HALLMARK\_TNFA\_SIGNALING\_VIA\_NFKB http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_TNFA\_SIGNALING\_VIA\_NFKB Klf6 Jag1 Dennd5a Gch1 B4galt1 Icam1 Il1b Il6 Irf1 Lamb3 Myc Nr4a2 Olr1 Plau Ccnd1 Ifih1 Bmp2 Tap1 Tgif1 Tlr2 Tnf Irs2 Litaf Map3k8 Abca1 Egr2 Clcf1 Tnc Il7r Ldlr Smad3 Nfkb2 Tubb2a Nr4a3 Sqstm1 Phlda1 Nfat5 B4galt5 Tnip1 Tank Cdkn1a Cebpb Cebpd Pdlim5 Ehd1 Btg3 Csf1 Csf2 Gadd45a Rcan1 Hbegf Dusp1 Dusp2 Edn1 Efna1 Egr1 Egr3 Ets2 F2rl1 F3 Fos Fosl2 Maff Fut4 Gem Cxcl1 Nr4a1 Hes1 Birc2 Birc3 Id2 Ifit2 Ifngr2 Ccn1 Il1a Il6st Il12b Il15ra Tnfrsf9 Il18 Inhba Cxcl10 Jun Junb Areg Rhob Lif Marcks Mxd1 Mcl1 Atf3 Nfe2l2 Nfil3 Nfkb1 Nfkbia Nfkbie Ninj1 Atp2b1 Serpine1 Serpinb2 Pde4b Per1 Plaur Plek Map2k3 Ptgs2 Ptpre Ptx3 Rel Bcl2a1d Rela Relb Bcl3 Bcl6 Sat1 Ccl5 Ccl20 Cxcl5 Cxcl11 Sdc4 Sgk1 Slc2a3 Sod2 Stat5a Btg1 Klf10 Tnfaip2 Tnfaip6 Traf1 Phlda2 Vegfa Zfp36 Btg2 Fosl1 Snn Bhlhe40 Tnfsf9 Cflar Tsc22d1 Sphk1 Msc Cd83 Cd80 Cd44 Cd69 Gfpt2 Il23a Panx1 G0s2 Ppp1r15a Ccrl2 Icosl Ackr3 Ccnl1 Tnfaip3 Plk2 Fjx1 Klf4 Ptger4 Klf9 Kynu Plpp3 Spsb1 Ripk2 Tnip2 Trip10 Cxcl2 Slc16a6 Tnfaip8 Gpr183 Pnrc1 Pfkfb3 Dusp4 Ier5 Yrdc Serpinb8 Zc3h12a Slc2a6 Fosb Pmepa1 Gadd45b Ier2 Ddx58 Klf2 Trib1 Socs3 Dnajb4 Zbtb10 Kdm6b Tiparp Nampt Dram1 Ier3 Rnf19b Dusp5 Eif1

HALLMARK\_MITOTIC\_SPINDLE http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_MITOTIC\_SPINDLE Lrpprc Cenpe Cenpf Septin9 Kptn Fgd4 Csnk1d Epb41 Rab3gap1 Palld Kif1b Flna Flnb Cd2ap Kif4 Abl1 Bin1 Apc Arhgdia Lmnb1 Myh9 Myo1e Notch2 Numa1 Ophn1 Pkd2 Cenpj Bcr Dst Sptan1 Brca2 Trio Tsc1 Vcl Alms1 Actn4 Smc1a Smc3 Sass6 Dync1h1 Gsn Kif11 Mid1 Myo9b Nek2 Nf1 Pafah1b1 Pcnt Nin Anln Cdk5rap2 Als2 Rasa1 Sos1 Tuba4a Tubgcp6 Arhgef2 Cep57 Tubd1 Clip1 Ranbp9 Myh10 Hdac6 Bcl2l11 Net1 Cdc42ep2 Pdlim5 Cntrl Katna1 Cdc42ep1 Dlg1 Ect2 Cttn Epb41l2 Mapre1 Abr Birc5 Shroom2 Kif3c Arf6 Arhgap5 Llgl1 Marcks Map3k11 Nck1 Pcm1 Plk1 Pxn Rfc1 Rock1 Itsn1 Fscn1 Sptbn1 Stau1 Bub1 Tiam1 Top2a Ezr Clip2 Ywhae Capzb Uxt Nck2 Racgap1 Lats1 Cdk1 Cdc27 Cdc42 Incenp Cdc42ep4 Klc1 Kifap3 Rasa2 Dock2 Ttk Wasf1 Arhgap10 Kif3b Kif5b Arhgef3 Abi1 Katnb1 Ralbp1 Kif23 Arhgap4 Dynll2 Wasl Fbxo5 Arhgef7 Clasp1 Cyth2 Synpo Tubgcp2 Tubgcp3 Tubgcp5 Cep250 Bcar1 Farp1 Mark4 Smc4 Nusap1 Rhof Atg4b Prc1 Gemin4 Kif2c Rapgef5 Arap3 Dock4 Tlk1 Stk38l Arhgef11 Ndc80 Arfgef1 Kif15 Hook3 Tbcd Wasf2 Rabgap1 Rhot2 Sorbs2 Cntrob Arhgap29 Arfip2 Rapgef6 Kif22 Kntc1 Fgd6 Dlgap5 Akap13 Ccnb2 Sac3d1 Cep192 Kif20b Nedd9 Shroom1 Mid1ip1 Ppp4r2 Arhgef12 Taok2 Arl8a Ssh2 Pif1 Cdc42bpa Cep131 Map1s Tpx2 Plekhg2 Arhgap27 Rictor Sun2 Ccdc88a Cep72 Prex1 Pcgf5 Aurka Rasal2 Espl1 Ckap5

HALLMARK\_WNT\_BETA\_CATENIN\_SIGNALING http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_WNT\_BETA\_CATENIN\_SIGNALING Ctnnb1 Jag1 Myc Notch1 Ptch1 Trp53 Axin1 Ncstn Rbpj Psen2 Wnt1 Axin2 Hey2 Fzd1 Frat1 Csnk1e Dvl2 Hey1 Gnai1 Lef1 Notch4 Ppard Adam17 Tcf7 Numb Ccnd2 Ncor2 Kat2a Nkd1 Hdac2 Dkk1 Wnt5b Wnt6 Dll1 Skp2 Hdac5 Fzd8 Dkk4 Cul1 Jag2 Hdac11 Maml1

HALLMARK\_IL6\_JAK\_STAT3\_SIGNALING http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_IL6\_JAK\_STAT3\_SIGNALING Csf2ra A2m Pik3r5 Hmox1 Fas Il1b Il2ra Il2rg Il6 Il10rb Irf1 Itgb3 Ptpn1 Ptpn11 Stat3 Tlr2 Tnf Tnfrsf1a Osmr Acvrl1 Cd36 Map3k8 Il17ra Il4ra Myd88 Stat1 Tgfb1 Cbl Il17rb Stam2 Tyk2 Pdgfc Irf9 Ccr1 Cntfr Csf1 Csf2 Csf3r Dntt Grb2 Ifnar1 Ifngr1 Ifngr2 Il1r1 Il6st Il7 Il12rb1 Il13ra1 Il15ra Cxcl10 Itga4 Jun Lepr Ltb Ltbr Pf4 Pim1 Pla2g2a Ptpn2 Bak1 Reg1 Ccl7 Cxcl11 Stat2 Tnfrsf1b Il1r2 Socs1 Acvr1b Cd9 Cd14 Cd38 Cd44 Tnfrsf21 Tnfrsf12a Il18r1 Cxcl2 Inhbe Cxcl9 Ebi3 Socs3 Hax1 Cxcl13 Il3ra Crlf2 Il9r

HALLMARK\_DNA\_REPAIR http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_DNA\_REPAIR Ada Ccno Clp1 Ercc8 Ddb2 Ercc2 Ercc4 Arl6ip1 Hprt Aprt Itpa Pnp Npr2 Pde6g Dgcr8 Rad51 Surf1 Trp53 Polr1c Cant1 Gsdme Dguok Ak1 Ercc3 Ercc5 Nme1 Polr1d Nt5c3 Pold1 Polh Upf3b Tk2 Umps Xpc Aaas Cox17 Poll Rbx1 Nelfcd Adrm1 Bcap31 Alyref Dad1 Ddb1 Ercc1 Fen1 Gpx4 Gtf2h1 Guk1 Hcls1 Impdh2 Lig1 Bcam Smad5 Mpg Nme3 Pde4b Pola1 Polb Polr2a Polr2c Polr2f Polr2i Prim1 Rad52 Rala Rev3l Rfc2 Rpa2 Sdcbp Ssrp1 Supt4a Supt5 Taf6 Taf10 Tarbp2 Eloa Tsg101 Tyms Ell Mrpl40 Edf1 Nelfb Nme4 Cetn2 Gtf2a2 Nt5c Adcy6 Pom121 Nelfe Dctn4 Polr2g Nudt21 Pcna Brf2 Nudt9 Polr2e Rae1 Ncbp2 Taf9 Stx3 Rfc5 Rfc3 Taf1c Rrm2b Nfx1 Taf12 Vps28 Polr2h Usp11 Ago4 Cstf3 Polr2j Gtf2b Sf3a3 Rpa3 Pold3 Taf13 Polr3c Mpc2 Rnmt Srsf6 Eif1b Gmpr2 Rfc4 Vps37b Vps37d Pold4 Sec61a1 Polr1h Gtf3c5 Sac3d1 Dut Pole4 Snapc5 Polr2k Polr3gl Cda Snapc4 Pola2 Zfp707 Gtf2h3 Zwint Gtf2f1 Cmpk2

` Gtf2h5 Polr2d Ak3

HALLMARK\_G2M\_CHECKPOINT http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_G2M\_CHECKPOINT Cdk4 Traip Cenpe Cenpf Dmd Orc6 Kif4 Abl1 Hmga1b Hmmr Hnrnpu Lbr Lmnb1 Mcm2 Mcm6 Myc Notch2 Numa1 Chmp1a Atrx Knl1 Bard1 Pura Ccnd1 Stil Brca2 Wrn Smc1a Rad54l Cdkn1b Stag1 Ctcf Plk4 Dkc1 Egf Ewsr1 Ezh2 Fancc Kif11 Smad3 Mcm5 Nek2 Pafah1b1 Map3k20 Pole Rad21 Tgfb1 Nsd2 Cdc45 Cdc6 Cul3 Nasp H2az1 Cks1b Chaf1a Cdkn2c Prmt5 Tacc3 Syncrip Cenpa Nup50 Dbf4 Katna1 Chek1 Dtymk E2f1 E2f2 Efna5 Amd1 Gspt1 H2ax Hif1a Hmgb3 Hnrnpd Hoxc10 Birc5 Hus1 Ilf3 Stmn1 Lig3 Marcks Mcm3 Meis1 Meis2 Mki67 Mnat1 Mybl2 Ncl Odc1 Odf2 Orc5 Plk1 Pml Rad23b Rbl1 Upf1 Bcl3 Rpa2 Srsf1 Srsf2 Slc7a1 Snrpd1 Sqle Ss18 Suv39h1 Bub1 Tfdp1 Tle3 Tmpo Top1 Top2a Hira Slc7a5 Cdc7 Ccna2 Ccnf Ccnt1 Racgap1 Exo1 Bub3 Pttg1 Cdk1 Cdc25a Cdc25b Cdc27 Casp8ap2 Incenp Cbx1 Nup98 Sap30 Dr1 Prim2 Kpnb1 Ttk Cdc20 E2f3 E2f4 Jpt1 Kif5b Mad2l1 Foxn3 Slc12a2 Smarcc1 Hspa8 Ube2c Kif23 Fbxo5 Prpf4b Slc38a1 Atf5 Sfpq Cul4a Mapk14 Cul1 Pbk Tnpo2 Aurkb H2bc12 Nolc1 Smc4 Smc2 Nusap1 Prc1 Xpo1 Kif2c Ddx39a Ndc80 Kif15 Cks2 Cdkn3 H2az2 Pds5b Kif22 Cul5 Tent4a Ube2s Srsf10 Ccnb2 Mtf2 Troap Tra2b Kif20b Ythdc1 Pola2 Rps6ka5 Kmt5a Uck2 Arid4a Tpx2 Gins2 Polq Aurka Rasal2 Espl1 G3bp1

HALLMARK\_APOPTOSIS http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_APOPTOSIS Ifitm3 Add1 Cth Ctnnb1 Cyld Dcn Dpyd Erbb2 F2 Gch1 Gucy2e Hgf Hmox1 Xiap Hspb1 Igf2r App Fas Il1b Fasl Il6 Irf1 Lmna Nefh Pdgfrb Prf1 Ank Psen1 Rara Ccnd1 Bmp2 Sod1 Sptan1 Brca1 Tap1 Tnf Casp8 Cav1 Bcl10 Dnm1l Cdkn1b Ebp Crebbp Erbb3 Gsn Smad7 Ppt1 Diablo Psen2 Rnasel Tgfb2 Timp3 Sqstm1 Dffa Isg20 Bcl2l11 Bcap31 Cdkn1a Txnip Btg3 Clu Gadd45a Ddit3 Egr3 Emp1 Eno2 Ereg F2r Fdxr Gna15 Gpx1 Gpx3 Gpx4 Gsr Gstm2 H1f0 Anxa1 Hmgb2 Birc3 Ifnb1 Ifngr1 Il1a Il18 Jun Krt18 Rhob Lef1 Lum Mcl1 Mgmt Mmp2 Atf3 Pak1 Plat Plcb2 Pmaip1 Avpr1a Ppp3r1 Dnajc3 Ptk2 Bax Rela Bcl2l1 Bcl2l2 Rock1 Sat1 Sc5d Bgn Bid Slc20a1 Sod2 Bnip3l Tgfbr3 Tspo Timp1 Timp2 Top2a Vdac2 Wee1 Btg2 Casp1 Casp2 Casp3 Casp4 Casp7 Casp9 Pea15a Tnfsf10 Cflar Ccnd2 Cd2 Cd14 Cd38 Cd44 Cd69 Cdc25b Cdk2 Dap3 Dnaja1 Lgals3 Casp6 Satb1 Pdcd4 Ccna1 Tnfrsf12a Bmf Bcl2l10 Ppp2r5b Igfbp6 Madd Dap Rhot2 Plppr4 Fez1 Etf1 Gadd45b Retsat Nedd9 Bik Aifm3 Ier3

HALLMARK\_NOTCH\_SIGNALING http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_NOTCH\_SIGNALING Jag1 Notch1 Notch2 Notch3 Ccnd1 Tcf7l2 Wnt5a Lfng Psenen Psen2 Heyl Fzd1 Rbx1 Hes1 Arrb1 Ppard Prkca Wnt2 Fzd5 Dtx1 Sap30 Dtx2 Kat2a Dll1 Fzd7 St3gal6 Fbxw11 Cul1 Aph1a Dtx4 Skp1 Maml2

HALLMARK\_PROTEIN\_SECRETION http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_PROTEIN\_SECRETION Adam10 Arfgef2 Ctsc Cln5 Kif1b Galc Gla Gnas Igf2r Lamp2 Ocrl Atp7a Rps6ka3 Sod1 Dst Stx16 Gosr2 Dnm1l Ap2s1 Cltc Abca1 Egfr Cog2 Ppt1 Ap3b1 Copb2 Sec24d Cope Ykt6 Rab9 Rab2a Uso1 Scamp3 Bet1 Ap3s1 Clcn3 Ap1g1 Ica1 Arf1 Krt18 M6pr Atp1a1 Pam Atp6v1b1 Mapk1 Rab5a Sh3gl2 Bnip3 Tpd52 Tsg101 Stam Sspn Cav2 Snap23 Zw10 Scamp1 Vps4b Cd63 Snx2 Copb1 Ap2m1 Vamp3 Vps45 Ap2b1 Clta Lman1 Napa Napg Sec22b Rab14 Ergic3 Stx7 Tom1l1 Tmx1 Tspan8 Arcn1 Sec31a Golga4 Vamp4 Dop1a Stx12 Tmed10 Anp32e Arfgef1 Arfip1 Atp6v1h Rer1 Scrn1 Rab22a Yipf6 Mon2 Sgms1 Gbf1 Arfgap3

HALLMARK\_INTERFERON\_ALPHA\_RESPONSE http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_INTERFERON\_ALPHA\_RESPONSE Adar Ifitm3 Irf1 Ifih1 Tap1 Wars Casp8 Pnpt1 Lpar6 Tdrd7 Il4ra B2m Procr Nub1 Isg20 Rsad2 Irf9 Txnip Usp18 Cnp Csf1 Elf1 Samd9l Ifit2 Il7 Il15 Cxcl10 Ly6e Mx2 Oas1a Plscr1 Eif2ak2 Psma3 Psmb8 Psmb9 Psme1 Psme2 Cxcl11 Sell Trim21 Stat2 Trim25 Trim26 Casp1 Cd47 Cd74 Ogfr Rnf31 Dhx58 Ccrl2 Ifi30 Mov10 Irf2 Gmpr Ripk2 Lap3 Slc25a28 Ddx60 Trafd1 Isg15 Parp9 Parp12 Parp14 Helz2 Lamp3 Mvb12a Cmtr1 Ifi35 Ifi44l Trim14 Irf7 Ube2l6 Oasl1 Lgals3bp Uba7 Nmi Ifitm1 Ifitm2 Gbp3 Rtp4 Epsti1 Ifi44 Bst2 Tent5a Cmpk2 Ncoa7 Batf2 Ifi27 Sp110 Herc6 Tmem140 C1s1 Trim12c Ifit3

HALLMARK\_INTERFERON\_GAMMA\_RESPONSE http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_INTERFERON\_GAMMA\_RESPONSE Adar Ifitm3 Samhd1 Gch1 Cfh Icam1 Fas Il6 Irf1 Jak2 Ciita Pnp Rnf213 Ptpn1 Cfb Ifih1 Stat3 Tap1 Tapbp Serping1 Wars Casp8 Pnpt1 Nup93 Tdrd7 Auts2 H2-Aa Il4ra Il10ra Irf5 Myd88 B2m Stat1 Stat4 Cd40 Lats2 Il18bp Tor1b St8sia4 Isg20 Rsad2 Arl4a Cdkn1a Irf9 Txnip Mthfd2 Usp18 Fpr1 Samd9l Gpr18 Gzma Hif1a H2-DMa Ifit2 Ifnar2 Il2rb Il7 Il15 Il15ra Ido1 Cxcl10 Irf4 Itgb7 Lcp2 Ly6e Mx2 Nfkb1 Nfkbia Pde4b Pfkp Pim1 Pla2g4a Plscr1 Pml Eif2ak2 Psma2 Psma3 Psmb2 Psmb8 Psmb9 Psmb10 Psme1 Psme2 Ptgs2 Ptpn2 Ptpn6 Ccl5 Ccl7 Cxcl11 Xcl1 Sectm1a Selp Sod2 Bpgm Trim21 Stat2 Btg1 Tnfaip2 Tnfaip6 Upp1 Vcam1 Trim25 Trim26 Sspn Ncoa3 Casp1 Casp3 Casp4 Casp7 Socs1 Vamp8 Ripk1 Tnfsf10 St3gal5 Cd86 Cd38 Cd69 Cd74 Fgl2 Ogfr Rnf31 Peli1 Dhx58 Ifi30 Nod1 Tnfaip3 Irf2 Mvp Irf8 P2ry14 Cd274 Ripk2 Lap3 Slc25a28 Zbp1 Ddx60 Slamf7 Trafd1 Isg15 Parp12 Rapgef6 Parp14 Helz2 Oas2 Oas3 Fcgr1 Cxcl9 Ddx58 Cmtr1 Ifi35 Isoc1 Rbck1 Ifi44l Trim14 Irf7 Arid5b Ube2l6 Mettl7b Oasl1 Socs3 Lgals3bp Marchf1 Nmi Ifitm2 Cmklr1 Znfx1 Vamp5 Gbp3 Nampt Rtp4 Epsti1 Bank1 Ifi44 Bst2 Lysmd2 Cmpk2 Eif4e3 Batf2 Ifi27 Sp110 Xaf1 Herc6 Sri C1s1 Apol6 Nlrc5 Sppl2a Ifit3

HALLMARK\_HEDGEHOG\_SIGNALING http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_HEDGEHOG\_SIGNALING L1cam Myh9 Ophn1 Ptch1 Cdk6 Nf1 Rasa1 Shh Vldlr Hey2 Nkx6-1 Cntfr Crmp1 Dpysl2 Ets2 Hey1 Gli1 Ache Nrcam Plg Pml Thy1 Tle1 Tle3 Vegfa Scg2 Nrp2 Nrp1 Adgrg1 Celsr1 Ldb1 Rtn1 Slit1 Cdk5r1 Unc5c Amot

HALLMARK\_COMPLEMENT http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_COMPLEMENT Sh2b3 Ctsc Cp Dusp6 F2 F5 F7 Zfpm2 Pik3r5 Gata3 Pclo Gp1ba Gp9 Gpd2 Ang Cfh Hnf4a Il6 Irf1 Jak2 Lamp2 Cd46 Olr1 Pdgfb Pfn1 Phex Pik3ca Psen1 Raf1 Gnb4 Cfb Zeb1 Serping1 C2 C3 C9 Was Car2 Calm1 Adam9 Cd36 Cd40lg Col4a2 Cr2 Ctsd Tmprss6 Kif2a Lipa Mmp13 Serpinc1 Pdp1 Prkcd Src Pla2g7 Actn2 Usp8 Pik3cg Cpq Cdh13 Usp14 Rhog Kcnip3 Rasgrp1 Cebpb Ehd1 Akap10 Clu Csrp1 Ctsb Adra2b Ctsh Ctss Dgkg Dpp4 F3 F8 F10 Fcer1g Fcnb Fdx1 Fn1 Maff Fyn Gnai2 Gnai3 Gnb2 Gngt2 Grb2 Gzma Gzmb Gzmk Anxa5 Hspa1a Hspa5 Apoc1 Itih1 Klkb1 Lck Lcp2 Lrp1 Lta4h Ltf Lyn Me1 Mmp8 Mmp12 Mmp14 Mmp15 Mt3 Atox1 Notch4 Serpine1 Serpinb2 Pim1 Pla2g4a Plat Plaur Plg Plek Plscr1 Ppp2cb Ppp4c Prep Lgmn Psmb9 Rnf4 S100a9 S100a13 Ccl5 Stx4a Timp1 Timp2 C1qa C1qc Tfpi2 Calm3 Casp1 Casp3 Casp4 Casp7 Casp9 Gng2 Apoa4 Sirt6 Kcnip2 Lgals3 Cdk5r1 Gmfb Tnfaip3 Rce1 Scg3 Irf2 Kynu Usp16 Spock2 Hpcal4 Dyrk2 Msrb1 Lap3 Xpnpep1 Pcsk9 Cblb Gca Usp15 Dock10 Dock4 Ctso Vcpip1 Prdm4 Brpf3 Rbsn Dgkh Irf7 Cda Rabif Itgam Cpm Dock9 Prss36 Ctsl Dusp5 Klk1 Prcp C1s1 L3mbtl4

HALLMARK\_UNFOLDED\_PROTEIN\_RESPONSE http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_UNFOLDED\_PROTEIN\_RESPONSE Dctn1 Eef2 Eif4g1 Npm1 Parn Nhp2 Wfs1 Calr Gosr2 Nop56 Dkc1 Eif4e Atf6 Fus Psat1 Hspa9 Aldh18a1 Rps14 Tubb2a Eif2ak3 Bag3 Ero1a Xbp1 Cks1b Herpud1 Sec11a Ern1 Preb Cebpb Cebpg Mthfd2 Eif2s1 Eif4a1 Eif4a2 Eif4ebp1 H2ax Hspa5 Igfbp1 Atf3 Atf4 Nfya Nfyb Exosc9 Exosc10 Dnajc3 Shc1 Hsp90b1 Vegfa Slc7a5 Khsrp Stc2 Slc1a4 Lsm4 Asns Cnot4 Kif5b Cnot2 Ddx10 Dnajb9 Ywhaz Xpot Slc30a5 Serp1 Yif1a Ddit4 Zbtb17 Edem1 Atp6v0d1 Arfgap1 Dcp1a Pdia6 Pdia5 Cxxc1 Sec31a Nolc1 Gemin4 Cnot6 Paip1 Exosc2 Wipi1 Arxes2 Spcs1 Chac1 Exosc5 Ssr1 Pop4 Imp3 Exoc2 Kdelr3 Exosc4 Eif4a3 Tars Banf1 Edc4 Ttc37 Srprb Rrp9 Hyou1 Exosc1 Iars Srpr Nop14 Nabp1 Sdad1 Mtrex Dnaja4 Fkbp14 Tatdn2 Dcp2 Lsm1 Tspyl2

HALLMARK\_PI3K\_AKT\_MTOR\_SIGNALING http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_PI3K\_AKT\_MTOR\_SIGNALING Cdk4 Akt1 Hras Fasl Il2rg Arhgdia Ngf Pfn1 Pten Ptpn11 Raf1 Rps6ka3 Tnfrsf1a Tsc2 Calr Fgf17 Cdkn1b Cltc Egfr Eif4e Pikfyve Plcb1 Tbk1 Itpr2 Myd88 Pitx2 Ppp2r1b Rac1 Rit1 Slc2a1 Cxcr4 Sqstm1 Dapp1 Mknk1 Ywhab Arpc3 Cdkn1a Vav3 Cfl1 Adcy2 Csnk2b Grk2 Ddit3 E2f1 Fgf6 Sfn Grb2 Il4 Arf1 Lck Smad2 Atf1 Nck1 Nfkbib Pin1 Plcg1 Ppp1ca Prkag1 Prkar2a Prkcb Mapk1 Mapk8 Map2k3 Map2k6 Sla Stat2 Tiam1 Hsp90b1 Traf2 Camk4 Ripk1 Cdk1 Fgf22 Cdk2 Actr3 Ap2m1 Nod1 Gsk3b Pdk1 Map3k7 Mapk10 Gna14 Rps6ka1 Mknk2 Acaca Akt1s1 Irak4 Dusp3 Mapk9 Prkaa2 Pak4 Actr2 Rptor Pla2g12a Mapkap1 Ube2d3 Ecsit Cab39 Pik3r3 Trib3 Ube2n Ralb Cab39l Them4 Gngt1

HALLMARK\_E2F\_TARGETS http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_E2F\_TARGETS Cdk4 Cdkn2a Rnaseh2a Cenpe Cit Chek2 Dnmt1 Nup205 Orc6 Kif4 Psmc3ip Hells Hmga1b Hmmr Lbr Lmnb1 Mcm2 Mcm6 Mlh1 Msh2 Myc Nbn Pms2 Prps1 Nup107 Bard1 Rad51c Snrpb Brca1 Brca2 Bub1b Trp53 Ung Diaph3 Smc1a Ppm1d Smc3 Cdkn1b Stag1 Nop56 Ctcf Plk4 Tubb5 Ak2 Ezh2 Ube2t Mcm5 Nme1 Pold1 Pole Rad21 Tubg1 Ctps Nasp H2az1 Cks1b Cnot9 Rad50 Cdkn1a Cdkn2c Tacc3 Syncrip Mthfd2 Chek1 Cse1l Dck Eif2s1 Cbx5 Xrcc6 Gspt1 H2ax Hmgb2 Hmgb3 Hnrnpd Birc5 Hus1 Ilf3 Stmn1 Lig1 Mcm3 Mki67 Mre11a Mybl2 Orc2 Plk1 Pnn Pold2 Prkdc Rad1 Ran Ranbp1 Rbbp7 Rfc1 Rfc2 Rpa2 Rrm2 Srsf1 Srsf2 Shmt1 Ssrp1 Suv39h1 Tk1 Tmpo Top2a Wee1 Slbp Dek Timeless Ccne1 Racgap1 Zw10 Pttg1 Tbrg4 Cdk1 Melk Cdc25a Cdc25b Pop7 Eed Prim2 Cdc20 Jpt1 Mad2l1 Nap1l1 Nudt21 Lyar Mcm7 Pcna Trip13 Cdca3 Rfc3 Rpa1 Ing3 Paics Spag5 Mxd3 Prdx4 Nup153 Phf5a Cenpm Aurkb Donson Nolc1 Smc4 Ipo7 Xpo1 Kif2c Usp1 Ddx39a Anp32e Asf1b Smc6 Rpa3 Pold3 Cks2 Cdkn3 Asf1a Ncapd2 Luc7l3 Mcm4 Pds5b Kif22 Depdc1a Tipin Lsm8 Ube2s Dlgap5 Pa2g4 Ccnb2 Atad2 Exosc8 Dut Pole4 Gins3 Tfrc Tra2b Brms1l Pan2 Pola2 Gins4 Ubr7 Gins1 Rad51ap1 Cdca8 Ccp110 Psip1 Dclre1b Dctpp1 Spc25 Spc24 Ppp1r8 Kif18b Tcf19 E2f8 Mms22l Dscc1 Aurka Espl1 Wdr90

HALLMARK\_EPITHELIAL\_MESENCHYMAL\_TRANSITION http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_EPITHELIAL\_MESENCHYMAL\_TRANSITION Fbln5 Cthrc1 Col1a1 Col1a2 Col3a1 Col5a1 Col6a2 Col6a3 Col7a1 Col8a2 Dcn Eln Fbln1 Fbn1 Flna Gja1 Efemp2 Fas Il6 Itgb3 Lama3 Lamc2 Matn3 Msx1 Mylk Notch2 Pdgfrb Plod2 Pmp22 Prrx1 Htra1 Pthlh Acta2 Sgcd Sgcg Bmp1 Snai2 Dst Tgfbi Tpm2 Vegfc Vim Wnt5a Pdlim4 Serpinh1 Col4a1 Col4a2 Col11a1 Comp Ecm1 Fbn2 Fuca1 Tnc Itga2 Lama2 Loxl1 Mmp3 Ppib Cxcl12 P3h1 Sgcb Slc6a8 Sparc Tgfb1 Timp3 Tpm1 Crlf1 Grem1 Col5a3 Gpc1 Cdh2 Cdh6 Edil3 Cdh11 Postn Col12a1 Copa Vcan Ccn2 Gadd45a Dpysl3 Emp3 Eno2 Fap Fbln2 Fgf2 Nid2 Foxc2 Fmod Fn1 Gas1 Gem Anpep Aplp1 Id2 Igfbp2 Igfbp3 Igfbp4 Ccn1 Il15 Inhba Itga5 Itgav Itgb1 Itgb5 Jun Areg Rhob Lama1 Lamc1 Lgals1 Lox Lrp1 Lum Matn2 Mest Mgp Mmp2 Mmp14 Nnmt Nt5e Tnfrsf11b Oxtr Serpine1 Pcolce Pfn2 Serpine2 Plaur Plod1 Qsox1 Ptx3 Rgs4 Bdnf Sat1 Bgn Cxcl5 Sdc1 Sdc4 Slit3 Sntb1 Spock1 Spp1 Tagln Tgfbr3 Tgm2 Thbs1 Thbs2 Thy1 Timp1 Vcam1 Vegfa Scg2 Tfpi2 Mfap5 Calu Plod3 Slit2 Cd44 Fstl3 Dab2 Gm21451 Adam12 Dkk1 Capg Tnfaip3 Sfrp1 Col5a2 Col16a1 Cadm1 Fzd8 Mcm7 Pcolce2 Tnfrsf12a Cxcl15 Myl9 Glipr1 Tpm4 Wipf1 Cald1 Fermt2 Cap2 Ntm Colgalt1 Lrrc15 Pvr Fstl1 Gpx7 Pmepa1 Gadd45b Basp1 Sfrp4 Magee1 Ecm2 Abi3bp

HALLMARK\_INFLAMMATORY\_RESPONSE http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_INFLAMMATORY\_RESPONSE Nlrp3 Klf6 Cybb Kif1b Pik3r5 Gch1 Atp2c1 Gpc3 Gp1ba Icam1 Il1b Il6 Il10 Irf1 Itgb3 Lta Mefv Met Msr1 Myc Ndp Slc11a2 Olr1 Axl Psen1 Raf1 Prok2 Scn1b Nod2 Slc1a2 Tacr3 Tapbp Tlr1 Tlr2 Best1 Osmr Abca1 Il4ra Il7r Il10ra Kcnj2 Ldlr Atp2a2 Tlr3 Cd40 Clec5a Pcdh7 Gpr132 Slc4a4 Chst2 Rhog Adrm1 Rasgrp1 Cdkn1a Nmur1 Npffr2 Ccr7 Slc31a1 Slc31a2 Adm Adora2b Csf1 Csf3 Csf3r Hbegf Aplnr Edn1 Ahr Emp3 Adgre1 Ereg F3 Fpr1 Gna15 Gnai3 Has2 Hif1a Hpn Hrh1 Ifnar1 Ifngr2 Il1a Il1r1 Il2rb Il12b Il15 Il15ra Tnfrsf9 Il18 Inhba Cxcl10 Itga5 Cd82 Kcna3 Lck Lcp2 Lif Ly6e Lyn Mxd1 Mep1a Mmp14 Nfkb1 Nfkbia Atp2b1 Oprk1 Osm P2rx4 P2rx7 P2ry2 Serpine1 Pde4b Plaur Eif2ak2 Ptafr Ptgir Ptpre Rela Rgs16 Ros1 Bdkrb1 Ccl5 Ccl7 Ccl17 Ccl20 Ccl22 Ccl24 Cxcl5 Cxcl11 Sele Sell Slamf1 Slc7a1 Slc7a2 Tacr1 Timp1 Tnfaip6 Tnfrsf1b Tpbg C3ar1 Vip Btg2 Fzd5 Marco Tnfsf10 Tnfsf9 Il18rap Sphk1 Acvr1b Slc28a2 Acvr2a Cd14 Cd48 Cd69 Cd70 Lpar1 Calcrl Sema4d Cxcr6 Aqp9 Ccrl2 Icosl Ptger4 Abi1 Cx3cl1 Rgs1 Dcbld2 Cxcl15 Stab1 Ripk2 Gabbr1 Il18r1 Tnfsf15 Irak2 Ffar2 Gpr183 Lamp3 Pvr Itgb8 Rnf144b Cxcl9 Ptger2 Ebi3 Sgms2 Selenos Irf7 Icam4 Nmi Kcnmb2 Ifitm1 Cmklr1 Nampt Rtp4 Bst2 Pdpn Sri Scarf1

HALLMARK\_ANGIOGENESIS http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_ANGIOGENESIS Col3a1 Jag1 Fgfr1 App Lpl Msx1 Olr1 Thbd Lrpap1 Postn Vcan Apoh Itgav Kcnj8 Lum Serpina5 Pdgfa Pf4 Prg2 Ptk2 S100a4 Cxcl5 Slco2a1 Spp1 Stc1 Timp1 Vav2 Vegfa Vtn Nrp1 Ccnd2 Pglyrp1 Tnfrsf21 Col5a2 Jag2 Fstl1

HALLMARK\_IL2\_STAT5\_SIGNALING http://www.broadinstitute.org/gsea/msigdb/cards/HALLMARK\_IL2\_STAT5\_SIGNALING Cdkn1c Ifitm3 Cish Col6a1 Klf6 Coch Dennd5a Gata1 Igf2r Il2ra Il10 Il13 Itga6 Irf6 Myc Myo1e Pnp Enpp1 Abcb1a Serpinb6a Plec Prnp Snx14 Ptch1 Pth1r Bcl2 Slc39a8 Bmp2 Bmpr2 Car2 Pus1 Spry4 Capn3 Tnfsf11 Cd79b Huwe1 Ndrg1 Map3k8 Ctla4 Ecm1 Gm4737 Fah Amacr Icos Il4ra Il10ra Serpinc1 Prkch Scn9a Umps Drc1 Cd81 Cdc6 Phlda1 Gucy1b1 Xbp1 Ncs1 Arl4a Praf2 Plin2 Ccr4 Csf1 Csf2 Ctsz Ahnak Ahr Emp1 Eno3 Etv4 Alcam F2rl2 Flt3l Maff Gpx4 Anxa4 Hk2 Slc29a2 Aplp1 Ifngr1 Igf1r Il2rb Tnfrsf9 Cxcl10 Irf4 Itgae Itgav Rhob Lif Ltb Mxd1 Muc1 Myo1c Nfil3 Nt5e Odc1 P2rx4 P4ha1 Furin Penk Pim1 Plscr1 Pou2f1 Gpr83 Bcl2l1 Rgs16 Rnh1 Rora S100a1 Sell Selp St3gal4 Slc2a3 Spp1 Tgm2 Tiam1 Tnfrsf1b Traf1 Tnfrsf4 Il1r2 Ncoa3 Eomes Casp3 Cst7 Bhlhe40 Socs1 Adam19 Tnfsf10 Nrp1 Ccnd2 Ccnd3 Ccne1 Syngr2 Il1rl1 Cd83 Cd86 Tnfrsf8 Cd44 Cd48 Hipk2 Plagl1 Ager Fgl2 Socs2 Slc1a5 Gabarapl1 Lrig1 Dhrs3 Twsg1 Gsto1 Capg Ikzf2 Tnfrsf21 Mapkapk2 Snx9 Irf8 Swap70 Tlr7 Nop2 Il18r1 Batf Glipr2 Hopx Rhoh Cdcp1 Eef1akmt1 Dcps Itih5 Batf3 Ikzf4 Rragd Smpdl3a Fam126b Galm Ptger2 Gadd45b Ttc39b Gpr65 Tnfrsf18 Lrrc8c Pdcd2l Wls Phtf2 Ckap4 Cyfip1 Nfkbiz Uck2 Map6 Spred2 Gbp3 Sh3bgrl2 Cdc42se2 Ptrh2 Lclat1 Syt11 She Etfbkmt Il3ra Plpp1 Rabgap1l