 | SMAD2, TCF7L2, SMAD4, CCND1, CDH1, PPP2R1A, CTNNB1, TGFBR2 | 37 | 9.44E-05 | GSK3B, BMPR2, YWHAB, ITGB2, SERPINE1, PPP2R2A, FGF1, GLI2, PPP2CA, PPP1CB, PPP2CB, PPP1CC, CCND3, CCND2, CCND1, PPP2R1A, DVL1, DVL2, DVL3, SMAD1, FZD3, SMAD4, TGFB1, FBXW11, BMP8A, BMP8B, TGFBR1, BMP6, PPP1CA, LATS1, BMP2, ID1, CTNNB1, NF2, BMPR1B, BMPR1A, TP73 | 33 |
| hsa05146:Amoebiasis | 7 | 0.040529418 | PIK3CA, GNAS, FN1, PIK3CB, PIK3R1, TLR4, PIK3CG | 28 | 0.000221 | LAMA3, ITGB2, HSPB1, PIK3R3, PIK3R2, PIK3R1, RELA, PIK3R5, GNA15, PRKACG, CASP3, GNA11, IL12A, PRKACB, PRKCG, TGFB1, FN1, PRKCA, NFKB1, PLCB3, IL6, PLCB4, IFNG, PIK3CA, GNAQ, IL1B, PLCB2, RAB7A | 25 |
| hsa04210:Apoptosis | 6 | 0.015713445 | PIK3CA, ATM, PIK3CB, PIK3R1, TP53, PIK3CG | 19 | 0.000452 | NTRK1, PIK3R3, TNFRSF10B, FASLG, PIK3R2, PIK3R1, RELA, NFKB1, PIK3R5, IKBKB, IL3, PIK3CA, CASP10, CASP3, RIPK1, FADD, IKBKG, BID, TP53 | 16 |
| hsa05216:Thyroid cancer | 11 | 6.11E-10 | TCF7L2, RXRA, CCND1, CDH1, TPR, NCOA4, CTNNB1, BRAF, KRAS, HRAS, TP53 | 12 | 0.000488 | RXRB, NTRK1, MAP2K1, NRAS, RXRA, MAP2K2, CCND1, CTNNB1, KRAS, RXRG, TP53, MAPK3 | 7 |
| hsa04024:cAMP signaling pathway | 11 | 0.019647411 | CREB1, GRIN3A, PIK3CA, GNAS, EP300, BRAF, SOX9, PIK3CB, PIK3R1, GNAI1, PIK3CG | 41 | 0.001513911 | CHRM2, CAMK2A, PIK3R3, PIK3R2, PIK3R1, PLD1, GLI1, GNAI1, RELA, GNAI2, SLC9A1, PIK3R5, PPP1CB, MAPK9, PPP1CC, PAK1, RAP1A, RRAS, PRKACG, RAC2, EP300, SOX9, DRD1, RAC1, DRD2, PRKACB, MAPK3, MAP2K1, CREBBP, MAP2K2, NFATC1, RHOA, NFKB1, GRIN1, PPP1CA, MAPK10, CREB1, PIK3CA, RAF1, PPARA, MYL9 | 35 |
| hsa04930:Type II diabetes mellitus | 7 | 0.000897 | PIK3CA, PRKCD, IRS2, PIK3CB, PIK3R1, MTOR, PIK3CG | 15 | 0.001809648 | PRKCE, INSR, IRS4, PIK3R3, PIK3R2, IRS2, PIK3R1, PIK3R5, INS, MAPK10, IKBKB, MAPK9, SOCS3, PIK3CA, MAPK3 | 12 |
| hsa05206:MicroRNAs in cancer | 21 | 1.32E-05 | PDGFRA, NOTCH1, CDKN2A, DNMT3A, PTEN, IRS2, BRCA1, DICER1, EGFR, MTOR, CCND1, ERBB2, EP300, KRAS, ATM, PLCG1, SOS1, HRAS, FGFR3, TP53, EZH2 | 53 | 0.003721326 | CDKN1A, CDKN1B, BMPR2, PTEN, IRS2, BRCA1, BMI1, IKBKB, CCND2, CCND1, CASP3, DNMT3B, EP300, PDGFRB, PRKCG, MAP2K1, MAP2K2, PRKCE, DNMT3A, PRKCA, SIRT1, RHOA, CDC25A, ZEB1, CCNE1, RAF1, MET, TP53, CRK, NOTCH1, SHC1, NOTCH4, PDGFB, THBS1, EGFR, NRAS, ERBB2, E2F1, PLCG2, E2F2, HMOX1, E2F3, PAK4, MCL1, FZD3, CREBBP, UBE2I, NFKB1, CCNG1, MDM2, PDCD4, KRAS, MDM4 | 42 |
| hsa04070:Phosphatidylinositol signaling system | 6 | 0.084201731 | PIK3CA, PTEN, PLCG1, PIK3CB, PIK3R1, PIK3CG | 23 | 0.004606401 | PRKCG, PTEN, INPPL1, ITPR1, PIK3R3, PIK3C2G, PRKCA, PIK3R2, OCRL, PIK3R1, PIK3R5, PLCB3, PLCB4, PIK3CA, PLCG2, PIP5K1A, PIP4K2A, PIK3C3, PIP5K1B, PIP4K2B, PIP5K1C, PLCB2, PLCD1 | 20 |
| hsa04923:Regulation of lipolysis in adipocytes | 7 | 0.002029755 | PIK3CA, GNAS, IRS2, PIK3CB, PIK3R1, GNAI1, PIK3CG | 14 | 0.0199789 | INSR, IRS4, PIK3R3, PIK3R2, IRS2, PIK3R1, GNAI1, PIK3R5, INS, GNAI2, FABP4, PIK3CA, PRKACG, PRKACB | 10 |
| hsa00562:Inositol phosphate metabolism | 5 | 0.088716732 | PIK3CA, PTEN, PLCG1, PIK3CB, PIK3CG | 16 | 0.029524704 | PTEN, INPPL1, PIK3C2G, OCRL, PLCB3, PLCB4, PIK3CA, PLCG2, PIP5K1A, PIP4K2A, PIK3C3, PIP5K1B, PIP4K2B, PIP5K1C, PLCB2, PLCD1 | 14 |
| hsa05130:Pathogenic Escherichia coli infection | 5 | 0.032679193 | TUBA1A, CTTN, CDH1, CTNNB1, TLR4 | 12 | 0.050313179 | CDC42, ITGB1, ARPC3, NCL, NCK2, HCLS1, CTNNB1, PRKCA, ARPC4, ARPC5, RHOA, NCK1 | 11 |
| hsa04144:Endocytosis | 15 | 0.001758385 | SMAD2, PDGFRA, HSPA8, CLTC, HLA-B, NEDD4L, HLA-A, EGFR, TGFBR2, DNM3, CLTCL1, AMPH, HRAS, FGFR3, FGFR2 | 40 | 0.059407256 | CLTB, NEDD4L, CXCR4, CLTA, ARRB1, ARRB2, PLD1, AP2A2, EGFR, IGF1R, CDC42, CAPZB, CLTCL1, AP2S1, PIP5K1A, PIP5K1B, PIP5K1C, EPS15, AP2M1, GIT1, RAB8A, SMURF2, ARPC4, STAM, HLA-A, HSPA2, ARPC5, RHOA, TGFBR1, DNM1, RAB11A, EPN2, HLA-E, ARPC3, HGS, IL2RB, MDM2, FGFR4, FGFR2, RAB7A | 35 |

**Table 8. The pathway intersection of driver genes and downstream genes in lung cancer of Primitive subtype**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Term | drivers\_count | driver\_pvalue | drivers | Out\_count | Out\_pvalue | Outs | Outs\_drivers\_count |
| hsa05200:Pathways in cancer | 43 | 9.32E-19 | RB1, HSP90AB1, MAX, PTEN, PIK3CB, PIK3R1, BRCA2, GNAI1, EGFR, PIK3CG, RXRA, MECOM, CCND1, TPR, ERBB2, ABL1, EP300, PLCG1, HRAS, SMAD2, TCF7L2, PDGFRA, SMAD4, CDKN2A, HGF, MMP2, NCOA4, FN1, BRAF, AXIN2, MTOR, TGFBR2, RUNX1, PIK3CA, KIT, GNAS, CTNNB1, KRAS, ITGA6, SOS1, FGFR3, TP53, FGFR2 | 157 | 1.16E-42 | RB1, CBLB, FGF2, FGF3, CRKL, IGF1R, FGF5, FGF8, FGF9, MYC, EP300, SKP2, PRKACB, PDGFRA, MAP2K1, MAP2K2, HGF, MITF, PRKCA, PGF, RUNX1, RBX1, MSH6, MSH2, CCNE1, TP53, CSF1R, CTBP2, MAX, CTBP1, EPAS1, CUL2, PDGFB, PDGFA, PIK3R3, KLK3, PIK3R1, HIF1A, RASGRP1, FOXO1, HSP90B1, DVL1, DVL2, FGF20, PLCG2, DVL3, PLCG1, FGF22, FGF21, STAT5A, SMAD2, FZD3, CREBBP, TGFB2, JUN, TGFB1, SMAD3, JUP, FZD5, FZD4, TGFB3, FN1, BRAF, IGF1, GNG12, GNG11, PTK2, NFKB1, FGF17, NFKBIA, CDK4, GNB2, FGF18, CDK2, MDM2, GNAS, GNB3, GRB2, FGF13, FGF12, FGFR3, FGFR1, RET, CDKN1A, CDKN1B, PTEN, SLC2A1, PIK3CD, LAMC1, PIK3CB, GLI3, CKS1B, GNGT1, SHH, CASP8, CASP3, RAC2, RAC3, ITGAV, IKBKG, RAC1, HRAS, JAK1, MMP1, ITGA2, MMP2, FOS, RHOA, TGFBR1, PIK3CA, KIT, ITGA6, PPARG, CRK, MET, PLCB2, BIRC2, PPARD, RALA, HDAC2, HDAC1, GSTP1, LAMA3, LEF1, GNAI3, CXCR4, RELA, GNAI1, GNAI2, RXRB, CDC42, NRAS, MAPK8, GNG3, RXRA, GNG5, GNG4, GNA11, ERBB2, E2F1, CTNNA1, E2F2, MAPK1, E2F3, CTNNA2, RXRG, NTRK1, CDKN2B, LAMB3, EGF, STAT3, MLH1, PML, MAPK10, KITLG, FAS, KRAS | 132 |
| hsa04151:PI3K-Akt signaling pathway | 31 | 4.69E-11 | HSP90AB1, PTEN, BRCA1, PIK3CB, PIK3R1, EGFR, PIK3CG, STK11, RXRA, CCND1, PPP2R1A, MYB, JAK2, HRAS, PDGFRA, HGF, FN1, TSC2, MTOR, CREB1, PIK3CA, RHEB, KIT, KRAS, ITGA6, SGK1, SOS1, FGFR3, TP53, TLR4, FGFR2 | 125 | 8.29E-29 | ATF2, EPO, IRS1, PPP2R2A, FGF2, FGF3, IGF1R, FGF5, CCND3, STK11, CCND2, FGF8, FGF9, PPP2R1A, MYC, KDR, PDGFRA, MAP2K1, MAP2K2, IL4R, HGF, RPS6, TSC1, PRKCA, PRLR, PGF, CCNE1, TP53, EPHA2, CSF1R, PDGFB, PDGFA, PIK3R3, PIK3R1, FOXO3, EFNA4, HSP90B1, PDGFD, PDGFC, FGF20, PCK1, FGF22, MCL1, FGF21, NGFR, INSR, FN1, IGF1, GNG12, GNG11, PTK2, NFKB1, IL2, FGF17, EFNA1, IL4, GH1, IL3, IL7, CDK4, GNB2, FGF18, CDK2, MDM2, GNB3, GRB2, FGF13, FGFR4, IL7R, FGF12, FGFR3, FGFR1, CDKN1A, CDKN1B, FLT1, ITGB5, YWHAB, ITGB4, PTEN, PIK3CD, LAMC1, BRCA1, PIK3CB, PRL, GNGT1, PPP2R5E, ITGAV, IKBKG, RAC1, JAK3, HRAS, JAK1, SYK, PDPK1, ITGA2, PPP2R5D, PPP2R5C, RBL2, CREB1, PIK3CA, KIT, ITGA6, MET, TLR2, PRKAA1, PRKAA2, LAMA3, THBS1, RELA, PPP2CA, PPP2CB, NRAS, GNG3, RXRA, GNG5, GNG4, MAPK1, LAMB3, IFNB1, EGF, KITLG, RPS6KB1, IL2RA, KRAS, PKN2 | 107 |
| hsa04015:Rap1 signaling pathway | 19 | 6.43E-07 | PDGFRA, DOCK4, HGF, CTNND1, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, GNAI1, PIK3CA, KIT, GNAS, CTNNB1, KRAS, PLCG1, HRAS, FGFR3, FGFR2 | 92 | 3.54E-28 | FLT1, ITGAM, CTNND1, ITGB2, PIK3CD, PIK3CB, FGF2, FGF3, IGF1R, CRKL, FGF5, FGF8, FGF9, KDR, RAC2, RAC3, PLCE1, RAC1, HRAS, MAGI1, MAP2K3, PDGFRA, PRKCI, MAP2K1, MAP2K2, HGF, MAGI2, PRKCA, RHOA, PGF, MRAS, PIK3CA, PRKD3, KIT, PRKD2, LCP2, PRKD1, TLN1, MET, PLCB2, CRK, EPHA2, CSF1R, RALA, SRC, PDGFB, GNAI3, PDGFA, PIK3R3, PIK3R1, THBS1, EFNA4, GNAI1, GNAI2, CDC42, NRAS, GRIN2A, RAP1A, PARD6A, PDGFD, PDGFC, FGF20, MAPK1, PLCG1, DRD2, FGF22, FGF21, MAP2K6, NGFR, EGF, INSR, BRAF, IGF1, MAPK14, GRIN2B, MAPK12, GRIN1, MAPK13, EFNA1, GNAO1, FGF17, KITLG, ID1, FGF18, GNAS, KRAS, CALM3, FGF13, FGFR4, FGF12, FGFR3, FGFR1 | 78 |
| hsa04014:Ras signaling pathway | 18 | 8.05E-06 | PDGFRA, HGF, PTPN11, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, RASA1, KIT, ABL1, NF1, KRAS, PLCG1, SOS1, HRAS, FGFR3, FGFR2 | 96 | 3.82E-28 | FLT1, PIK3CD, PIK3CB, FGF2, ELK1, ETS2, FGF3, IGF1R, FGF5, GNGT1, TBK1, FGF8, FGF9, KDR, RAC2, RAC3, PLCE1, IKBKG, RAC1, PRKACB, HRAS, PDGFRA, MAP2K1, MAP2K2, KSR1, HGF, RRAS2, PRKCA, GAB2, RHOA, PGF, MRAS, PIK3CA, KIT, MET, EPHA2, CSF1R, RALA, SHC2, SHC3, PDGFB, PDGFA, PIK3R3, PIK3R1, FOXO4, PLD1, RASGRP1, EFNA4, RELA, PLD2, CDC42, NRAS, PAK1, GRIN2A, MAPK8, GNG3, RAP1A, GNG5, GNG4, PDGFD, PDGFC, FGF20, PLCG2, MAPK1, PLCG1, PAK3, PAK2, FGF22, FGF21, PAK4, BRAP, NGFR, EGF, INSR, IGF1, GNG12, GRIN2B, GNG11, NFKB1, GRIN1, EFNA1, MAPK10, FGF17, KITLG, GNB2, FGF18, REL, GNB3, KRAS, CALM3, GRB2, FGF13, FGFR4, FGF12, FGFR3, FGFR1 | 86 |
| hsa04110:Cell cycle | 17 | 9.30E-09 | RB1, SMAD2, SMAD4, MCM7, CDKN2A, CUL1, BUB1B, SMC3, SMC1A, TFDP1, CCND1, RAD21, ABL1, EP300, ATM, TP53, ATR | 68 | 5.99E-28 | RB1, CDKN1A, CDKN1B, MCM7, CCNH, YWHAB, SMC3, CDC20, CCND3, CDC23, CCND2, PTTG1, MYC, CHEK2, CHEK1, CDC27, EP300, SKP2, SMC1A, CDC25A, RBX1, RBL2, CCNA2, DBF4, ESPL1, TFDP2, CCNE1, MCM4, MCM5, MCM6, TP53, MAD1L1, MCM2, HDAC2, PCNA, PRKDC, HDAC1, CUL1, CCNB2, FZR1, CCNB1, RAD21, E2F1, E2F2, E2F3, SFN, E2F5, SMAD2, TGFB2, CDKN2B, CREBBP, TGFB1, CDKN2C, SMAD3, GADD45B, TGFB3, GADD45A, PLK1, CDC7, CDC6, CDK7, STAG2, CDK4, CDC16, CDK2, MDM2, ATM, MAD2L1 | 58 |
| hsa05218:Melanoma | 15 | 2.70E-10 | RB1, PDGFRA, CDKN2A, HGF, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, CCND1, KRAS, HRAS, TP53 | 45 | 5.32E-22 | RB1, CDKN1A, PTEN, PDGFB, PDGFA, PIK3CD, PIK3R3, PIK3CB, PIK3R1, FGF2, FGF3, IGF1R, FGF5, NRAS, FGF8, FGF9, PDGFD, PDGFC, E2F1, FGF20, E2F2, MAPK1, E2F3, HRAS, FGF22, FGF21, PDGFRA, MAP2K1, MAP2K2, EGF, HGF, BRAF, MITF, IGF1, FGF17, PIK3CA, CDK4, FGF18, MDM2, KRAS, FGF13, MET, FGF12, TP53, FGFR1 | 34 |
| hsa05205:Proteoglycans in cancer | 26 | 8.47E-13 | DDX5, PIK3CB, PIK3R1, EGFR, PIK3CG, CCND1, ERBB4, ERBB2, FLNA, PLCG1, HRAS, HGF, MMP2, FN1, MSN, PTPN11, BRAF, ESR1, MTOR, CTTN, PIK3CA, CTNNB1, KRAS, SOS1, TP53, TLR4 | 80 | 1.78E-21 | CDKN1A, ITGB5, PIK3CD, CBLB, PIK3CB, FGF2, ELK1, IGF1R, PPP1CC, MYC, CASP3, KDR, PLCE1, ITGAV, RAC1, PRKACB, HRAS, MAP2K1, MAP2K2, PDPK1, HGF, MMP2, ITGA2, RPS6, RRAS2, PRKCA, RHOA, DCN, MRAS, PIK3CA, HCLS1, MET, TP53, TLR2, CAMK2B, DDX5, SRC, SDC2, ITPR1, PIK3R3, PIK3R1, IQGAP1, THBS1, HIF1A, SLC9A1, CDC42, NRAS, PAK1, ERBB3, ERBB4, ERBB2, PLCG2, MAPK1, PLCG1, CAMK2G, TGFB2, FZD3, TGFB1, FZD5, CAV3, FZD4, STAT3, IGF2, FN1, MSN, BRAF, IGF1, MAPK14, ESR1, MAPK12, PTK2, MAPK13, RPS6KB1, MDM2, PDCD4, FAS, KRAS, NANOG, GRB2, FGFR1 | 64 |
| hsa04068:FoxO signaling pathway | 19 | 5.27E-10 | SMAD2, SMAD4, PTEN, BRAF, IRS2, PIK3CB, PIK3R1, EGFR, PIK3CG, TGFBR2, STK11, PIK3CA, CCND1, EP300, KRAS, ATM, SGK1, SOS1, HRAS | 63 | 2.76E-21 | CDKN1A, CDKN1B, IRS1, PRKAG1, PTEN, PIK3CD, PRKAG2, PIK3CB, IGF1R, STK11, CCND2, EP300, SKP2, HRAS, MAP2K1, MAP2K2, PDPK1, PRMT1, PRKAB1, SIRT1, TGFBR1, RBL2, PIK3CA, PRKAA1, PRKAA2, PIK3R3, PIK3R1, FOXO4, FOXO3, FOXO1, CCNB2, NRAS, MAPK8, CCNB1, MAPK1, PCK1, PLK4, SMAD2, TGFB2, CDKN2B, CREBBP, TGFB1, SMAD3, GADD45B, TGFB3, EGF, GADD45A, INSR, PLK1, STAT3, BRAF, IGF1, MAPK14, MAPK12, MAPK13, MAPK10, BCL6, CDK2, MDM2, KRAS, GRB2, ATM, IL7R | 52 |
| hsa05166:HTLV-I infection | 26 | 1.76E-10 | RB1, CRTC3, CRTC1, BUB1B, PIK3CB, PIK3R1, PIK3CG, CCND1, MYB, EP300, HRAS, POLE, SMAD2, PDGFRA, SMAD4, RANBP3, MAP3K1, CDKN2A, TGFBR2, CREB1, PIK3CA, CTNNB1, KRAS, ATM, TP53, ATR | 92 | 3.91E-21 | RB1, ATF2, CDKN1A, CRTC3, CRTC1, ITGB2, SLC2A1, PIK3CD, PIK3CB, ELK1, ETS2, CDC20, CCND3, ZFP36, CDC23, CCND2, PTTG1, MYC, CHEK2, CHEK1, CDC27, EP300, IKBKG, JAK3, PRKACB, HRAS, JAK1, HLA-DPA1, MAP2K4, PDGFRA, TBP, MSX2, RRAS2, FOS, TGFBR1, MRAS, CREB1, PIK3CA, TLN1, TP53, ATF3, HLA-DQB1, PCNA, SRF, PDGFB, CREM, PDGFA, PIK3R3, GPS2, PIK3R1, RELA, NRAS, TERT, POLD1, DVL1, DVL2, E2F1, DVL3, E2F2, E2F3, SMAD2, STAT5A, EGR1, TGFB2, CDKN2B, JUN, FZD3, CREBBP, TGFB1, CDKN2C, SMAD3, FZD5, FZD4, TGFB3, NFYB, NFKB1, IL2, NFATC4, NFKBIA, DLG1, CDK4, IL2RA, CDC16, HLA-DPB1, HLA-DRA, KRAS, ATM, LTBR, MAP3K14, RAN, HLA-DRB1, MAD2L1 | 78 |
| hsa05169:Epstein-Barr virus infection | 9 | 0.005223419 | LYN, RB1, NCOR2, PSMD11, PIK3CA, PIK3CB, PIK3R1, TP53, PIK3CG | 59 | 1.05E-20 | RB1, CDKN1A, CDKN1B, PIK3CD, PIK3CB, RBPJ, PSMD6, TBK1, PSMD4, MYC, PSMD2, PSMD1, IKBKG, SKP2, JAK3, JAK1, HLA-DPA1, MAP2K3, MAP2K4, SYK, NCOR2, CCNA2, PIK3CA, TP53, HLA-DQB1, RBPJL, PSMD12, HDAC2, PSMD13, HDAC1, PIK3R3, PIK3R1, RELA, MAPK8, IRAK1, PLCG2, RIPK1, MAP2K6, LYN, JUN, STAT3, EIF2AK2, MAPK14, MAPK12, NFKB1, MAPK13, NFKBIA, MAPK10, SNW1, PSMC4, NEDD4, PSMC2, CDK2, HLA-DPB1, MDM2, HLA-DRA, MAP3K14, HLA-DRB1, NFKBIB | 52 |
| hsa05203:Viral carcinogenesis | 16 | 3.92E-05 | LYN, RB1, CDKN2A, CHD4, GTF2H1, PIK3CB, PIK3R1, PIK3CG, CREB1, PIK3CA, CCND1, EP300, KRAS, HRAS, TP53, HIST1H2BD | 80 | 1.08E-20 | RB1, ATF2, CDKN1A, CDKN1B, YWHAB, GTF2B, HDAC11, PIK3CD, CHD4, PIK3CB, RBPJ, CDC20, CCND3, CASP8, CCND2, CASP3, CHEK1, EP300, IKBKG, RAC1, SKP2, JAK3, PRKACB, HRAS, JAK1, TBP, SYK, RHOA, RBL2, CCNA2, CREB1, PIK3CA, CCNE1, MAPKAPK2, HIST1H2BB, TP53, IRF9, MAD1L1, HDAC4, RBPJL, GTF2A1, SP100, HDAC2, HDAC3, SRC, HDAC1, SRF, HPN, PIK3R3, PIK3R1, HDAC9, GTF2E1, HDAC6, RELA, CDC42, NRAS, MAPK1, PMAIP1, LYN, STAT5A, CDKN2B, JUN, CREBBP, GSN, STAT3, EIF2AK2, GTF2H1, GTF2H4, NFKB1, NFKBIA, HIST1H4A, DLG1, SNW1, CDK4, CDK2, REL, MDM2, KRAS, GRB2, LTBR | 68 |
| hsa05220:Chronic myeloid leukemia | 18 | 1.24E-13 | RB1, SMAD4, CDKN2A, BRAF, PTPN11, PIK3CB, PIK3R1, PIK3CG, TGFBR2, RUNX1, MECOM, PIK3CA, CCND1, ABL1, KRAS, SOS1, HRAS, TP53 | 43 | 1.23E-19 | RB1, CDKN1A, SHC2, HDAC2, CDKN1B, SHC3, CTBP2, CTBP1, HDAC1, PIK3CD, PIK3R3, CBLB, PIK3CB, PIK3R1, RELA, CRKL, NRAS, MYC, E2F1, E2F2, MAPK1, E2F3, IKBKG, HRAS, STAT5A, TGFB2, MAP2K1, TGFB1, MAP2K2, TGFB3, BRAF, GAB2, TGFBR1, NFKB1, RUNX1, NFKBIA, PIK3CA, CDK4, MDM2, GRB2, KRAS, TP53, CRK | 34 |
| hsa04722:Neurotrophin signaling pathway | 16 | 4.30E-08 | MAP3K1, PRKCD, MATK, BRAF, PTPN11, PIK3CB, PIK3R1, PSEN1, PIK3CG, PIK3CA, ABL1, KRAS, PLCG1, SOS1, HRAS, TP53 | 57 | 1.49E-19 | IRS1, PIK3CD, PIK3CB, CRKL, RPS6KA3, RPS6KA5, RPS6KA2, RPS6KA1, RAC1, HRAS, MAP3K5, MAP2K1, MAP2K2, PDPK1, PRKCD, IRAK4, RHOA, PIK3CA, MAPKAPK2, TP53, CRK, CAMK2B, ZNF274, SHC2, SHC3, MAGED1, PIK3R3, PIK3R1, FOXO3, RELA, CDC42, NRAS, MAPK8, RAP1A, MAPK7, IRAK1, NTF3, PLCG2, MAPK1, PLCG1, CAMK2G, NTRK1, NGFR, JUN, SORT1, NTRK3, BRAF, MAPK14, MAPK12, NFKB1, MAPK13, NFKBIA, MAPK10, KRAS, CALM3, GRB2, NFKBIB | 48 |
| hsa04010:MAPK signaling pathway | 18 | 3.52E-05 | PDGFRA, HSPA8, MAP3K1, MAX, BRAF, EGFR, TGFBR2, MECOM, RASA1, NF1, FLNA, KRAS, SOS1, HRAS, FGFR3, TP53, FGFR2, MAP3K4 | 89 | 1.71E-19 | ATF2, HSPB1, FGF2, ELK1, FGF3, CRKL, FGF5, RPS6KA3, RPS6KA5, FGF8, FGF9, MYC, RPS6KA2, CASP3, RPS6KA1, RAC2, RAC3, IKBKG, RAC1, PRKACB, HRAS, MAP3K4, MAP3K5, MAP4K1, MAP2K3, MAP2K4, PDGFRA, MAP2K1, MEF2C, MAP2K2, RRAS2, PRKCA, FOS, TGFBR1, MRAS, IL1B, MAPKAPK2, MAPKAPK5, TP53, CRK, MAX, SRF, PDGFB, PDGFA, RASGRP1, RELA, CDC42, NRAS, PAK1, MAPK8, RAP1A, MAPK7, NTF3, FGF20, MAPK1, PAK2, FGF22, FGF21, MAP2K6, NTRK1, TGFB2, JUN, TGFB1, JUND, GADD45B, TGFB3, EGF, GADD45A, BRAF, HSPA2, MAPK14, GNG12, MAPK12, NFKB1, MAPK13, MAPK10, FGF17, PPP5C, FGF18, FAS, KRAS, GRB2, FGF13, FGFR4, MAP3K14, FGF12, FGFR3, MAP3K11, FGFR1 | 81 |
| hsa05215:Prostate cancer | 22 | 9.75E-17 | RB1, PDGFRA, TCF7L2, HSP90AB1, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, CREB1, PIK3CA, CCND1, ERBB2, EP300, CTNNB1, KRAS, SOS1, HRAS, TP53, FGFR2 | 46 | 6.75E-18 | RB1, CDKN1A, CDKN1B, LEF1, PTEN, PDGFB, PDGFA, PIK3CD, PIK3R3, KLK3, PIK3CB, PIK3R1, FOXO1, RELA, HSP90B1, IGF1R, NRAS, PDGFD, ERBB2, PDGFC, E2F1, E2F2, MAPK1, EP300, E2F3, IKBKG, HRAS, PDGFRA, MAP2K1, CREBBP, MAP2K2, EGF, PDPK1, BRAF, IGF1, NFKB1, NFKBIA, CREB1, PIK3CA, CCNE1, CDK2, MDM2, GRB2, KRAS, TP53, FGFR1 | 33 |
| hsa05161:Hepatitis B | 15 | 3.03E-06 | RB1, SMAD4, MAP3K1, PTEN, PIK3CB, PIK3R1, PIK3CG, CREB1, PIK3CA, CCND1, EP300, KRAS, HRAS, TP53, TLR4 | 61 | 1.02E-17 | RB1, ATF2, CDKN1A, CDKN1B, YWHAB, PTEN, PIK3CD, PIK3CB, ELK1, TBK1, CASP8, CASP10, MYC, CASP3, EP300, IKBKG, HRAS, JAK1, MAP2K4, MAP2K1, MAP2K2, PRKCA, FOS, TICAM1, TGFBR1, DDB2, CCNA2, CREB1, PIK3CA, CCNE1, TP53, TLR2, PCNA, SRC, PIK3R3, PIK3R1, RELA, NRAS, MAPK8, E2F1, E2F2, MAPK1, E2F3, STAT5A, TGFB2, JUN, CREBBP, TGFB1, IFNB1, TGFB3, STAT3, NFKB1, NFATC4, NFKBIA, MAPK10, CDK4, CDK2, FAS, KRAS, GRB2, MYD88 | 51 |
| hsa04012:ErbB signaling pathway | 14 | 4.14E-08 | BRAF, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, ERBB4, ERBB2, ABL1, KRAS, PLCG1, SOS1, HRAS | 45 | 2.72E-17 | CAMK2B, CDKN1A, SHC2, CDKN1B, SHC3, SRC, PIK3CD, PIK3R3, CBLB, PIK3CB, PIK3R1, ELK1, CRKL, PAK1, NRAS, MAPK8, ERBB3, ERBB4, MYC, ERBB2, PLCG2, MAPK1, PLCG1, PAK3, HRAS, PAK2, CAMK2G, NCK1, PAK4, STAT5A, MAP2K4, JUN, MAP2K1, MAP2K2, EGF, PRKCA, BRAF, NRG2, PTK2, MAPK10, PIK3CA, RPS6KB1, GRB2, KRAS, CRK | 36 |
| hsa05202:Transcriptional misregulation in cancer | 14 | 6.98E-05 | DDX5, MAX, H3F3C, DOT1L, MLLT3, TGFBR2, RUNX1, NCOR1, RXRA, EWSR1, SIN3A, ATM, TP53, KDM6A | 65 | 7.93E-17 | CDKN1A, CDKN1B, CCNT2, FLT1, ITGAM, CCNT1, SIX1, IGF1R, LYL1, CCND2, MYC, MEN1, MEF2C, IGFBP3, LMO2, PAX5, ETV4, MLF1, RUNX2, RUNX1, MYCN, NCOR1, MAF, EWSR1, PPARG, MET, TP53, CSF1R, CEBPB, DDX5, HDAC2, MAX, HDAC1, PDGFA, MLLT3, FOXO1, RELA, RXRB, HIST1H3A, RXRA, RXRG, NTRK1, NGFR, SMAD1, CDKN2C, TAF15, JUP, EYA1, FUS, PBX3, IGF1, NFKB1, PBX1, PTK2, PML, CDK9, IL3, MEIS1, BCL6, SP1, ID2, HIST3H3, REL, MDM2, ATM | 56 |
| hsa04919:Thyroid hormone signaling pathway | 21 | 3.75E-13 | NOTCH1, NCOA3, TSC2, PIK3CB, PIK3R1, ESR1, MTOR, PIK3CG, MED12, NCOR1, RXRA, PIK3CA, CCND1, SIN3A, RHEB, EP300, CTNNB1, KRAS, PLCG1, HRAS, TP53 | 51 | 6.20E-16 | THRA, SLC2A1, PIK3CD, PIK3CB, MED16, MED17, MED14, MED13, MYC, EP300, PLCE1, ITGAV, PRKACB, HRAS, NCOA1, NCOA2, MED1, MAP2K1, MAP2K2, PDPK1, NCOA3, PRKCA, NCOR1, PIK3CA, PLCB2, TP53, NOTCH2, HDAC2, HDAC3, NOTCH1, SRC, HDAC1, NOTCH4, PIK3R3, GATA4, PIK3R1, HIF1A, FOXO1, SLC9A1, RXRB, NRAS, RXRA, PLCG2, MAPK1, PLCG1, RXRG, CREBBP, ESR1, MED13L, MDM2, KRAS | 38 |
| hsa05142:Chagas disease (American trypanosomiasis) | 10 | 0.000433 | SMAD2, PIK3CA, PPP2R1A, GNAS, PIK3CB, PIK3R1, TLR4, GNAI1, PIK3CG, TGFBR2 | 48 | 7.35E-16 | GNAI3, PIK3CD, PIK3R3, PPP2R2A, PIK3CB, PIK3R1, GNAI1, RELA, GNAI2, PPP2CA, PPP2CB, GNA14, GNA15, MAPK8, CASP8, IRAK1, PPP2R1A, GNA11, MAPK1, IKBKG, SMAD2, MAP2K4, TGFB2, JUN, TGFB1, SMAD3, IFNB1, TGFB3, FOS, IRAK4, MAPK14, TICAM1, TGFBR1, MAPK12, IL2, NFKB1, MAPK13, GNAO1, MAPK10, NFKBIA, IFNG, PIK3CA, IL1B, GNAS, FAS, PLCB2, MYD88, TLR2 | 41 |
| hsa05214:Glioma | 17 | 3.36E-13 | RB1, PDGFRA, CDKN2A, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, CCND1, KRAS, PLCG1, SOS1, HRAS, TP53 | 36 | 4.73E-15 | RB1, CAMK2B, CDKN1A, SHC2, SHC3, PTEN, PDGFB, PDGFA, PIK3CD, PIK3R3, PIK3CB, PIK3R1, IGF1R, NRAS, E2F1, PLCG2, E2F2, MAPK1, E2F3, PLCG1, HRAS, CAMK2G, PDGFRA, MAP2K1, MAP2K2, EGF, PRKCA, BRAF, IGF1, PIK3CA, CDK4, MDM2, GRB2, KRAS, CALM3, TP53 | 25 |
| hsa05211:Renal cell carcinoma | 11 | 1.42E-06 | PIK3CA, HGF, EP300, BRAF, PTPN11, KRAS, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 36 | 8.87E-15 | EPAS1, CUL2, PDGFB, SLC2A1, PIK3CD, PIK3R3, PIK3CB, PIK3R1, HIF1A, CRKL, CDC42, PAK1, NRAS, RAP1A, MAPK1, EP300, RAC1, PAK3, HRAS, PAK2, PAK4, TGFB2, JUN, MAP2K1, CREBBP, TGFB1, MAP2K2, TGFB3, HGF, BRAF, RBX1, PIK3CA, GRB2, KRAS, MET, CRK | 28 |
| hsa05212:Pancreatic cancer | 17 | 3.36E-13 | RB1, SMAD2, SMAD4, CDKN2A, BRAF, PIK3CB, PIK3R1, BRCA2, EGFR, PIK3CG, TGFBR2, PIK3CA, CCND1, ERBB2, KRAS, TP53, ARHGEF6 | 35 | 3.70E-14 | RB1, RALA, PIK3CD, PIK3R3, PIK3CB, PIK3R1, RELA, CDC42, MAPK8, ERBB2, E2F1, RAC2, E2F2, MAPK1, RAC3, E2F3, IKBKG, RAC1, JAK1, SMAD2, TGFB2, MAP2K1, TGFB1, SMAD3, TGFB3, EGF, STAT3, BRAF, TGFBR1, NFKB1, MAPK10, PIK3CA, CDK4, KRAS, TP53 | 26 |
| hsa04664:Fc epsilon RI signaling pathway | 9 | 0.000109 | LYN, PIK3CA, KRAS, PLCG1, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 35 | 2.08E-13 | PIK3CD, PIK3R3, PIK3CB, PIK3R1, NRAS, MAPK8, PLCG2, RAC2, MAPK1, RAC3, FYN, PLCG1, RAC1, HRAS, MAP2K6, LYN, MAP2K3, MAP2K4, MAP2K1, MAP2K2, SYK, PDPK1, IL13, PRKCA, GAB2, MAPK14, MAPK12, MAPK13, MAPK10, IL4, IL3, PIK3CA, GRB2, KRAS, LCP2 | 28 |
| hsa04660:T cell receptor signaling pathway | 8 | 0.006225985 | PIK3CA, KRAS, PLCG1, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 43 | 5.88E-13 | ITK, PIK3CD, PIK3R3, PIK3CB, PIK3R1, RASGRP1, RELA, CDC42, PAK1, NRAS, GRAP2, MAPK1, FYN, IKBKG, PLCG1, PAK3, HRAS, PAK2, NCK1, PAK4, JUN, MAP2K1, MAP2K2, PDPK1, FOS, MAPK14, RHOA, MAPK12, IL2, NFKB1, MAPK13, IL4, NFKBIA, DLG1, IFNG, PIK3CA, CDK4, GRB2, KRAS, PRKCQ, LCP2, MAP3K14, NFKBIB | 37 |
| hsa04510:Focal adhesion | 18 | 2.28E-06 | PDGFRA, HGF, PTEN, FN1, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, ARHGAP35, PIK3CA, CCND1, ERBB2, FLNA, CTNNB1, ITGA6, SOS1, HRAS | 67 | 7.96E-13 | FLT1, ITGB5, ITGB4, PTEN, ILK, PIK3CD, PIK3CB, LAMC1, ELK1, IGF1R, MYLK, CRKL, PPP1CC, CCND3, CCND2, KDR, RAC2, RAC3, ITGAV, RAC1, HRAS, PDGFRA, MAP2K1, PDPK1, HGF, ITGA2, PRKCA, RHOA, PGF, PIK3CA, ITGA6, TLN1, MET, CRK, BIRC2, SHC2, SHC3, SRC, LAMA3, PDGFB, PDGFA, PIK3R3, PIK3R1, THBS1, CDC42, PAK1, MAPK8, RAP1A, PDGFD, ERBB2, PDGFC, MAPK1, FYN, PAK3, PAK2, PAK4, JUN, LAMB3, CAV3, EGF, FN1, BRAF, IGF1, PTK2, MYLPF, MAPK10, GRB2 | 56 |
| hsa04810:Regulation of actin cytoskeleton | 17 | 1.29E-05 | PDGFRA, FN1, MSN, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, ARHGAP35, PIK3CA, KRAS, ITGA6, SOS1, HRAS, FGFR3, FGFR2, ARHGEF6 | 67 | 2.16E-12 | ITGAM, ITGB5, ITGB4, ITGB2, PIK3CD, PIK3CB, FGF2, FGF3, MYLK, CRKL, FGF5, PPP1CC, FGF8, FGF9, RAC2, PIP4K2A, RAC3, ITGAV, PIP4K2C, RAC1, HRAS, GIT1, PDGFRA, MAP2K1, MAP2K2, ITGA2, RRAS2, RHOA, MRAS, PIK3CA, ITGA6, CRK, SRC, PDGFB, PDGFA, PIK3R3, PIK3R1, IQGAP1, SLC9A1, CDC42, NRAS, PAK1, PDGFD, PDGFC, FGF20, MAPK1, PAK3, PAK2, FGF22, FGF21, PAK4, GSN, EGF, FN1, MSN, BRAF, GNG12, PTK2, MYLPF, FGF17, FGF18, KRAS, FGF13, FGFR4, FGF12, FGFR3, FGFR1 | 56 |
| hsa04910:Insulin signaling pathway | 13 | 4.56E-05 | TSC2, BRAF, IRS2, PIK3CB, PIK3R1, MTOR, PIK3CG, PIK3CA, PRKAR1A, RHEB, KRAS, SOS1, HRAS | 50 | 1.23E-11 | IRS1, INPPL1, PRKAG1, PIK3CD, PRKAG2, CBLB, PIK3CB, ELK1, CRKL, HK3, PPP1CC, PRKACB, HRAS, SREBF1, PRKCI, MAP2K1, MAP2K2, PDPK1, RPS6, TSC1, PRKAB1, PIK3CA, PRKAR1B, PRKAR1A, FBP1, CRK, RHOQ, SHC2, PRKAA1, PRKAA2, SHC3, PIK3R3, PIK3R1, FOXO1, NRAS, MAPK8, SOCS1, PRKAR2B, MAPK1, PCK1, PPARGC1A, INSR, BRAF, SORBS1, MAPK10, RPS6KB1, FASN, KRAS, CALM3, GRB2 | 43 |
| hsa04066:HIF-1 signaling pathway | 10 | 0.000237 | PIK3CA, ERBB2, EP300, PLCG1, PIK3CB, PIK3R1, TLR4, EGFR, MTOR, PIK3CG | 40 | 1.40E-11 | CAMK2B, CDKN1A, CDKN1B, FLT1, TFRC, EPO, CUL2, SLC2A1, PIK3CD, PIK3R3, PIK3CB, PIK3R1, HIF1A, RELA, IGF1R, HK3, ERBB2, PLCG2, HMOX1, MAPK1, EP300, PLCG1, CAMK2G, PDK1, MAP2K1, CREBBP, MAP2K2, EGF, INSR, RPS6, STAT3, PRKCA, IGF1, NFKB1, RBX1, IFNG, PIK3CA, RPS6KB1, LTBR, GAPDH | 34 |
| hsa05223:Non-small cell lung cancer | 16 | 4.93E-13 | RB1, CDKN2A, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, RXRA, PIK3CA, CCND1, ERBB2, KRAS, PLCG1, SOS1, HRAS, TP53 | 29 | 2.86E-11 | RB1, PIK3CD, PIK3R3, PIK3CB, PIK3R1, FOXO3, RXRB, NRAS, RXRA, ERBB2, E2F1, PLCG2, E2F2, MAPK1, E2F3, PLCG1, HRAS, RXRG, MAP2K1, MAP2K2, EGF, PDPK1, PRKCA, BRAF, PIK3CA, CDK4, GRB2, KRAS, TP53 | 18 |
| hsa04917:Prolactin signaling pathway | 10 | 2.17E-05 | CCND1, PIK3CA, KRAS, PIK3CB, PIK3R1, JAK2, SOS1, HRAS, ESR1, PIK3CG | 33 | 3.69E-11 | SHC2, SHC3, SRC, PIK3CD, PIK3R3, PIK3CB, PIK3R1, PRL, FOXO3, RELA, NRAS, MAPK8, SOCS1, CCND2, MAPK1, HRAS, STAT5A, MAP2K1, MAP2K2, STAT3, FOS, MAPK14, PRLR, ESR1, MAPK12, ESR2, NFKB1, MAPK13, MAPK10, PIK3CA, IRF1, GRB2, KRAS | 27 |
| hsa04071:Sphingolipid signaling pathway | 10 | 0.001225368 | PIK3CA, PPP2R1A, PTEN, KRAS, PIK3CB, PIK3R1, HRAS, TP53, GNAI1, PIK3CG | 45 | 4.13E-11 | SGMS1, GNAI3, PTEN, PIK3CD, PIK3R3, PPP2R2A, PIK3CB, PIK3R1, PLD1, GNAI1, RELA, GNAI2, PLD2, PPP2CA, PPP2CB, NRAS, MAPK8, PPP2R1A, PPP2R5E, RAC2, MAPK1, RAC3, FYN, RAC1, HRAS, MAP3K5, MAP2K1, MAP2K2, PDPK1, PRKCE, PRKCA, PPP2R5D, PPP2R5C, GAB2, MAPK14, RHOA, MAPK12, NFKB1, MAPK13, MAPK10, PIK3CA, KRAS, PLCB2, TP53, NSMAF | 36 |
| hsa05219:Bladder cancer | 11 | 1.21E-08 | RB1, CCND1, CDKN2A, MMP2, ERBB2, BRAF, KRAS, HRAS, FGFR3, TP53, EGFR | 24 | 8.16E-11 | RB1, CDKN1A, MAP2K1, MAP2K2, MMP1, SRC, EGF, MMP2, BRAF, THBS1, NRAS, RPS6KA5, CDK4, MYC, ERBB2, MDM2, E2F1, E2F2, MAPK1, KRAS, E2F3, HRAS, FGFR3, TP53 | 16 |
| hsa04550:Signaling pathways regulating pluripotency of stem cells | 16 | 3.41E-07 | SMAD2, SMAD4, RIF1, LIFR, PIK3CB, PIK3R1, AXIN2, PIK3CG, TBX3, PIK3CA, CTNNB1, KRAS, JAK2, HRAS, FGFR3, FGFR2 | 49 | 8.33E-11 | RIF1, PIK3CD, PIK3CB, FGF2, IGF1R, MYC, JARID2, JAK3, HRAS, JAK1, MAP2K1, MAP2K2, LIFR, PAX6, HNF1A, PIK3CA, PIK3R3, PIK3R1, NRAS, DVL1, DVL2, DVL3, MAPK1, SMAD2, SMAD1, FZD3, SMAD3, FZD5, FZD4, PCGF2, STAT3, LIF, SMAD9, IGF1, MAPK14, KLF4, SMAD5, MAPK12, MAPK13, MEIS1, ID2, ID1, KRAS, NANOG, GRB2, FGFR4, FGFR3, MYF5, FGFR1 | 40 |
| hsa05210:Colorectal cancer | 14 | 5.39E-10 | SMAD2, TCF7L2, SMAD4, BRAF, PIK3CB, PIK3R1, AXIN2, PIK3CG, TGFBR2, PIK3CA, CCND1, CTNNB1, KRAS, TP53 | 30 | 1.01E-10 | LEF1, PIK3CD, PIK3R3, PIK3CB, PIK3R1, MAPK8, MYC, CASP3, RAC2, MAPK1, RAC3, RAC1, SMAD2, TGFB2, JUN, MAP2K1, TGFB1, SMAD3, TGFB3, BRAF, FOS, MLH1, RHOA, TGFBR1, MSH6, MAPK10, MSH2, PIK3CA, KRAS, TP53 | 23 |
| hsa05222:Small cell lung cancer | 12 | 2.09E-06 | RB1, RXRA, CCND1, PIK3CA, MAX, PTEN, FN1, ITGA6, PIK3CB, PIK3R1, TP53, PIK3CG | 36 | 1.01E-10 | RB1, CDKN1B, MAX, LAMA3, PTEN, PIK3CD, PIK3R3, LAMC1, PIK3CB, PIK3R1, RELA, CKS1B, RXRB, RXRA, MYC, E2F1, E2F2, E2F3, ITGAV, IKBKG, SKP2, RXRG, CDKN2B, LAMB3, ITGA2, FN1, PTK2, NFKB1, NFKBIA, PIK3CA, CCNE1, CDK4, CDK2, ITGA6, TP53, BIRC2 | 26 |
| hsa04914:Progesterone-mediated oocyte maturation | 8 | 0.002877534 | HSP90AB1, PIK3CA, BRAF, KRAS, PIK3CB, PIK3R1, GNAI1, PIK3CG | 36 | 2.19E-10 | GNAI3, PIK3CD, PIK3R3, PIK3CB, PIK3R1, GNAI1, GNAI2, IGF1R, CCNB2, RPS6KA3, FZR1, MAPK8, CCNB1, CDC23, RPS6KA2, CDC27, RPS6KA1, MAPK1, PRKACB, MAP2K1, PLK1, BRAF, IGF1, MAPK14, MAPK12, CDC25A, MAPK13, MAPK10, CCNA2, PIK3CA, CDC16, CDK2, KRAS, PGR, MAD1L1, MAD2L1 | 30 |
| hsa04380:Osteoclast differentiation | 8 | 0.024822802 | CYLD, CREB1, PIK3CA, PIK3CB, PIK3R1, PIK3CG, FOSL2, TGFBR2 | 46 | 3.06E-10 | CSF1R, PIK3CD, PIK3R3, PIK3CB, PIK3R1, RELA, MAPK8, SOCS1, PLCG2, MAPK1, FYN, IKBKG, RAC1, JUNB, JAK1, MAP2K6, TGFB2, JUN, MAP2K1, TGFB1, JUND, SYK, IFNB1, LILRB1, MITF, FOS, GAB2, MAPK14, TGFBR1, MAPK12, NFKB1, MAPK13, FOSL2, MAPK10, NFKBIA, CREB1, IFNG, PIK3CA, IL1B, NOX3, GRB2, PPARG, LCP2, MAP3K14, IRF9, NOX1 | 41 |
| hsa05213:Endometrial cancer | 16 | 1.47E-13 | TCF7L2, PTEN, BRAF, PIK3CB, PIK3R1, AXIN2, EGFR, PIK3CG, PIK3CA, CCND1, ERBB2, CTNNB1, KRAS, SOS1, HRAS, TP53 | 26 | 9.72E-10 | LEF1, PTEN, ILK, PIK3CD, PIK3R3, PIK3CB, PIK3R1, FOXO3, ELK1, NRAS, MYC, ERBB2, CTNNA1, MAPK1, CTNNA2, HRAS, MAP2K1, MAP2K2, EGF, PDPK1, BRAF, MLH1, PIK3CA, GRB2, KRAS, TP53 | 17 |
| hsa05221:Acute myeloid leukemia | 13 | 1.96E-09 | TCF7L2, BRAF, PIK3CB, PIK3R1, MTOR, PIK3CG, RUNX1, PIK3CA, CCND1, KIT, KRAS, SOS1, HRAS | 27 | 1.17E-09 | LEF1, PIK3CD, PIK3R3, PIK3CB, PIK3R1, RELA, NRAS, MYC, PIM1, MAPK1, IKBKG, HRAS, STAT5A, MAP2K1, MAP2K2, JUP, STAT3, BRAF, NFKB1, PML, RUNX1, PIK3CA, RPS6KB1, KIT, GRB2, KRAS, PPARD | 19 |
| hsa04115:p53 signaling pathway | 7 | 0.003356407 | CCND1, CDKN2A, PTEN, TSC2, ATM, TP53, ATR | 29 | 5.15E-09 | CDKN1A, PTEN, PPM1D, THBS1, CCNB2, CCND3, CCNB1, CASP8, CCND2, CHEK2, PERP, CASP3, CHEK1, PMAIP1, SFN, GADD45B, GADD45A, IGFBP3, IGF1, SERPINB5, DDB2, CCNE1, CDK4, CDK2, MDM2, FAS, ATM, MDM4, TP53 | 26 |
| hsa05164:Influenza A | 10 | 0.014100603 | HSPA8, PIK3CA, EP300, NLRP3, NUP98, PIK3CB, PIK3R1, JAK2, TLR4, PIK3CG | 52 | 1.09E-08 | ATF2, NXT1, PIK3CD, PIK3CB, TBK1, EP300, JAK1, HLA-DPA1, MAP2K3, MAP2K4, MAP2K1, MAP2K2, PRKCA, IRAK4, TICAM1, IFNG, PIK3CA, IL1B, NUP98, IRF9, HLA-DQB1, PIK3R3, FURIN, PIK3R1, RELA, NXF1, MAPK8, PABPN1, MAPK1, RAE1, MAP2K6, CPSF4, JUN, CREBBP, IFNB1, TNFRSF10B, EIF2AK2, HSPA2, MAPK14, MAPK12, NFKB1, PML, TNFRSF10D, MAPK13, NFKBIA, MAPK10, HLA-DPB1, HLA-DRA, FAS, MYD88, HLA-DRB1, NFKBIB | 47 |
| hsa04370:VEGF signaling pathway | 7 | 0.002079549 | PIK3CA, KRAS, PLCG1, PIK3CB, PIK3R1, HRAS, PIK3CG | 27 | 1.11E-08 | SHC2, SRC, PIK3CD, HSPB1, PIK3R3, PIK3CB, PIK3R1, CDC42, NRAS, KDR, PLCG2, RAC2, MAPK1, RAC3, PLCG1, RAC1, HRAS, MAP2K1, MAP2K2, PRKCA, MAPK14, MAPK12, PTK2, MAPK13, PIK3CA, MAPKAPK2, KRAS | 21 |
| hsa04912:GnRH signaling pathway | 9 | 0.000815 | MAP3K1, MMP2, PRKCD, GNAS, KRAS, SOS1, HRAS, EGFR, MAP3K4 | 34 | 1.60E-08 | CAMK2B, SRC, ITPR1, PLD1, ELK1, PLD2, CDC42, NRAS, MAPK8, MAPK7, GNA11, MAPK1, HRAS, CAMK2G, PRKACB, MAP3K4, MAP2K6, MAP2K3, MAP2K4, JUN, MAP2K1, MAP2K2, MMP2, PRKCD, PRKCA, MAPK14, MAPK12, MAPK13, MAPK10, GNAS, GRB2, KRAS, CALM3, PLCB2 | 28 |
| hsa05162:Measles | 10 | 0.002505594 | HSPA8, CCND1, PIK3CA, MSN, PIK3CB, PIK3R1, JAK2, TP53, TLR4, PIK3CG | 43 | 2.09E-08 | CDKN1B, PIK3CD, PIK3R3, PIK3CB, PIK3R1, RELA, CCND3, TBK1, CCND2, IRAK1, FYN, JAK3, JAK1, STAT5A, CSNK2A1, IFNB1, IL13, STAT3, TNFRSF10B, EIF2AK2, MSN, HSPA2, IRAK4, IL2, NFKB1, TNFRSF10D, IL4, NFKBIA, IFNG, PIK3CA, CCNE1, CDK4, IL1B, IL2RA, CSNK2B, CDK2, FAS, PRKCQ, TP53, MYD88, IRF9, NFKBIB, TLR2 | 38 |
| hsa05230:Central carbon metabolism in cancer | 15 | 6.13E-11 | PDGFRA, PTEN, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, KIT, ERBB2, KRAS, HRAS, FGFR3, TP53, FGFR2 | 27 | 3.69E-08 | RET, PTEN, SLC2A1, PIK3CD, PIK3R3, PIK3CB, PIK3R1, HIF1A, HK3, NRAS, MYC, ERBB2, MAPK1, HRAS, PDK1, NTRK1, PDGFRA, MAP2K1, MAP2K2, NTRK3, PIK3CA, KIT, KRAS, MET, FGFR3, TP53, FGFR1 | 16 |
| hsa04062:Chemokine signaling pathway | 12 | 0.0025103 | LYN, PIK3CA, PRKCD, BRAF, KRAS, PIK3CB, PIK3R1, JAK2, SOS1, HRAS, GNAI1, PIK3CG | 53 | 4.52E-08 | ITK, GSK3A, PIK3CD, PIK3CB, CRKL, GNGT1, RAC2, IKBKG, RAC1, JAK3, PRKACB, HRAS, MAP2K1, PRKCD, RHOA, FGR, HCK, PIK3CA, PLCB2, CRK, SHC2, SHC3, SRC, GNAI3, CXCR4, PIK3R3, PIK3R1, FOXO3, GNAI1, RELA, GNAI2, CDC42, NRAS, PAK1, GNG3, RAP1A, GRK5, GNG5, GNG4, MAPK1, LYN, STAT3, BRAF, GNG12, GNG11, NFKB1, PTK2, NFKBIA, GNB2, GNB3, KRAS, GRB2, NFKBIB | 44 |
| hsa04915:Estrogen signaling pathway | 16 | 2.91E-09 | HSPA8, HSP90AB1, MMP2, PRKCD, PIK3CB, PIK3R1, ESR1, EGFR, PIK3CG, GNAI1, CREB1, PIK3CA, GNAS, KRAS, SOS1, HRAS | 35 | 4.69E-08 | ATF2, SHC2, SHC3, SRC, GNAI3, ITPR1, PIK3CD, PIK3R3, PIK3CB, PIK3R1, GNAI1, HSP90B1, GNAI2, NRAS, MAPK1, HRAS, PRKACB, JUN, MAP2K1, MAP2K2, MMP2, PRKCD, HSPA2, FOS, ESR1, ESR2, GNAO1, CREB1, PIK3CA, SP1, GNAS, GRB2, KRAS, CALM3, PLCB2 | 24 |
| hsa04152:AMPK signaling pathway | 13 | 1.43E-05 | TSC2, IRS2, PIK3CB, PIK3R1, MTOR, PIK3CG, STK11, CREB1, PIK3CA, CCND1, PPP2R1A, RHEB, LEPR | 40 | 5.93E-08 | PRKAA1, PRKAA2, IRS1, PRKAG1, PRKAG2, PIK3CD, PIK3R3, PPP2R2A, PIK3CB, PIK3R1, FOXO3, ELAVL1, FOXO1, IGF1R, PPP2CA, PPP2CB, STK11, PPP2R1A, PPP2R5E, HNF4A, PCK1, PPARGC1A, RAB8A, SREBF1, PDPK1, INSR, TSC1, PPP2R5D, PPP2R5C, IGF1, EEF2, SIRT1, PRKAB1, CCNA2, CREB1, PIK3CA, RPS6KB1, FASN, PPARG, FBP1 | 34 |
| hsa04310:Wnt signaling pathway | 12 | 0.000208 | TCF7L2, SMAD4, SOX17, CCND1, TBL1XR1, CHD8, CUL1, EP300, CTNNB1, AXIN2, PSEN1, TP53 | 43 | 6.84E-08 | CAMK2B, CTBP2, CTBP1, CHD8, LEF1, CUL1, LRP5, LRP6, CCND3, MAPK8, CCND2, SOX17, MYC, RUVBL1, DVL1, DVL2, RAC2, DVL3, EP300, RAC3, RAC1, TBL1X, CAMK2G, PRKACB, JUN, FZD3, CREBBP, MMP7, FZD5, CSNK2A1, FZD4, CSNK1A1, FBXW11, PRKCA, RHOA, NFATC4, RBX1, MAPK10, TBL1XR1, CSNK2B, PLCB2, TP53, PPARD | 37 |
| hsa04520:Adherens junction | 9 | 0.000148 | SMAD2, TCF7L2, SMAD4, ERBB2, CTNND1, EP300, CTNNB1, EGFR, TGFBR2 | 28 | 1.05E-07 | SRC, CTNND1, LEF1, IQGAP1, IGF1R, CDC42, ERBB2, CTNNA1, RAC2, MAPK1, EP300, RAC3, FYN, CTNNA2, RAC1, SMAD2, CREBBP, SMAD3, CSNK2A1, INSR, SORBS1, RHOA, TGFBR1, CSNK2B, SNAI1, SNAI2, MET, FGFR1 | 24 |
| hsa04350:TGF-beta signaling pathway | 7 | 0.010092951 | SMAD2, SMAD4, TFDP1, PPP2R1A, CUL1, EP300, TGFBR2 | 31 | 1.08E-07 | CUL1, THBS1, PPP2CA, PPP2CB, PPP2R1A, MYC, MAPK1, EP300, E2F5, PITX2, SMAD2, SMAD1, TGFB2, CDKN2B, CREBBP, TGFB1, SMAD3, SMURF2, SMURF1, TGFB3, SMAD9, SMAD5, RHOA, TGFBR1, DCN, RBX1, IFNG, RPS6KB1, SP1, ID2, ID1 | 27 |
| hsa04730:Long-term depression | 7 | 0.001908964 | LYN, PPP2R1A, GNAS, BRAF, KRAS, HRAS, GNAI1 | 25 | 1.76E-07 | GNAZ, GNAI3, ITPR1, GNAI1, GNAI2, IGF1R, PPP2CA, PPP2CB, NRAS, PPP2R1A, GNA11, MAPK1, NOS1, HRAS, LYN, MAP2K1, MAP2K2, PRKCA, BRAF, IGF1, GNAO1, GNAS, CRH, KRAS, PLCB2 | 18 |
| hsa05160:Hepatitis C | 13 | 3.16E-05 | BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, RXRA, PIK3CA, PPP2R1A, PSME3, KRAS, SOS1, HRAS, TP53 | 41 | 2.01E-07 | CDKN1A, PIK3CD, PIK3R3, PPP2R2A, PIK3CB, PIK3R1, RELA, PPP2CA, PPP2CB, NRAS, MAPK8, RXRA, TBK1, PPP2R1A, MAPK1, RIPK1, IKBKG, HRAS, JAK1, IFNB1, EGF, PDPK1, STAT3, EIF2AK2, BRAF, MAPK14, TICAM1, MAPK12, NFKB1, MAPK13, PIAS1, MAPK10, NFKBIA, PIK3CA, IRF1, PSME3, GRB2, KRAS, PPARA, TP53, IRF9 | 31 |
| hsa05231:Choline metabolism in cancer | 13 | 1.79E-06 | PDGFRA, TSC2, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, RHEB, KRAS, PLCG1, SOS1, HRAS | 34 | 2.84E-07 | PDGFB, PDGFA, PIK3CD, PIK3R3, PIK3CB, PIK3R1, PLD1, HIF1A, PLD2, NRAS, MAPK8, PDGFD, PDGFC, RAC2, MAPK1, RAC3, PLCG1, RAC1, HRAS, PDGFRA, JUN, MAP2K1, MAP2K2, EGF, PDPK1, PRKCA, TSC1, FOS, MAPK10, PIK3CA, RPS6KB1, SP1, GRB2, KRAS | 27 |
| hsa05034:Alcoholism | 9 | 0.04056712 | CREB1, H3F3C, GNAS, BRAF, KRAS, SOS1, HRAS, GNAI1, HIST1H2BD | 49 | 4.10E-07 | ATF2, HDAC11, GNGT1, PPP1CC, HRAS, HIST1H2AC, HIST1H2AB, MAP2K1, H2AFY, CREB1, CRH, HIST1H2BB, HDAC4, SHC2, HDAC2, HDAC3, SHC3, HDAC1, GNAI3, HDAC9, HDAC6, GNAI1, GNAI2, NRAS, GRIN2A, GNG3, HIST1H3A, GNG5, GNG4, MAPK1, DRD1, DRD2, BRAF, GNG12, GRIN2C, GRIN2B, GNG11, GRIN1, GRIN2D, GNAO1, HIST1H4A, H2AFY2, GNB2, HIST3H3, GNAS, GNB3, KRAS, CALM3, GRB2 | 43 |
| hsa04931:Insulin resistance | 10 | 0.000573 | CREB1, PIK3CA, PRKCD, PTEN, IRS2, PTPN11, PIK3CB, PIK3R1, MTOR, PIK3CG | 35 | 5.07E-07 | PRKAA1, PRKAA2, IRS1, PRKAG1, PTEN, SLC2A1, PRKAG2, PIK3CD, PIK3R3, PIK3CB, PIK3R1, FOXO1, RELA, RPS6KA3, PPP1CC, MAPK8, RPS6KA2, RPS6KA1, PCK1, PPARGC1A, SREBF1, PDPK1, PRKCE, INSR, PRKCD, STAT3, PRKAB1, NFKB1, MAPK10, NFKBIA, CREB1, PIK3CA, RPS6KB1, PRKCQ, PPARA | 29 |
| hsa05216:Thyroid cancer | 10 | 6.42E-09 | TCF7L2, RXRA, CCND1, TPR, NCOA4, CTNNB1, BRAF, KRAS, HRAS, TP53 | 16 | 7.03E-07 | NTRK1, RET, MAP2K1, MAP2K2, LEF1, BRAF, RXRB, NRAS, RXRA, MYC, MAPK1, KRAS, PPARG, HRAS, RXRG, TP53 | 11 |
| hsa04630:Jak-STAT signaling pathway | 11 | 0.001260597 | CCND1, PIK3CA, LEPR, EP300, PTPN11, LIFR, PIK3CB, PIK3R1, JAK2, SOS1, PIK3CG | 42 | 8.84E-07 | IL22, EPO, MPL, PIK3CD, IL5RA, PIK3R3, PIK3CB, PIK3R1, PRL, CCND3, SOCS1, CCND2, MYC, PIM1, EP300, IL12RB1, JAK3, JAK1, PIAS4, STAT5A, PIAS3, CREBBP, IL4R, IFNB1, IL13, STAT3, LIF, LIFR, STAM, PRLR, IL2, PIAS1, IL4, GH1, IL3, IFNG, PIK3CA, IL7, IL2RA, GRB2, IL7R, IRF9 | 37 |
| hsa04662:B cell receptor signaling pathway | 8 | 0.000738 | LYN, PIK3CA, KRAS, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 26 | 9.08E-07 | INPPL1, PIK3CD, PIK3R3, PIK3CB, PIK3R1, RELA, NRAS, PLCG2, RAC2, MAPK1, RAC3, IKBKG, RAC1, HRAS, LYN, JUN, MAP2K1, MAP2K2, SYK, FOS, NFKB1, NFKBIA, PIK3CA, GRB2, KRAS, NFKBIB | 20 |
| hsa04750:Inflammatory mediator regulation of TRP channels | 7 | 0.020389087 | PIK3CA, PRKCD, GNAS, PLCG1, PIK3CB, PIK3R1, PIK3CG | 32 | 1.44E-06 | CAMK2B, SRC, ITPR1, PIK3CD, PIK3R3, IL1RAP, PIK3CB, PIK3R1, PPP1CC, MAPK8, PLCG2, PLCG1, CAMK2G, PRKACB, MAP2K6, MAP2K3, NTRK1, PRKCH, PRKCE, PRKCD, PRKCA, IGF1, MAPK14, MAPK12, MAPK13, MAPK10, PIK3CA, IL1B, GNAS, PRKCQ, CALM3, PLCB2 | 26 |
| hsa04150:mTOR signaling pathway | 10 | 3.96E-06 | STK11, PIK3CA, RHEB, PTEN, TSC2, BRAF, PIK3CB, PIK3R1, MTOR, PIK3CG | 23 | 1.68E-06 | PRKAA1, PRKAA2, PDPK1, IRS1, RPS6, PTEN, PIK3CD, PIK3R3, BRAF, PRKCA, TSC1, PIK3CB, PIK3R1, IGF1, RPS6KA3, STK11, PIK3CA, RPS6KB1, RRAGC, RPS6KA2, RRAGD, RPS6KA1, MAPK1 | 17 |
| hsa04330:Notch signaling pathway | 4 | 0.087723084 | NCOR2, NOTCH1, EP300, PSEN1 | 20 | 4.09E-06 | NOTCH2, RBPJL, CREBBP, HDAC2, NOTCH1, JAG1, CTBP2, MAML1, CTBP1, HDAC1, NOTCH4, RBPJ, NCOR2, NCSTN, SNW1, DVL1, DVL2, DVL3, EP300, HES1 | 17 |
| hsa04024:cAMP signaling pathway | 10 | 0.029810309 | CREB1, PIK3CA, GNAS, EP300, BRAF, SOX9, PIK3CB, PIK3R1, GNAI1, PIK3CG | 50 | 5.56E-06 | PIK3CD, PIK3CB, GLI3, PPP1CC, RAC2, EP300, RAC3, PLCE1, RAC1, PRKACB, MAP2K1, MAP2K2, RRAS2, FOS, RHOA, CREB1, PIK3CA, PPARA, CAMK2B, GNAI3, PIK3R3, PIK3R1, PLD1, GNAI1, RELA, SLC9A1, GNAI2, PLD2, PAK1, GRIN2A, MAPK8, RAP1A, MAPK1, TNNI3, DRD1, DRD2, CAMK2G, DRD5, JUN, CREBBP, BRAF, GRIN2C, GRIN2B, NFKB1, GRIN1, GRIN2D, NFKBIA, MAPK10, GNAS, CALM3 | 42 |
| hsa05100:Bacterial invasion of epithelial cells | 10 | 4.67E-05 | DNM3, CTTN, PIK3CA, CLTCL1, CLTC, FN1, CTNNB1, PIK3CB, PIK3R1, PIK3CG | 26 | 1.15E-05 | SHC2, SHC3, SRC, ILK, PIK3CD, PIK3R3, CBLB, PIK3CB, PIK3R1, CRKL, CDC42, CLTCL1, CTNNA1, CTNNA2, RAC1, CAV3, RHOG, FN1, RHOA, DNM1, PTK2, DNM2, PIK3CA, HCLS1, MET, CRK | 21 |
| hsa04540:Gap junction | 8 | 0.003069884 | PDGFRA, TUBA1A, GNAS, KRAS, SOS1, HRAS, GNAI1, EGFR | 28 | 1.29E-05 | SRC, GNAI3, PDGFB, ITPR1, PDGFA, GNAI1, GNAI2, GJA1, NRAS, MAPK7, GNA11, PDGFD, PDGFC, MAPK1, DRD1, DRD2, HRAS, PRKACB, PDGFRA, MAP2K1, MAP2K2, EGF, PRKCA, CSNK1D, GNAS, GRB2, KRAS, PLCB2 | 23 |
| hsa04666:Fc gamma R-mediated phagocytosis | 7 | 0.010092951 | LYN, PIK3CA, PRKCD, PLCG1, PIK3CB, PIK3R1, PIK3CG | 27 | 1.56E-05 | INPPL1, PIK3CD, PIK3R3, PIK3CB, PIK3R1, PLD1, PLD2, CRKL, CDC42, PAK1, PLCG2, RAC2, MAPK1, PLCG1, RAC1, LYN, MAP2K1, GSN, SYK, PRKCE, PRKCD, PRKCA, GAB2, HCK, PIK3CA, RPS6KB1, CRK | 21 |
| hsa05206:MicroRNAs in cancer | 22 | 9.35E-07 | PDGFRA, NOTCH1, CDKN2A, DNMT3A, PTEN, IRS2, BRCA1, DICER1, EGFR, MTOR, CCND1, ERBB2, ABL1, EP300, KRAS, ATM, PLCG1, SOS1, HRAS, FGFR3, TP53, EZH2 | 64 | 1.65E-05 | CDKN1A, CDKN1B, IRS1, PTEN, BRCA1, CRKL, RPS6KA5, CCND2, MYC, CASP3, PIM1, DNMT3B, CYP1B1, EP300, HRAS, PDGFRA, MAP2K1, MAP2K2, PRKCE, DNMT3A, PRKCA, SIRT1, RHOA, SERPINB5, CDC25A, ZEB1, CCNE1, MET, TP53, CRK, NOTCH2, DNMT1, NOTCH1, NOTCH4, PDGFB, PDGFA, THBS1, NRAS, SOCS1, MAPK7, ERBB3, ERBB2, E2F1, PLCG2, E2F2, HMOX1, E2F3, PLCG1, PAK4, MCL1, TGFB2, FZD3, CREBBP, UBE2I, STAT3, NFKB1, MDM2, PDCD4, KRAS, GRB2, ATM, MDM4, FGFR3, EZH2 | 50 |
| hsa04916:Melanogenesis | 9 | 0.001512388 | TCF7L2, CREB1, KIT, GNAS, EP300, CTNNB1, KRAS, HRAS, GNAI1 | 30 | 2.08E-05 | CAMK2B, LEF1, GNAI3, GNAI1, GNAI2, NRAS, DVL1, DVL2, DVL3, MAPK1, EP300, HRAS, CAMK2G, PRKACB, MAP2K1, FZD3, CREBBP, MAP2K2, FZD5, FZD4, PRKCA, MITF, GNAO1, KITLG, CREB1, KIT, GNAS, KRAS, CALM3, PLCB2 | 23 |
| hsa04210:Apoptosis | 6 | 0.011301396 | PIK3CA, ATM, PIK3CB, PIK3R1, TP53, PIK3CG | 22 | 2.24E-05 | NTRK1, PIK3CD, PIK3R3, TNFRSF10B, PIK3CB, PIK3R1, RELA, NFKB1, TNFRSF10D, NFKBIA, IL3, CASP8, PIK3CA, CASP10, CASP3, FAS, RIPK1, ATM, IKBKG, TP53, MAP3K14, BIRC2 | 17 |
| hsa04725:Cholinergic synapse | 9 | 0.002930997 | CREB1, PIK3CA, KRAS, PIK3CB, PIK3R1, JAK2, HRAS, GNAI1, PIK3CG | 32 | 2.48E-05 | CAMK2B, GNAI3, ITPR1, PIK3CD, PIK3R3, PIK3CB, PIK3R1, GNAI1, GNAI2, GNGT1, NRAS, GNG3, GNG5, GNG4, GNA11, MAPK1, FYN, HRAS, CAMK2G, PRKACB, MAP2K1, PRKCA, FOS, GNG12, GNG11, GNAO1, CREB1, PIK3CA, GNB2, GNB3, KRAS, PLCB2 | 25 |
| hsa04360:Axon guidance | 7 | 0.060161309 | EPHB6, RASA1, ABL1, KRAS, HRAS, GNAI1, EPHA3 | 35 | 2.71E-05 | GNAI3, CXCR4, EFNA4, GNAI1, ROBO1, GNAI2, CDC42, PAK1, NRAS, RAC2, MAPK1, RAC3, FYN, RAC1, PAK3, HRAS, PAK2, EPHB1, EPHB3, NCK1, PAK4, EPHA5, EPHA7, L1CAM, RHOD, RHOA, PTK2, NFATC4, EFNA1, CDK5, KRAS, EPHA1, MET, EPHA3, EPHA2 | 31 |
| hsa04920:Adipocytokine signaling pathway | 7 | 0.004179262 | STK11, RXRA, LEPR, IRS2, PTPN11, JAK2, MTOR | 23 | 5.37E-05 | PRKAA1, PRKAA2, IRS1, STAT3, PRKAG1, SLC2A1, PRKAG2, PRKAB1, RELA, NFKB1, MAPK10, RXRB, NFKBIA, STK11, MAPK8, RXRA, PRKCQ, IKBKG, PCK1, PPARA, PPARGC1A, RXRG, NFKBIB | 21 |
| hsa04960:Aldosterone-regulated sodium reabsorption | 7 | 0.000182 | PIK3CA, NEDD4L, KRAS, PIK3CB, PIK3R1, SGK1, PIK3CG | 16 | 6.31E-05 | PDPK1, IRS1, INSR, PIK3CD, PIK3R3, NEDD4L, PRKCA, PIK3CB, PIK3R1, IGF1, NR3C2, PIK3CA, SCNN1A, MAPK1, KRAS, SFN | 11 |
| hsa05146:Amoebiasis | 7 | 0.028691063 | PIK3CA, GNAS, FN1, PIK3CB, PIK3R1, TLR4, PIK3CG | 30 | 6.80E-05 | ITGAM, LAMA3, ITGB2, PIK3CD, HSPB1, PIK3R3, LAMC1, PIK3CB, PIK3R1, RELA, GNA14, GNA15, CASP3, GNA11, PRKACB, TGFB2, TGFB1, LAMB3, TGFB3, FN1, PRKCA, PTK2, NFKB1, IFNG, PIK3CA, IL1B, GNAS, PLCB2, RAB7A, TLR2 | 25 |
| hsa04670:Leukocyte transendothelial migration | 12 | 3.97E-05 | PIK3CA, MMP2, CTNND1, CTNNB1, MSN, PTPN11, PLCG1, PIK3CB, PIK3R1, GNAI1, ARHGAP35, PIK3CG | 31 | 0.000133 | ITK, ITGAM, CTNND1, ITGB2, GNAI3, CXCR4, PIK3CD, PIK3R3, PIK3CB, PIK3R1, GNAI1, GNAI2, CDC42, RAP1A, CTNNA1, PLCG2, RAC2, PLCG1, CTNNA2, RAC1, MMP2, RHOH, MSN, PRKCA, MAPK14, RHOA, MAPK12, PTK2, MAPK13, MYLPF, PIK3CA | 23 |
| hsa04120:Ubiquitin mediated proteolysis | 8 | 0.030723344 | MAP3K1, FBXW7, CUL3, CUL1, HUWE1, KEAP1, NEDD4L, BRCA1 | 35 | 0.000141 | CUL5, UBE2D2, CUL2, CUL1, UBE2D1, NEDD4L, CBLB, BRCA1, PRPF19, RHOBTB1, RHOBTB2, CDC20, FZR1, SOCS1, CDC23, CDC27, SKP2, PIAS4, PIAS3, UBE2I, SMURF2, SMURF1, FBXW11, FBXW7, HUWE1, PML, PIAS1, DDB2, RBX1, ITCH, NEDD4, CDC16, MDM2, TRIP12, BIRC2 | 30 |
| hsa04650:Natural killer cell mediated cytotoxicity | 10 | 0.001377176 | PIK3CA, BRAF, PTPN11, KRAS, PLCG1, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 32 | 0.000174 | SHC2, SHC3, ITGB2, PIK3CD, PIK3R3, PIK3CB, PIK3R1, PAK1, NRAS, CASP3, PLCG2, RAC2, MAPK1, RAC3, FYN, PLCG1, RAC1, HRAS, MAP2K1, MAP2K2, SYK, IFNB1, TNFRSF10B, PRKCA, BRAF, TNFRSF10D, IFNG, PIK3CA, FAS, GRB2, KRAS, LCP2 | 25 |
| hsa04390:Hippo signaling pathway | 8 | 0.047986325 | SMAD2, TCF7L2, SMAD4, CCND1, PPP2R1A, CTNNB1, AXIN2, TGFBR2 | 37 | 0.000216 | YWHAB, LEF1, ITGB2, PPP2R2A, PPP2CA, PPP2CB, PPP1CC, CCND3, PARD6A, CCND2, PPP2R1A, MYC, DVL1, DVL2, CTNNA1, DVL3, CTNNA2, SMAD2, SMAD1, TGFB2, PRKCI, FZD3, TGFB1, SMAD3, FZD5, FZD4, TGFB3, FBXW11, CSNK1D, TGFBR1, LATS1, DLG1, DLG4, ID2, ID1, SNAI2, NF2 | 35 |
| hsa04611:Platelet activation | 8 | 0.02392163 | LYN, PIK3CA, GNAS, PIK3CB, PIK3R1, GNAI1, ARHGAP35, PIK3CG | 33 | 0.000258 | SRC, SNAP23, GNAI3, ITPR1, PIK3CD, PIK3R3, PIK3CB, PIK3R1, RASGRP1, GNAI1, GNAI2, MYLK, PPP1CC, RAP1A, PLCG2, MAPK1, FYN, PRKACB, LYN, PRKCI, SYK, GP1BB, ITGA2, MAPK14, GP5, RHOA, MAPK12, MAPK13, PIK3CA, GNAS, LCP2, TLN1, PLCB2 | 27 |
| hsa03460:Fanconi anemia pathway | 6 | 0.00586343 | BLM, TOP3A, FANCA, BRCA1, BRCA2, ATR | 17 | 0.000903 | BLM, RMI1, TOP3A, RPA1, FANCA, RPA2, FANCC, BRCA1, FANCE, MLH1, FANCG, FANCF, RAD51C, ERCC4, RPA3, ERCC1, HES1 | 13 |
| hsa04930:Type II diabetes mellitus | 7 | 0.000581 | PIK3CA, PRKCD, IRS2, PIK3CB, PIK3R1, MTOR, PIK3CG | 14 | 0.00745929 | IRS1, PRKCE, INSR, PRKCD, PIK3CD, PIK3R3, PIK3CB, PIK3R1, MAPK10, HK3, MAPK8, SOCS1, PIK3CA, MAPK1 | 10 |
| hsa04144:Endocytosis | 12 | 0.016663174 | DNM3, SMAD2, HSPA8, PDGFRA, CLTCL1, CLTC, NEDD4L, HRAS, FGFR3, EGFR, FGFR2, TGFBR2 | 45 | 0.013601771 | TFRC, SRC, NEDD4L, CXCR4, CBLB, PLD1, IGF1R, PLD2, CDC42, PARD6A, GRK5, KIF5B, CLTCL1, HRAS, EPS15, GIT1, RAB8A, SMAD2, PDGFRA, PRKCI, SMAD3, CAV3, SMURF2, SMURF1, EPS15L1, STAM, HSPA2, RHOA, TGFBR1, DNM1, EPN1, PML, RAB11A, EPN2, DNM2, EPN3, DAB2, ITCH, DNAJC6, IL2RA, NEDD4, MDM2, FGFR4, FGFR3, RAB7A | 39 |
| hsa04320:Dorso-ventral axis formation | 4 | 0.020622905 | NOTCH1, KRAS, SOS1, EGFR | 8 | 0.055269909 | NOTCH2, MAP2K1, NOTCH1, NOTCH4, MAPK1, GRB2, KRAS, ETS2 | 6 |

**Table 9. The pathway intersection of driver genes and downstream genes in lung cancer of Secretory subtype**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Term | drivers\_count | driver\_pvalue | drivers | Out\_count | Out\_pvalue | Outs | Outs\_drivers\_count |
| hsa04510:Focal adhesion | 19 | 4.83E-07 | PDGFRA, HGF, PTEN, FN1, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, ARHGAP35, ACTG1, PIK3CA, CCND1, ERBB2, FLNA, CTNNB1, ITGA6, SOS1, HRAS | 59 | 1.63E-22 | ITGB5, ITGB3, ITGA2B, ILK, PIK3CD, LAMC2, PIK3CB, LAMC1, PIK3CG, IGF1R, MYLK, PPP1CB, CCND3, CCND1, KDR, PDGFRB, PRKCG, PDGFRA, MAP2K1, ITGA4, ACTN1, ITGA2, PRKCA, ACTN4, COL2A1, MYL7, COL4A2, COL4A1, COL4A4, COL6A2, COL4A3, COL4A5, ITGA6, TLN1, MET, MYL9, BIRC2, LAMA5, SHC3, SHC1, PXN, PDGFB, PDGFA, PIK3R5, CDC42, MAPK9, MAPK8, PDGFD, MAPK1, FYN, FLNC, PAK3, PAK2, PAK4, MAPK3, IGF1, PPP1CA, MYLPF, DIAPH1 | 54 |
| hsa04151:PI3K-Akt signaling pathway | 31 | 4.69E-11 | HSP90AB1, PTEN, BRCA1, PIK3CB, PIK3R1, EGFR, PIK3CG, STK11, RXRA, CCND1, PPP2R1A, MYB, JAK2, HRAS, PDGFRA, HGF, FN1, TSC2, MTOR, CREB1, PIK3CA, RHEB, KIT, KRAS, ITGA6, SGK1, SOS1, FGFR3, TP53, TLR4, FGFR2 | 74 | 3.96E-20 | HSP90AB1, ITGB5, EPO, IRS1, YWHAB, ITGB3, ITGA2B, PIK3CD, LAMC2, FASLG, PIK3CB, LAMC1, FGF1, FGF2, PIK3CG, IGF1R, FGF5, GNGT1, FGF6, CCND3, FGF7, CCND1, MYC, MYB, KDR, JAK2, JAK3, JAK1, PDGFRB, PDGFRA, MAP2K1, ITGA4, ITGA2, PPP2R5A, PRKCA, PPP2R5C, RBL2, COL2A1, COL4A2, COL4A1, COL4A4, COL6A2, COL4A3, KIT, COL4A5, ITGA6, MET, TP53, CSF1R, LAMA5, PDGFB, PDGFA, IL2RG, INS, PIK3R5, PPP2CB, PDGFD, GNG7, MAPK1, EIF4B, MAPK3, NGFR, IFNB1, NOS3, IGF1, GNG13, IL3, RHEB, IL2RA, FGF18, MDM2, TEK, IL7R, FGFR3 | 62 |
| hsa05200:Pathways in cancer | 43 | 9.32E-19 | RB1, HSP90AB1, MAX, PTEN, PIK3CB, PIK3R1, BRCA2, GNAI1, EGFR, PIK3CG, RXRA, MECOM, CCND1, CDH1, TPR, ERBB2, ABL1, EP300, PLCG1, HRAS, SMAD2, TCF7L2, PDGFRA, SMAD4, CDKN2A, HGF, MMP2, NCOA4, FN1, BRAF, MTOR, TGFBR2, RUNX1, PIK3CA, KIT, GNAS, CTNNB1, KRAS, ITGA6, SOS1, FGFR3, TP53, FGFR2 | 79 | 1.04E-19 | RB1, RET, SPI1, HSP90AB1, ITGA2B, SLC2A1, PIK3CD, LAMC2, FASLG, PIK3CB, LAMC1, FGF1, FGF2, PIK3CG, CKS1B, IGF1R, FGF5, GNGT1, FGF6, FGF7, CCND1, MYC, PRKACG, CASP3, JAK1, PDGFRB, PRKCG, PDGFRA, MAP2K1, MMP1, ITGA2, PRKCA, COL4A2, COL4A1, COL4A4, COL4A3, KIT, COL4A5, ITGA6, MET, PLCB2, TP53, BIRC2, CSF1R, LAMA5, GSTP1, PDGFB, PDGFA, CXCR4, TGFA, RASGRP1, RASGRP3, GNAI2, PIK3R5, CDC42, MAPK9, MAPK8, GNG7, CTNNA1, MAPK1, CTNNA3, E2F3, FADD, RXRG, MAPK3, STAT5A, TGFB2, TGFB1, SMAD3, FZD4, STAT3, IGF1, GNG13, NFKB2, NFKBIA, FGF18, MDM2, FAS, FGFR3 | 69 |
| hsa04014:Ras signaling pathway | 18 | 8.05E-06 | PDGFRA, HGF, PTPN11, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, RASA1, KIT, ABL1, NF1, KRAS, PLCG1, SOS1, HRAS, FGFR3, FGFR2 | 55 | 1.73E-17 | PIK3CD, FASLG, PIK3CB, FGF1, FGF2, PIK3CG, IGF1R, FGF5, GNGT1, FGF6, FGF7, PRKACG, KDR, PDGFRB, PRKCG, PDGFRA, MAP2K1, PLA2G4C, RRAS2, PRKCA, GAB2, MRAS, KIT, MET, CSF1R, SHC3, SHC1, PDGFB, PDGFA, RASGRP1, INS, RASGRP3, PIK3R5, CDC42, MAPK9, GRIN2A, MAPK8, PDGFD, GNG7, MAPK1, PAK3, PAK2, PAK4, MAPK3, NGFR, IGF1, GRIN2B, GNG13, GRIN1, FGF18, REL, CALM3, TEK, FGFR3, LAT | 50 |
| hsa05162:Measles | 10 | 0.002505594 | HSPA8, CCND1, PIK3CA, MSN, PIK3CB, PIK3R1, JAK2, TP53, TLR4, PIK3CG | 38 | 1.89E-14 | PIK3CD, FASLG, PIK3CB, CD3E, IL2RG, PIK3CG, PIK3R5, CCND3, CCND1, IL12B, IL12A, FYN, JAK2, JAK3, IKBKE, JAK1, STAT5A, HSPA8, CSNK2A1, IFNB1, DDX58, IL13, STAT3, TNFRSF10B, EIF2AK2, NFKBIA, IFNG, IRF3, IL1B, IL2RA, IRF7, CD28, FAS, PRKCQ, TP53, MYD88, NFKBIB, TP73 | 32 |
| hsa04015:Rap1 signaling pathway | 21 | 2.48E-08 | PDGFRA, DOCK4, HGF, CTNND1, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, GNAI1, ACTG1, PIK3CA, CDH1, KIT, GNAS, CTNNB1, KRAS, PLCG1, HRAS, FGFR3, FGFR2 | 48 | 4.36E-14 | CSF1R, ITGAM, ITGB3, ITGA2B, ITGB2, PDGFB, PDGFA, PIK3CD, PIK3CB, FGF1, FGF2, PIK3CG, GNAI2, IGF1R, PIK3R5, INS, RASGRP3, FGF5, CDC42, FGF6, FGF7, GRIN2A, PDGFD, KDR, MAPK1, DRD2, MAPK3, PRKCG, PDGFRB, NGFR, PDGFRA, MAP2K1, PRKCA, IGF1, GRIN2B, GRIN1, MRAS, PRKD3, KIT, FGF18, LCP2, CALM3, TEK, TLN1, MET, PLCB2, FGFR3, LAT | 43 |
| hsa05214:Glioma | 17 | 3.36E-13 | RB1, PDGFRA, CDKN2A, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, CCND1, KRAS, PLCG1, SOS1, HRAS, TP53 | 26 | 1.04E-13 | RB1, CAMK2B, SHC3, SHC1, CAMK2A, PDGFB, PDGFA, PIK3CD, TGFA, PIK3CB, PIK3CG, IGF1R, PIK3R5, CCND1, MAPK1, E2F3, MAPK3, PRKCG, PDGFRB, PDGFRA, MAP2K1, PRKCA, IGF1, MDM2, CALM3, TP53 | 20 |
| hsa05205:Proteoglycans in cancer | 28 | 1.33E-14 | DDX5, PIK3CB, PIK3R1, EGFR, PIK3CG, ACTG1, CCND1, ERBB4, ERBB2, FLNA, PLCG1, HRAS, LUM, HGF, MMP2, FN1, MSN, PTPN11, BRAF, ESR1, MTOR, CTTN, PIK3CA, CTNNB1, KRAS, SOS1, TP53, TLR4 | 46 | 1.28E-13 | CAMK2B, ITGB5, ITGB3, PXN, CAMK2A, ITPR1, PIK3CD, FASLG, PIK3CB, FGF2, PIK3CG, IGF1R, PIK3R5, CDC42, PPP1CB, ERBB3, CCND1, PRKACG, MYC, CASP3, KDR, IL12B, MAPK1, FLNC, EIF4B, MAPK3, PRKCG, TGFB2, MAP2K1, TGFB1, FZD4, ITGA2, STAT3, IGF2, RRAS2, FRS2, PRKCA, ANK2, IGF1, PPP1CA, MRAS, CTTN, MDM2, FAS, MET, TP53 | 41 |
| hsa04010:MAPK signaling pathway | 19 | 9.32E-06 | PDGFRA, HSPA8, MAP3K1, MAX, BRAF, EGFR, MAPK8IP1, TGFBR2, MECOM, RASA1, NF1, FLNA, KRAS, SOS1, HRAS, FGFR3, TP53, FGFR2, MAP3K4 | 51 | 1.08E-12 | HSPB1, ARRB1, FASLG, ARRB2, FGF1, FGF2, FGF5, FGF6, FGF7, MYC, PRKACG, CASP3, RPS6KA1, PDGFRB, MAP4K1, PRKCG, PDGFRA, MAP2K1, MEF2C, PLA2G4C, RRAS2, PRKCA, CACNB1, MRAS, IL1B, TP53, PDGFB, PDGFA, RASGRP1, RASGRP3, RELB, CDC42, MAPK9, MAPK8, NTF3, MAPK1, FLNC, PAK2, MAP2K5, MAPK3, HSPA8, TGFB2, TGFB1, GADD45B, GADD45A, NFATC1, NFKB2, FGF18, FAS, MAP3K14, FGFR3 | 47 |
| hsa05218:Melanoma | 16 | 2.09E-11 | RB1, PDGFRA, CDKN2A, HGF, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, CCND1, CDH1, KRAS, HRAS, TP53 | 26 | 1.09E-12 | RB1, PDGFB, PDGFA, PIK3CD, PIK3CB, FGF1, FGF2, PIK3CG, IGF1R, PIK3R5, FGF5, FGF6, FGF7, CCND1, PDGFD, MAPK1, E2F3, MAPK3, PDGFRB, PDGFRA, MAP2K1, IGF1, FGF18, MDM2, MET, TP53 | 20 |
| hsa05161:Hepatitis B | 15 | 3.03E-06 | RB1, SMAD4, MAP3K1, PTEN, PIK3CB, PIK3R1, PIK3CG, CREB1, PIK3CA, CCND1, EP300, KRAS, HRAS, TP53, TLR4 | 37 | 1.86E-12 | RB1, PCNA, YWHAB, PIK3CD, FASLG, PIK3CB, PIK3CG, PIK3R5, MAPK9, MAPK8, CCND1, MYC, CASP3, MAPK1, E2F3, FADD, IKBKE, JAK1, MAPK3, PRKCG, STAT5A, TGFB2, MAP2K1, TGFB1, IFNB1, DDX58, STAT3, PRKCA, NFATC1, DDB2, NFKBIA, CCNA2, IRF3, IRF7, FAS, TP53, MYD88 | 32 |
| hsa04810:Regulation of actin cytoskeleton | 17 | 1.29E-05 | PDGFRA, FN1, MSN, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, ARHGAP35, ACTG1, PIK3CA, KRAS, ITGA6, SOS1, HRAS, FGFR3, FGFR2 | 45 | 3.40E-12 | ITGAM, ITGB5, ITGB3, PXN, ITGA2B, ITGB2, PDGFB, PDGFA, PIK3CD, PIK3CB, FGF1, FGF2, PIK3CG, MYLK, PIK3R5, INS, FGF5, CDC42, PPP1CB, FGF6, FGF7, PDGFD, MAPK1, PIP5K1C, PAK3, PAK2, MAPK3, PAK4, PDGFRB, PDGFRA, MAP2K1, ITGA4, ACTN1, ITGA2, RRAS2, ACTN4, PPP1CA, MYLPF, DIAPH1, MYL7, MRAS, FGF18, ITGA6, FGFR3, MYL9 | 40 |
| hsa04660:T cell receptor signaling pathway | 8 | 0.006225985 | PIK3CA, KRAS, PLCG1, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 30 | 4.46E-12 | ITK, PIK3CD, PIK3CB, CD3E, RASGRP1, PIK3CG, PIK3R5, CDC42, GRAP2, MAPK1, FYN, PAK3, PAK2, MAPK3, PAK4, MAP2K1, NFATC1, NFKBIA, DLG1, CD4, IFNG, CD8B, CD28, PRKCQ, LCP2, CD247, NFKBIE, MAP3K14, LAT, NFKBIB | 28 |
| hsa04380:Osteoclast differentiation | 8 | 0.024822802 | CYLD, CREB1, PIK3CA, PIK3CB, PIK3R1, PIK3CG, FOSL2, TGFBR2 | 34 | 1.06E-11 | CSF1R, SPI1, NCF1, ITGB3, PIK3CD, PIK3CB, PIK3CG, RELB, PIK3R5, MAPK9, SOCS3, MAPK8, SOCS1, MAPK1, FYN, JAK1, MAPK3, TGFB2, MAP2K1, TGFB1, IFNB1, CYBB, NFATC1, LILRB1, GAB2, NFKB2, NFKBIA, IFNG, IL1B, NOX3, BTK, LCP2, MAP3K14, NOX1 | 32 |
| hsa05146:Amoebiasis | 7 | 0.028691063 | PIK3CA, GNAS, FN1, PIK3CB, PIK3R1, TLR4, PIK3CG | 30 | 2.20E-11 | LAMA5, ITGAM, ITGB2, PIK3CD, HSPB1, LAMC2, LAMC1, PIK3CB, PIK3CG, PIK3R5, GNA14, PRKACG, CASP3, IL12B, IL12A, PRKCG, TGFB2, TGFB1, ACTN1, PRKCA, ACTN4, COL2A1, IFNG, COL4A2, COL4A1, COL4A4, IL1B, COL4A3, COL4A5, PLCB2 | 28 |
| hsa05203:Viral carcinogenesis | 18 | 2.14E-06 | LYN, RB1, CDKN2A, HLA-B, CHD4, GTF2H1, HLA-A, PIK3CB, PIK3R1, PIK3CG, CREB1, PIK3CA, CCND1, EP300, KRAS, HRAS, TP53, HIST1H2BD | 41 | 3.46E-10 | RB1, RBPJL, HDAC3, YWHAB, GTF2B, PXN, HPN, PIK3CD, PIK3CB, RBPJ, PIK3CG, PIK3R5, CDC20, CDC42, CCND3, CCND1, PRKACG, CASP3, MAPK1, PMAIP1, JAK3, JAK1, MAPK3, STAT5A, ACTN1, STAT3, EIF2AK2, ACTN4, GTF2H4, NFKB2, RBL2, NFKBIA, CCNA2, DLG1, HIST1H4A, IRF3, PSMC1, REL, IRF7, MDM2, TP53 | 36 |
| hsa05169:Epstein-Barr virus infection | 11 | 0.000324 | LYN, RB1, NCOR2, PSMD11, PIK3CA, HLA-B, HLA-A, PIK3CB, PIK3R1, TP53, PIK3CG | 30 | 8.76E-10 | RB1, RBPJL, PSMD13, PIK3CD, PIK3CB, RBPJ, PIK3CG, RELB, PIK3R5, ICAM1, MAPK9, MAPK8, MYC, PSMD3, JAK3, JAK1, DDX58, STAT3, EIF2AK2, NFKB2, NFKBIA, CCNA2, PSMC3, IRF3, PSMC1, MDM2, NFKBIE, TP53, MAP3K14, NFKBIB | 26 |
| hsa05142:Chagas disease (American trypanosomiasis) | 10 | 0.000433 | SMAD2, PIK3CA, PPP2R1A, GNAS, PIK3CB, PIK3R1, TLR4, GNAI1, PIK3CG, TGFBR2 | 27 | 2.10E-09 | PIK3CD, FASLG, PIK3CB, CD3E, PIK3CG, GNAI2, PIK3R5, PPP2CB, GNA14, MAPK9, MAPK8, IL12B, MAPK1, IL12A, FADD, MAPK3, TGFB2, TGFB1, SMAD3, IFNB1, NFKBIA, IFNG, IL1B, FAS, CD247, PLCB2, MYD88 | 25 |
| hsa05222:Small cell lung cancer | 12 | 2.09E-06 | RB1, RXRA, CCND1, PIK3CA, MAX, PTEN, FN1, ITGA6, PIK3CB, PIK3R1, TP53, PIK3CG | 24 | 3.47E-09 | RB1, LAMA5, ITGA2, ITGA2B, PIK3CD, LAMC2, PIK3CB, LAMC1, PIK3CG, CKS1B, PIK3R5, NFKBIA, COL4A2, CCND1, COL4A1, MYC, COL4A4, COL4A3, COL4A5, ITGA6, E2F3, RXRG, TP53, BIRC2 | 18 |
| hsa04630:Jak-STAT signaling pathway | 11 | 0.001260597 | CCND1, PIK3CA, LEPR, EP300, PTPN11, LIFR, PIK3CB, PIK3R1, JAK2, SOS1, PIK3CG | 32 | 3.69E-09 | IL22, EPO, IL24, PIK3CD, PIK3CB, IL2RG, PIK3CG, PIK3R5, SOCS3, CCND3, SOCS1, CCND1, MYC, LEPR, IL12B, IL12A, JAK2, IL12RB1, JAK3, JAK1, IL12RB2, STAT5A, IFNB1, IL13, STAT3, LIFR, PIAS2, IL3, IFNG, IL2RA, LEP, IL7R | 26 |
| hsa05166:HTLV-I infection | 26 | 1.76E-10 | RB1, CRTC3, CRTC1, PIK3CB, PIK3R1, PIK3CG, CCND1, MYB, EP300, HRAS, POLE, SMAD2, PDGFRA, SMAD4, MAP3K1, CDKN2A, HLA-B, HLA-A, TGFBR2, CREB1, PIK3CA, CTNNB1, KRAS, ATM, TP53, ATR | 44 | 7.35E-09 | RB1, SPI1, PCNA, ITGB2, PDGFB, SLC2A1, PDGFA, PIK3CD, PIK3CB, CD3E, IL2RG, PIK3CG, RELB, PIK3R5, ICAM1, CDC20, CCND3, CCND1, TERT, PRKACG, MYC, POLD1, MYB, E2F3, JAK3, JAK1, PDGFRB, STAT5A, PDGFRA, TGFB2, TGFB1, SMAD3, FZD4, RRAS2, NFATC1, NFKB2, NFKBIA, DLG1, MRAS, IL2RA, TLN1, TP53, MAP3K14, MAD2L1 | 37 |
| hsa04068:FoxO signaling pathway | 19 | 5.27E-10 | SMAD2, SMAD4, PTEN, BRAF, IRS2, PIK3CB, PIK3R1, EGFR, PIK3CG, TGFBR2, STK11, PIK3CA, CCND1, EP300, KRAS, ATM, SGK1, SOS1, HRAS | 30 | 8.92E-09 | IRS1, PIK3CD, IRS2, FASLG, PIK3CB, PIK3CG, IGF1R, PIK3R5, INS, MAPK9, MAPK8, CCND1, MAPK1, MAPK3, PLK4, TGFB2, MAP2K1, PRKAB2, TGFB1, SMAD3, GADD45B, PRMT1, GADD45A, STAT3, IGF1, CSNK1E, RBL2, BCL6, MDM2, IL7R | 26 |
| hsa04722:Neurotrophin signaling pathway | 14 | 1.90E-06 | MAP3K1, PRKCD, BRAF, PTPN11, PIK3CB, PIK3R1, PIK3CG, PIK3CA, ABL1, KRAS, PLCG1, SOS1, HRAS, TP53 | 28 | 1.22E-08 | CAMK2B, SHC3, SHC1, IRS1, CAMK2A, PIK3CD, FASLG, PIK3CB, PIK3CG, PIK3R5, CDC42, MAPK9, MAPK8, NTF3, RPS6KA1, MAPK1, MAP2K5, MAPK3, NGFR, MAP2K1, PRKCD, FRS2, NFKBIA, CALM3, NFKBIE, TP53, NFKBIB, TP73 | 24 |
| hsa05212:Pancreatic cancer | 16 | 5.31E-12 | RB1, SMAD2, SMAD4, CDKN2A, BRAF, PIK3CB, PIK3R1, BRCA2, EGFR, PIK3CG, TGFBR2, PIK3CA, CCND1, ERBB2, KRAS, TP53 | 20 | 2.06E-08 | RB1, TGFB2, MAP2K1, TGFB1, SMAD3, STAT3, PIK3CD, TGFA, PIK3CB, PIK3CG, PIK3R5, CDC42, MAPK9, MAPK8, CCND1, MAPK1, E2F3, TP53, JAK1, MAPK3 | 15 |
| hsa04110:Cell cycle | 16 | 6.73E-08 | RB1, SMAD2, SMAD4, MCM7, CDKN2A, CUL1, SMC3, SMC1A, TFDP1, CCND1, RAD21, ABL1, EP300, ATM, TP53, ATR | 28 | 2.56E-08 | RB1, PCNA, MCM7, CCNH, YWHAB, CUL1, CDC20, CCND3, CCND1, MYC, E2F3, E2F4, E2F5, TGFB2, TGFB1, SMAD3, GADD45B, GADD45A, CDC7, CDC6, RBL2, CCNA2, CDK7, ESPL1, MDM2, TP53, MCM2, MAD2L1 | 23 |
| hsa05215:Prostate cancer | 22 | 9.75E-17 | RB1, PDGFRA, TCF7L2, HSP90AB1, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, CREB1, PIK3CA, CCND1, ERBB2, EP300, CTNNB1, KRAS, SOS1, HRAS, TP53, FGFR2 | 23 | 3.73E-08 | RB1, PDGFRB, PDGFRA, MAP2K1, HSP90AB1, PDGFB, PDGFA, PIK3CD, TGFA, PIK3CB, IGF1, PIK3CG, PIK3R5, INS, IGF1R, NFKBIA, CCND1, PDGFD, MDM2, MAPK1, E2F3, TP53, MAPK3 | 16 |
| hsa04919:Thyroid hormone signaling pathway | 22 | 3.33E-14 | NOTCH1, NCOA3, TSC2, PIK3CB, PIK3R1, ESR1, MTOR, PIK3CG, ACTG1, MED12, NCOR1, RXRA, PIK3CA, CCND1, SIN3A, RHEB, EP300, CTNNB1, KRAS, PLCG1, HRAS, TP53 | 26 | 8.81E-08 | NOTCH3, HDAC3, NOTCH1, THRA, ITGB3, NOTCH4, SLC2A1, PIK3CD, PIK3CB, PIK3CG, PIK3R5, CCND1, PRKACG, MYC, MAPK1, RXRG, MAPK3, NCOA1, PRKCG, MAP2K1, PRKCA, MED13L, RHEB, MDM2, PLCB2, TP53 | 20 |
| hsa05220:Chronic myeloid leukemia | 18 | 1.24E-13 | RB1, SMAD4, CDKN2A, BRAF, PTPN11, PIK3CB, PIK3R1, PIK3CG, TGFBR2, RUNX1, MECOM, PIK3CA, CCND1, ABL1, KRAS, SOS1, HRAS, TP53 | 20 | 1.27E-07 | RB1, STAT5A, TGFB2, MAP2K1, TGFB1, SHC3, SHC1, PIK3CD, PIK3CB, GAB2, PIK3CG, PIK3R5, NFKBIA, CCND1, MYC, MDM2, MAPK1, E2F3, TP53, MAPK3 | 15 |
| hsa04012:ErbB signaling pathway | 14 | 4.14E-08 | BRAF, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, ERBB4, ERBB2, ABL1, KRAS, PLCG1, SOS1, HRAS | 22 | 1.47E-07 | PRKCG, CAMK2B, STAT5A, MAP2K1, SHC3, SHC1, CAMK2A, PIK3CD, TGFA, PRKCA, PIK3CB, PIK3CG, PIK3R5, MAPK9, MAPK8, ERBB3, MYC, MAPK1, PAK3, PAK2, PAK4, MAPK3 | 20 |
| hsa04066:HIF-1 signaling pathway | 10 | 0.000237 | PIK3CA, ERBB2, EP300, PLCG1, PIK3CB, PIK3R1, TLR4, EGFR, MTOR, PIK3CG | 23 | 1.99E-07 | PRKCG, CAMK2B, MAP2K1, EPO, NOS3, CAMK2A, STAT3, SLC2A1, PIK3CD, PRKCA, PIK3CB, IGF1, PIK3CG, PIK3R5, INS, IGF1R, HK3, IFNG, HMOX1, MAPK1, TEK, GAPDH, MAPK3 | 21 |
| hsa04664:Fc epsilon RI signaling pathway | 9 | 0.000109 | LYN, PIK3CA, KRAS, PLCG1, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 19 | 2.60E-07 | MAP2K1, IL13, PLA2G4C, PIK3CD, PRKCA, PIK3CB, GAB2, PIK3CG, PIK3R5, MAPK9, IL3, MAPK8, BTK, MAPK1, LCP2, FYN, MS4A2, LAT, MAPK3 | 17 |
| hsa04750:Inflammatory mediator regulation of TRP channels | 7 | 0.020389087 | PIK3CA, PRKCD, GNAS, PLCG1, PIK3CB, PIK3R1, PIK3CG | 23 | 2.93E-07 | PRKCG, CAMK2B, PRKCD, CAMK2A, PLA2G4C, ITPR1, PIK3CD, PRKCA, IL1RAP, PIK3CB, IGF1, PIK3CG, PIK3R5, PPP1CA, PPP1CB, MAPK9, MAPK8, PRKACG, IL1B, F2RL1, CALM3, PRKCQ, PLCB2 | 20 |
| hsa05164:Influenza A | 10 | 0.014100603 | HSPA8, PIK3CA, EP300, NUP98, PIK3CB, PIK3R1, JAK2, TLR4, PIK3CG, ACTG1 | 32 | 3.16E-07 | PIK3CD, FASLG, FURIN, PIK3CB, PIK3CG, PIK3R5, ICAM1, MAPK9, SOCS3, MAPK8, IL12B, MAPK1, IL12A, JAK2, IKBKE, JAK1, MAPK3, HSPA8, MAP2K1, IFNB1, DDX58, TNFRSF10B, EIF2AK2, PRKCA, NFKBIA, IFNG, IRF3, IL1B, IRF7, FAS, MYD88, NFKBIB | 28 |
| hsa04910:Insulin signaling pathway | 13 | 4.56E-05 | TSC2, BRAF, IRS2, PIK3CB, PIK3R1, MTOR, PIK3CG, PIK3CA, PRKAR1A, RHEB, KRAS, SOS1, HRAS | 27 | 9.60E-07 | SHC3, SHC1, IRS1, PIK3CD, IRS2, PIK3CB, PIK3CG, PIK3R5, INS, PPP1CB, HK3, MAPK9, SOCS3, MAPK8, SOCS1, PRKAR2B, PRKACG, MAPK1, PPARGC1A, MAPK3, MAP2K1, PRKAB2, PPP1CA, PRKAR1A, RHEB, CALM3, FBP1 | 22 |
| hsa04611:Platelet activation | 9 | 0.00760998 | LYN, PIK3CA, GNAS, PIK3CB, PIK3R1, GNAI1, ARHGAP35, PIK3CG, ACTG1 | 26 | 1.05E-06 | ITGB3, ITGA2B, ITPR1, PIK3CD, PIK3CB, RASGRP1, PIK3CG, GNAI2, MYLK, PIK3R5, PPP1CB, PRKACG, MAPK1, FYN, MAPK3, NOS3, GP1BB, ITGA2, PLA2G4C, GP1BA, PPP1CA, COL2A1, BTK, LCP2, TLN1, PLCB2 | 24 |
| hsa04650:Natural killer cell mediated cytotoxicity | 10 | 0.001377176 | PIK3CA, BRAF, PTPN11, KRAS, PLCG1, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 25 | 1.12E-06 | SHC3, SHC1, ITGB2, PIK3CD, FASLG, PIK3CB, PIK3CG, PIK3R5, ICAM1, KLRK1, CASP3, MAPK1, FYN, MAPK3, PRKCG, MAP2K1, IFNB1, TNFRSF10B, PRKCA, NFATC1, IFNG, FAS, LCP2, CD247, LAT | 23 |
| hsa04670:Leukocyte transendothelial migration | 13 | 7.12E-06 | MMP2, CTNND1, MSN, PTPN11, PIK3CB, PIK3R1, PIK3CG, GNAI1, ARHGAP35, ACTG1, PIK3CA, CTNNB1, PLCG1 | 24 | 1.39E-06 | PRKCG, ITK, ITGAM, NCF1, ITGA4, ACTN1, PXN, ITGB2, CXCR4, PIK3CD, PRKCA, PIK3CB, ACTN4, PIK3CG, PIK3R5, GNAI2, ICAM1, CDC42, MYLPF, CDH5, MYL7, CTNNA1, CTNNA3, MYL9 | 22 |
| hsa04930:Type II diabetes mellitus | 7 | 0.000581 | PIK3CA, PRKCD, IRS2, PIK3CB, PIK3R1, MTOR, PIK3CG | 15 | 1.59E-06 | IRS1, PRKCD, PIK3CD, IRS2, PIK3CB, PIK3CG, PIK3R5, INS, MAPK9, HK3, SOCS3, MAPK8, SOCS1, MAPK1, MAPK3 | 11 |
| hsa04917:Prolactin signaling pathway | 10 | 2.17E-05 | CCND1, PIK3CA, KRAS, PIK3CB, PIK3R1, JAK2, SOS1, HRAS, ESR1, PIK3CG | 18 | 2.58E-06 | STAT5A, MAP2K1, SHC3, SHC1, STAT3, PIK3CD, PIK3CB, PIK3CG, PIK3R5, INS, MAPK9, SOCS3, MAPK8, SOCS1, CCND1, MAPK1, JAK2, MAPK3 | 14 |
| hsa05230:Central carbon metabolism in cancer | 15 | 6.13E-11 | PDGFRA, PTEN, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, KIT, ERBB2, KRAS, HRAS, FGFR3, TP53, FGFR2 | 17 | 2.77E-06 | PDGFRB, RET, PDGFRA, MAP2K1, SLC2A1, PIK3CD, PIK3CB, PIK3CG, PIK3R5, HK3, MYC, KIT, MAPK1, MET, FGFR3, TP53, MAPK3 | 11 |
| hsa05211:Renal cell carcinoma | 11 | 1.42E-06 | PIK3CA, HGF, EP300, BRAF, PTPN11, KRAS, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 17 | 4.28E-06 | TGFB2, MAP2K1, TGFB1, PDGFB, SLC2A1, PIK3CD, TGFA, PIK3CB, PIK3CG, PIK3R5, CDC42, MAPK1, PAK3, PAK2, MET, PAK4, MAPK3 | 15 |
| hsa04960:Aldosterone-regulated sodium reabsorption | 7 | 0.000182 | PIK3CA, NEDD4L, KRAS, PIK3CB, PIK3R1, SGK1, PIK3CG | 13 | 4.80E-06 | PRKCG, IRS1, PIK3CD, PRKCA, PIK3CB, IGF1, PIK3CG, PIK3R5, INS, NR3C2, SCNN1A, MAPK1, MAPK3 | 11 |
| hsa04730:Long-term depression | 7 | 0.001908964 | LYN, PPP2R1A, GNAS, BRAF, KRAS, HRAS, GNAI1 | 16 | 5.68E-06 | GRIA1, PRKCG, GRIA2, GNAZ, MAP2K1, PLA2G4C, ITPR1, PRKCA, IGF1, GNAI2, IGF1R, PPP2CB, CRH, MAPK1, PLCB2, MAPK3 | 16 |
| hsa04931:Insulin resistance | 10 | 0.000573 | CREB1, PIK3CA, PRKCD, PTEN, IRS2, PTPN11, PIK3CB, PIK3R1, MTOR, PIK3CG | 22 | 6.42E-06 | PRKAB2, NOS3, IRS1, PRKCD, STAT3, SLC2A1, PIK3CD, IRS2, PIK3CB, PIK3CG, PIK3R5, INS, PPP1CA, NFKBIA, PPP1CB, MAPK9, SOCS3, MAPK8, RPS6KA1, PRKCQ, PPARGC1A, OGT | 18 |
| hsa05210:Colorectal cancer | 13 | 6.78E-09 | SMAD2, TCF7L2, SMAD4, BRAF, PIK3CB, PIK3R1, PIK3CG, TGFBR2, PIK3CA, CCND1, CTNNB1, KRAS, TP53 | 16 | 8.79E-06 | TGFB2, MAP2K1, TGFB1, SMAD3, PIK3CD, PIK3CB, PIK3CG, PIK3R5, MAPK9, MAPK8, CCND1, MYC, CASP3, MAPK1, TP53, MAPK3 | 12 |
| hsa04920:Adipocytokine signaling pathway | 7 | 0.004179262 | STK11, RXRA, LEPR, IRS2, PTPN11, JAK2, MTOR | 17 | 9.70E-06 | PRKAB2, IRS1, STAT3, SLC2A1, IRS2, NFKBIA, MAPK9, SOCS3, MAPK8, LEP, LEPR, PRKCQ, JAK2, NFKBIE, PPARGC1A, RXRG, NFKBIB | 14 |
| hsa05223:Non-small cell lung cancer | 16 | 4.93E-13 | RB1, CDKN2A, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, RXRA, PIK3CA, CCND1, ERBB2, KRAS, PLCG1, SOS1, HRAS, TP53 | 15 | 1.17E-05 | RB1, PRKCG, MAP2K1, PIK3CD, TGFA, PRKCA, PIK3CB, PIK3CG, PIK3R5, CCND1, MAPK1, E2F3, RXRG, TP53, MAPK3 | 10 |
| hsa04062:Chemokine signaling pathway | 12 | 0.0025103 | LYN, PIK3CA, PRKCD, BRAF, KRAS, PIK3CB, PIK3R1, JAK2, SOS1, HRAS, GNAI1, PIK3CG | 30 | 1.22E-05 | ITK, SHC3, NCF1, SHC1, PXN, CXCR4, PIK3CD, ARRB1, ARRB2, PIK3CB, PIK3CG, GNAI2, PIK3R5, CDC42, GNGT1, PRKACG, GNG7, MAPK1, JAK2, JAK3, MAPK3, MAP2K1, PRKCD, STAT3, GNG13, FGR, NFKBIA, HCK, PLCB2, NFKBIB | 26 |
| hsa04370:VEGF signaling pathway | 7 | 0.002079549 | PIK3CA, KRAS, PLCG1, PIK3CB, PIK3R1, HRAS, PIK3CG | 15 | 3.33E-05 | PRKCG, MAP2K1, NOS3, PXN, PLA2G4C, PIK3CD, HSPB1, PRKCA, PIK3CB, PIK3CG, PIK3R5, CDC42, KDR, MAPK1, MAPK3 | 13 |
| hsa04071:Sphingolipid signaling pathway | 10 | 0.001225368 | PIK3CA, PPP2R1A, PTEN, KRAS, PIK3CB, PIK3R1, HRAS, TP53, GNAI1, PIK3CG | 22 | 3.46E-05 | PRKCG, MAP2K1, NOS3, PIK3CD, PPP2R5A, PRKCA, PIK3CB, GAB2, PPP2R5C, PIK3CG, PIK3R5, GNAI2, MAPK9, PPP2CB, MAPK8, MAPK1, FYN, MS4A2, PLCB2, TP53, NSMAF, MAPK3 | 19 |
| hsa04210:Apoptosis | 6 | 0.011301396 | PIK3CA, ATM, PIK3CB, PIK3R1, TP53, PIK3CG | 15 | 4.04E-05 | PIK3CD, TNFRSF10B, FASLG, PIK3CB, PIK3CG, PIK3R5, NFKBIA, IL3, CASP6, CASP3, FAS, FADD, TP53, MAP3K14, BIRC2 | 12 |
| hsa04550:Signaling pathways regulating pluripotency of stem cells | 15 | 1.99E-06 | SMAD2, SMAD4, RIF1, LIFR, PIK3CB, PIK3R1, PIK3CG, ACVR2A, PIK3CA, CTNNB1, KRAS, JAK2, HRAS, FGFR3, FGFR2 | 24 | 4.21E-05 | SMAD1, MAP2K1, SMAD3, FZD4, STAT3, PIK3CD, SMAD9, INHBB, LIFR, PIK3CB, IGF1, FGF2, PIK3CG, PIK3R5, IGF1R, SOX2, MYC, PCGF1, MAPK1, JAK2, JAK3, FGFR3, JAK1, MAPK3 | 19 |
| hsa04914:Progesterone-mediated oocyte maturation | 8 | 0.002877534 | HSP90AB1, PIK3CA, BRAF, KRAS, PIK3CB, PIK3R1, GNAI1, PIK3CG | 18 | 4.57E-05 | MAP2K1, HSP90AB1, PIK3CD, PIK3CB, IGF1, PIK3CG, PIK3R5, INS, GNAI2, IGF1R, CCNA2, MAPK9, MAPK8, PRKACG, RPS6KA1, MAPK1, MAD2L1, MAPK3 | 15 |
| hsa04150:mTOR signaling pathway | 10 | 3.96E-06 | STK11, PIK3CA, RHEB, PTEN, TSC2, BRAF, PIK3CB, PIK3R1, MTOR, PIK3CG | 14 | 8.25E-05 | PRKCG, IRS1, PIK3CD, PRKCA, PIK3CB, IGF1, PIK3CG, PIK3R5, INS, RHEB, RPS6KA1, MAPK1, EIF4B, MAPK3 | 11 |
| hsa05202:Transcriptional misregulation in cancer | 12 | 0.001057729 | DDX5, RXRA, NCOR1, EWSR1, MAX, SIN3A, ATM, MLLT3, TP53, TGFBR2, KDM6A, RUNX1 | 26 | 9.64E-05 | CSF1R, CEBPB, SPI1, ITGAM, SIX1, PDGFA, IGF1R, HIST1H3A, MYC, RXRG, NGFR, SMAD1, MEF2C, LMO2, IGF1, FLI1, RUNX2, IL3, MYCN, BCL6, EWSR1, HIST3H3, REL, MDM2, MET, TP53 | 24 |
| hsa05231:Choline metabolism in cancer | 13 | 1.79E-06 | PDGFRA, TSC2, PIK3CB, PIK3R1, EGFR, MTOR, PIK3CG, PIK3CA, RHEB, KRAS, PLCG1, SOS1, HRAS | 19 | 9.79E-05 | PDGFRB, PRKCG, PDGFRA, MAP2K1, PLA2G4C, PDGFB, PDGFA, PIK3CD, PRKCA, PIK3CB, PIK3CG, PIK3R5, MAPK9, MAPK8, RHEB, PDGFD, MAPK1, PIP5K1C, MAPK3 | 15 |
| hsa04024:cAMP signaling pathway | 10 | 0.029810309 | CREB1, PIK3CA, GNAS, EP300, BRAF, SOX9, PIK3CB, PIK3R1, GNAI1, PIK3CG | 29 | 0.000104 | GRIA1, CAMK2B, GRIA2, CAMK2A, PIK3CD, PIK3CB, PIK3CG, GNAI2, PIK3R5, PPP1CB, MAPK9, GRIN2A, MAPK8, PRKACG, MAPK1, TNNI3, DRD1, DRD2, MAPK3, MAP2K1, RRAS2, NFATC1, SSTR2, GRIN2B, GRIN1, PPP1CA, NFKBIA, CALM3, MYL9 | 27 |
| hsa04350:TGF-beta signaling pathway | 8 | 0.002355578 | SMAD2, SMAD4, TFDP1, PPP2R1A, CUL1, EP300, ACVR2A, TGFBR2 | 17 | 0.000105 | SMAD1, TGFB2, LEFTY1, TGFB1, SMAD3, CUL1, SMAD9, INHBB, BMP5, SMAD7, PPP2CB, IFNG, MYC, MAPK1, E2F4, E2F5, MAPK3 | 16 |
| hsa04666:Fc gamma R-mediated phagocytosis | 8 | 0.002355578 | LYN, PIK3CA, PRKCD, AMPH, PLCG1, PIK3CB, PIK3R1, PIK3CG | 17 | 0.000105 | PRKCG, MAP2K1, NCF1, PRKCD, PIK3CD, PRKCA, PIK3CB, GAB2, PIK3CG, PIK3R5, CDC42, HCK, BIN1, MAPK1, PIP5K1C, LAT, MAPK3 | 14 |
| hsa04725:Cholinergic synapse | 9 | 0.002930997 | CREB1, PIK3CA, KRAS, PIK3CB, PIK3R1, JAK2, HRAS, GNAI1, PIK3CG | 20 | 0.000111 | PRKCG, CAMK2B, MAP2K1, CAMK2A, ITPR1, PIK3CD, PRKCA, PIK3CB, PIK3CG, PIK3R5, GNAI2, GNG13, GNGT1, PRKACG, GNG7, MAPK1, FYN, JAK2, PLCB2, MAPK3 | 17 |
| hsa05213:Endometrial cancer | 16 | 1.47E-13 | TCF7L2, PTEN, BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, PIK3CA, CCND1, CDH1, ERBB2, CTNNB1, KRAS, SOS1, HRAS, TP53 | 13 | 0.000115 | MAP2K1, PIK3CD, ILK, PIK3CB, PIK3CG, PIK3R5, CCND1, MYC, CTNNA1, MAPK1, CTNNA3, TP53, MAPK3 | 9 |
| hsa04152:AMPK signaling pathway | 13 | 1.43E-05 | TSC2, IRS2, PIK3CB, PIK3R1, MTOR, PIK3CG, STK11, CREB1, PIK3CA, CCND1, PPP2R1A, RHEB, LEPR | 21 | 0.000153 | PRKAB2, IRS1, PIK3CD, PPP2R5A, IRS2, PIK3CB, PPP2R5C, IGF1, EEF2, PIK3CG, PIK3R5, INS, IGF1R, CCNA2, PPP2CB, CCND1, RHEB, LEP, LEPR, PPARGC1A, FBP1 | 15 |
| hsa05100:Bacterial invasion of epithelial cells | 12 | 8.70E-07 | DNM3, CTTN, PIK3CA, CDH1, CLTCL1, CLTC, FN1, CTNNB1, PIK3CB, PIK3R1, PIK3CG, ACTG1 | 16 | 0.000154 | SHC3, SHC1, PXN, PIK3CD, ILK, PIK3CB, PIK3CG, DNM1, PIK3R5, DNM2, CDC42, CTTN, CLTCL1, CTNNA1, CTNNA3, MET | 12 |
| hsa04540:Gap junction | 8 | 0.003069884 | PDGFRA, TUBA1A, GNAS, KRAS, SOS1, HRAS, GNAI1, EGFR | 17 | 0.000186 | PDGFRB, PRKCG, PDGFRA, MAP2K1, PDGFB, ITPR1, PDGFA, PRKCA, GNAI2, PRKACG, PDGFD, MAPK1, DRD1, DRD2, PLCB2, MAP2K5, MAPK3 | 16 |
| hsa05221:Acute myeloid leukemia | 13 | 1.96E-09 | TCF7L2, BRAF, PIK3CB, PIK3R1, MTOR, PIK3CG, RUNX1, PIK3CA, CCND1, KIT, KRAS, SOS1, HRAS | 13 | 0.000243 | STAT5A, MAP2K1, SPI1, STAT3, PIK3CD, PIK3CB, PIK3CG, PIK3R5, CCND1, MYC, KIT, MAPK1, MAPK3 | 9 |
| hsa04915:Estrogen signaling pathway | 16 | 2.91E-09 | HSPA8, HSP90AB1, MMP2, PRKCD, PIK3CB, PIK3R1, ESR1, EGFR, PIK3CG, GNAI1, CREB1, PIK3CA, GNAS, KRAS, SOS1, HRAS | 18 | 0.000243 | HSPA8, MAP2K1, SHC3, HSP90AB1, SHC1, NOS3, PRKCD, ITPR1, PIK3CD, PIK3CB, PIK3CG, PIK3R5, GNAI2, PRKACG, MAPK1, CALM3, PLCB2, MAPK3 | 13 |
| hsa05219:Bladder cancer | 12 | 7.10E-10 | RB1, CCND1, CDKN2A, CDH1, MMP2, ERBB2, BRAF, KRAS, HRAS, FGFR3, TP53, EGFR | 11 | 0.000262 | RB1, MAP2K1, CCND1, MMP1, MYC, MDM2, MAPK1, E2F3, FGFR3, TP53, MAPK3 | 7 |
| hsa04390:Hippo signaling pathway | 9 | 0.017730476 | SMAD2, TCF7L2, SMAD4, CCND1, CDH1, PPP2R1A, CTNNB1, ACTG1, TGFBR2 | 23 | 0.000372 | SMAD1, TGFB2, TGFB1, SMAD3, FZD4, YWHAB, ITGB2, CSNK1E, FGF1, BMP5, PPP1CA, SOX2, LATS1, PPP1CB, PPP2CB, CCND3, DLG1, CCND1, MYC, CTNNA1, SNAI2, CTNNA3, TP73 | 22 |
| hsa04115:p53 signaling pathway | 7 | 0.003356407 | CCND1, CDKN2A, PTEN, TSC2, ATM, TP53, ATR | 14 | 0.000383 | GADD45B, GADD45A, IGF1, DDB2, CCND3, CCND1, PERP, CASP3, MDM2, FAS, PMAIP1, MDM4, TP53, TP73 | 12 |
| hsa04520:Adherens junction | 11 | 2.83E-06 | SMAD2, TCF7L2, SMAD4, CDH1, ERBB2, CTNND1, EP300, CTNNB1, EGFR, ACTG1, TGFBR2 | 14 | 0.000687 | SMAD3, CSNK2A1, ACTN1, ACTN4, IGF1R, CDC42, CTNNA1, SNAI1, MAPK1, SNAI2, FYN, CTNNA3, MET, MAPK3 | 14 |
| hsa05160:Hepatitis C | 13 | 3.16E-05 | BRAF, PIK3CB, PIK3R1, EGFR, PIK3CG, RXRA, PIK3CA, PPP2R1A, PSME3, KRAS, SOS1, HRAS, TP53 | 20 | 0.001170011 | IFNB1, DDX58, STAT3, EIF2AK2, PIK3CD, PIK3CB, PIK3CG, PIK3R5, NFKBIA, MAPK9, PPP2CB, SOCS3, MAPK8, IRF3, IRF7, MAPK1, IKBKE, TP53, JAK1, MAPK3 | 17 |
| hsa05034:Alcoholism | 8 | 0.094040627 | CREB1, GNAS, BRAF, KRAS, SOS1, HRAS, GNAI1, HIST1H2BD | 24 | 0.001403996 | MAP2K1, HDAC3, SHC3, H2AFY, SHC1, GRIN2B, GNAI2, GNG13, GRIN1, PPP1CA, GNGT1, PPP1CB, HIST1H4A, GRIN2A, HIST1H3A, H2AFY2, GNG7, HIST3H3, CRH, MAPK1, CALM3, DRD1, DRD2, MAPK3 | 24 |
| hsa04662:B cell receptor signaling pathway | 8 | 0.000738 | LYN, PIK3CA, KRAS, PIK3CB, PIK3R1, SOS1, HRAS, PIK3CG | 13 | 0.001744442 | MAP2K1, PIK3CD, NFATC1, PIK3CB, PIK3CG, PIK3R5, RASGRP3, NFKBIA, BTK, MAPK1, NFKBIE, NFKBIB, MAPK3 | 11 |
| hsa04310:Wnt signaling pathway | 9 | 0.010739839 | TCF7L2, SMAD4, CCND1, TBL1XR1, CHD8, CUL1, EP300, CTNNB1, TP53 | 20 | 0.001823123 | PRKCG, CAMK2B, CSNK2A1, FZD4, CAMK2A, CUL1, NFATC1, PRKCA, CSNK1E, LRP6, MAPK9, CCND3, MAPK8, CCND1, TBL1XR1, PRKACG, MYC, TBL1X, PLCB2, TP53 | 16 |
| hsa05216:Thyroid cancer | 11 | 2.70E-10 | TCF7L2, RXRA, CCND1, CDH1, TPR, NCOA4, CTNNB1, BRAF, KRAS, HRAS, TP53 | 8 | 0.00236127 | RET, MAP2K1, CCND1, MYC, MAPK1, RXRG, TP53, MAPK3 | 6 |
| hsa04912:GnRH signaling pathway | 9 | 0.000815 | MAP3K1, MMP2, PRKCD, GNAS, KRAS, SOS1, HRAS, EGFR, MAP3K4 | 15 | 0.002516807 | CAMK2B, MAP2K1, PRKCD, CAMK2A, PLA2G4C, ITPR1, PRKCA, CDC42, MAPK9, MAPK8, PRKACG, MAPK1, CALM3, PLCB2, MAPK3 | 14 |
| hsa04360:Axon guidance | 7 | 0.060161309 | EPHB6, RASA1, ABL1, KRAS, HRAS, GNAI1, EPHA3 | 18 | 0.004186121 | EPHB6, EPHA5, EPHA4, CXCR4, L1CAM, ROBO1, GNAI2, CDC42, MAPK1, FYN, EPHB2, PAK3, PAK2, MET, EPHB4, EPHB3, PAK4, MAPK3 | 17 |
| hsa05206:MicroRNAs in cancer | 22 | 9.35E-07 | PDGFRA, NOTCH1, CDKN2A, DNMT3A, PTEN, IRS2, BRCA1, DICER1, EGFR, MTOR, CCND1, ERBB2, ABL1, EP300, KRAS, ATM, PLCG1, SOS1, HRAS, FGFR3, TP53, EZH2 | 32 | 0.004387211 | NOTCH3, DNMT1, NOTCH1, SHC1, IRS1, ITGB3, NOTCH4, PDGFB, PDGFA, IRS2, SOCS1, ERBB3, CCND1, MYC, CASP3, DNMT3B, CYP1B1, HMOX1, E2F3, PAK4, PRKCG, PDGFRB, PDGFRA, TGFB2, MAP2K1, STAT3, PRKCA, MDM2, MDM4, MET, FGFR3, TP53 | 26 |
| hsa04961:Endocrine and other factor-regulated calcium reabsorption | 5 | 0.016548257 | DNM3, CLTCL1, CLTC, GNAS, ESR1 | 9 | 0.008696973 | PRKCG, KL, PRKACG, CLTCL1, PRKCA, AP2B1, PLCB2, DNM1, DNM2 | 8 |
| hsa05416:Viral myocarditis | 6 | 0.007978101 | CCND1, HLA-B, ABL1, DMD, HLA-A, ACTG1 | 10 | 0.012053704 | CCND1, CASP3, CD80, ITGB2, CD28, FYN, DMD, CD55, EIF4G2, ICAM1 | 8 |
| hsa04320:Dorso-ventral axis formation | 4 | 0.020622905 | NOTCH1, KRAS, SOS1, EGFR | 6 | 0.030294862 | NOTCH3, MAP2K1, NOTCH1, NOTCH4, MAPK1, MAPK3 | 5 |
| hsa04923:Regulation of lipolysis in adipocytes | 7 | 0.001330286 | PIK3CA, GNAS, IRS2, PIK3CB, PIK3R1, GNAI1, PIK3CG | 9 | 0.03038631 | IRS1, PRKACG, PIK3CD, IRS2, PIK3CB, PIK3CG, GNAI2, PIK3R5, INS | 6 |
| hsa05412:Arrhythmogenic right ventricular cardiomyopathy (ARVC) | 5 | 0.059036719 | TCF7L2, CTNNB1, ITGA6, DMD, ACTG1 | 10 | 0.032005417 | CACNB1, ITGA4, ITGB5, ITGA2, ITGB3, ITGA2B, CTNNA1, ITGA6, DMD, CTNNA3 | 8 |
| hsa04916:Melanogenesis | 9 | 0.001512388 | TCF7L2, CREB1, KIT, GNAS, EP300, CTNNB1, KRAS, HRAS, GNAI1 | 13 | 0.032479275 | PRKCG, CAMK2B, MAP2K1, FZD4, CAMK2A, PRKCA, GNAI2, PRKACG, KIT, MAPK1, CALM3, PLCB2, MAPK3 | 12 |
| hsa04612:Antigen processing and presentation | 7 | 0.006259987 | HSPA8, CREB1, HSP90AB1, PSME3, HLA-B, HLA-A, B2M | 10 | 0.063478147 | HSPA8, CD4, HSP90AB1, NFYA, IFNG, CD8B, RFX5, PSME2, KIR3DL1, CTSS | 8 |

**Table 10. The eleven pathway existing in breast cancer patients**

|  |
| --- |
| Term |
| hsa04350:TGF-beta signaling pathway |
| hsa03460:Fanconi anemia pathway |
| hsa04730:Long-term depression |
| hsa05321:Inflammatory bowel disease (IBD) |
| hsa04720:Long-term potentiation |
| hsa05130:Pathogenic Escherichia coli infection |
| hsa04611:Platelet activation |
| hsa04390:Hippo signaling pathway |
| hsa04210:Apoptosis |
| hsa00562:Inositol phosphate metabolism |
| hsa04670:Leukocyte transendothelial migration |

**Table 11. The twenty-one pathway existing in lung cancer patients**

|  |
| --- |
| Term |
| hsa05416:Viral myocarditis |
| hsa05412:Arrhythmogenic right ventricular cardiomyopathy (ARVC) |
| hsa05130:Pathogenic Escherichia coli infection |
| hsa04612:Antigen processing and presentation |
| hsa04961:Endocrine and other factor-regulated calcium reabsorption |
| hsa04923:Regulation of lipolysis in adipocytes |
| hsa00562:Inositol phosphate metabolism |
| hsa04144:Endocytosis |
| hsa00562:Inositol phosphate metabolism |
| hsa04120:Ubiquitin mediated proteolysis |
| hsa04360:Axon guidance |
| hsa05034:Alcoholism |
| hsa04350:TGF-beta signaling pathway |
| hsa04730:Long-term depression |
| hsa04750:Inflammatory mediator regulation of TRP channels |
| hsa04611:Platelet activation |
| hsa04380:Osteoclast differentiation |
| hsa04670:Leukocyte transendothelial migration |
| hsa04920:Adipocytokine signaling pathway |
| hsa04390:Hippo signaling pathway |
| hsa04210:Apoptosis |

* **The setting of the input parameters**

We calculate the internal evaluation results, external evaluation results and survival time log-rank test of dadgaSNMNMF after tuning the biological features d ranging from 5 to 50. Below Table 10 - Table 14 show the performance of our model for lung and breast cancer after setting parameters d under various value. After tuning the parameters of d, we final decide to set the d value as 7 for lung and breast cancer in this study. Although the internal evaluation and external evaluation results illustrate 6 is smaller better than 7, the pvalue of breast cancer with 6 is worse than 7.

**Table 10. The internal evaluation results under different d value for breast cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| biological features d | silhouette\_width | Dunn | DBI(smaller beter) |
| 5 | 0.674 | 1.995 | 0.757 |
| 6 | 0.765 | 1.892 | 0.609 |
| 7 | 0.729 | 1.872 | 0.651 |
| 8 | 0.600 | 1.461 | 0.883 |
| 9 | 0.556 | 1.319 | 0.954 |
| 10 | 0.448 | 1.386 | 1.000 |
| 15 | 0.222 | 1.155 | 1.215 |
| 20 | 0.184 | 1.118 | 1.277 |
| 50 | 0.119 | 1.096 | 1.342 |

**Table 11. The internal evaluation results under different d value for lung cancer.**

|  |  |  |  |
| --- | --- | --- | --- |
| biological features d | silhouette\_width | Dunn | DBI(smaller beter) |
| 5 | 0.709 | 2.074 | 0.557 |
| 6 | 0.554 | 1.825 | 0.814 |
| 7 | 0.492 | 1.708 | 0.909 |
| 8 | 0.470 | 1.386 | 1.074 |
| 9 | 0.351 | 1.303 | 1.146 |
| 10 | 0.352 | 1.289 | 1.207 |
| 15 | 0.119 | 1.117 | 1.145 |
| 20 | 0.105 | 1.099 | 1.148 |
| 50 | 0.086 | 1.079 | 1.190 |

**Table 12. The external evaluation results under different d value for breast cancer.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| biological features d | Precision | Recall | Fscore | RI |
| 5 | 0.452 | 0.347 | 0.392 | 0.180 |
| 6 | 0.509 | 0.354 | 0.418 | 0.229 |
| 7 | 0.520 | 0.389 | 0.445 | 0.255 |
| 8 | 0.462 | 0.329 | 0.384 | 0.181 |
| 9 | 0.430 | 0.314 | 0.363 | 0.149 |
| 10 | 0.436 | 0.341 | 0.383 | 0.164 |
| 15 | 0.423 | 0.684 | 0.522 | 0.244 |
| 20 | 0.417 | 0.685 | 0.518 | 0.234 |
| 50 | 0.429 | 0.814 | 0.562 | 0.282 |

**Table 13. The external evaluation results under different d value for lung cancer.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| biological features d | Precision | Recall | Fscore | RI |
| 5 | 0.380 | 0.378 | 0.379 | 0.136 |
| 6 | 0.411 | 0.603 | 0.489 | 0.231 |
| 7 | 0.407 | 0.612 | 0.489 | 0.227 |
| 8 | 0.279 | 0.557 | 0.372 | -0.005 |
| 9 | 0.391 | 0.539 | 0.453 | 0.188 |
| 10 | 0.352 | 0.607 | 0.445 | 0.138 |
| 15 | 0.284 | 0.792 | 0.418 | 0.006 |
| 20 | 0.296 | 0.953 | 0.452 | 0.038 |
| 50 | 0.296 | 0.953 | 0.452 | 0.038 |

**Table 14. the log-rank test p-value of survival time under various subtypes with biological features’ value from 5-10.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **pvalue** | 5 | 6 | 7 | 8 | 9 | 10 | 15 | 20 | 50 |
| breast cancer | 0.51 | 0.079 | 0.002 | 0.042 | 0.049 | 0.35 | 0.73 | 0.76 | 1 |
| lung cancer | 0.0057 | 0.0065 | 0.0029 | 0.0058 | 0.0066 | 0.013 | 0.016 | 0.032 | 0.032 |

As for the parameters , we referred the parameter selection process of SNMNMF which empirically use several combinations of initial parameters to test the robustness of the results. According to the prior knowledge of driver genes can modulate the downstream genes in certain network, we upregulated the network constraints of the driver gene and downstream gene interaction network compared with the driver gene-driver gene network and driver gene-downstream gene network . In our study, we use three kinds of combinations to test the Fscore of our results under iteration times ranging from 0-1000(see Figure S1). For each setting, we found that the changing value of Fscore is relatively stay steadily with different iterations. However, the Fscore under the three settings are quite different. It to some degree explains the necessity of adjusting the parameters of . From the Figure S1, we can see the best performance for breast and lung cancer is setting 3 () with highest Fscore 0.445 and setting 2() with highest score 0.492, respectively. Compared with setting 1 have the equal value of and , in these two setting, the sparseness control of basis matrix W is higher than the coefficient matrix H which means limited the growth of W is more important than the H.



Fig. S1. The Fscore value for current setting. The three settings are (),(),(), respectively.

* **The survival analysis of the HOPES**

Below, Fig.S2. show the survival analysis results of HOPES in lung and breast cancer. From the graph, it is not hard to conclude that patients grouped by HOPSE have not significant clinical associations as its pvalue with 0.34(>0.05) and 0.012 for breast and lung cancer, respectively.

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Fig. S2. The survival analysis of HOPES in breast cancer and lung cancer.