

**Supplementary Table 1:** Primer sequence used in real-time PCR for binding site validation

Gene	Region (hg19)	Primer
<i>TCF7L2</i>	chr10:114709983-114710213	TCGCCCTGTCAATAATCTCC AGCCGAAGATACAGGAGGTG
<i>TCF7L2</i>	chr10:114767138-114767346	CACTCTCTTTGGCCAGGAT GCAGCACAACCTTCAGTCAA
<i>AKT2</i>	chr19:40791541-40791706	AGGGCCTAGCCGTAGTGATT TGACGAGCACACTGAAAAGG
<i>CDK6</i>	chr7:92464789-92465012	GCTGGCTGAATGTGACTTGA AGAGGCGCATGAAGGATTT
<i>STXBP</i>	chr19:7716981-7717399	CAATTTCCCGGTTTCTTTGA GTGCTCGTTAGGACCCGATA
<i>SLC25A28</i>	chr10:101380154-101380513	AAGCAACCATTGGTGGAGAC AGTTTCTCCCGCCCTTCTAA
<i>MC1R</i>	chr16:89984343-89984643	CTTTGATGTGGCTGTTGGTG GACCCTCCAGTCATCTCGTC
<i>KREMEN1</i>	chr22:29492710-29492920	TGCTTTTCAATATGGTTTTGACAT TGTCGGGTGTCAGTTGAGAA
<i>SRC</i>	chr20:35968893-35969121	CAGCTCTAGCTGCAGATTTCC GAAGAGGCCAGAGAAGGAC
<i>ACVR1C</i>	chr2:158485181-158485339	CTGCGAGCAGCAGGAGAG CCACACTGACTAGAGCCAACC
<i>CCND1</i>	chr11:69455838-69455977	CACACGACTACAGGGGAGT TCGGCTCTCGTTCTGCT
<i>ARNT</i>	chr1:150848622-150848871	ACCACATCACAGACCAGACG GGGGACTTGGGTAGACTCG
<i>BCL2L1</i>	chr20:30292494-30292743	CTGCCTCCTGTGTGGAAGTT ATCGACCAGTTCCTGTAGGC
<i>EIF2B4</i>	chr2:27592794-27593158	AAACAGGGCACAAAGTGAGC GGCTCCGGTCTACACAGTCT
<i>HIF1A</i>	chr14:62181845-62182017	TGGGAGTATAGACTGAATTACCATCTT AAATCCAAAATCCTAACTGAAAGG
<i>PKT2</i>	chr1:204462725-204462945	CCTCTTCCCACAATCCAGAA GCTGCTCTCCTGGCCTATAC
<i>ROCK2</i>	chr2:11497557-11498080	GTGTCGGCTCCTCTGATCTC GGCATGTCTGGATGACCTCT
<i>CTRL3</i>	chr1:152285711-152285766	ATGTGGTGTGGCTGTGATGGGAAC CGAGCAATCGGTAAATAGGTCTGG
<i>CTRL4</i>	chr7:159488-159583	CTTGCCCCTCTATTCCCCACCAAC CCCCTTCCCATCACTCACTGTCC

**Supplementary Table 2: TCF7L2 binding site and nearest unique genes analysis: by HOMER in all 8 ChIP-seq experiments.** HOMER was utilized to determine TCF7L2 binding sites and their association with RefSeq transcripts aligned to hg19 downloaded from UCSC via HOMER. The candidate target gene was the closest gene regardless of direction from binding site and TSS of ReSeq transcript.

<b>Cell Line: TCF7L2 ChIP-seq</b>	<b>Binding Sites</b>	<b>Unique Genes</b>
HCT116 (in-house)	864	750
HEPG2: (ENCODE)	2,745	1,924
HeLaS3 Exon (4-16)	2,440	1,983
HEPG2 (in-house)	3,810	2,435
HEK293	6,303	3,519
MCF7	6,013	3,863
PANC1	8,632	5,123
HeLaS3 Exon (1-3)	11,817	6,451

**Supplementary Table 3: The number of placed sequence reads for all eight CHIP-seq experiments plus subsequent occupancy sites determined.**

<b>Cell Line</b>	<b>Number of sequence read tags mapped (hg19)</b>	<b>Occupancy sites</b>
HCT116 (in house)	18,139,284	864
HEPG2 (in house)	28,787,589	3,810
HEPG2 (ENCODE)	43,397,093	2,745
PANC1 (ENCODE)	32,477,306	8,632
MCF7 (ENCODE)	44,105,603	6,013
Helas3 exon 1-3 (ENCODE)	57,938,025	11,817
Helas3 exon 4-16 (ENCODE)	25,608,903	2,440

**Supplementary Table 4: TCF7L2 binding site events that fall within 5kb-500kb of a RefSeq gene.** In all cases the TSS of the aligned transcript was used as the anchor point for distance measurements. HOMER was utilized to perform the distance measurements.

Distance from TCF7L2 bind site	HepG2 (In house)	HeLaS3 (exon 1-3)	HeLaS3 (exon4-16)	MCF7
5kb	(503/3,810) 13.2%	(3,611/11,817) 30.6%	(735/2,440) 30.9%	(1,054/6,013) 17.5%
50kb	(1,894/3,810) 49.7%	(7,726/11,817) 65.4%	(1,492/2,440) 61.1%	(3,287/6,013) 54.6%
100kb	(2,516/3,810) 66.0%	(9,357/11,817) 79.2%	(1,874/2,440) 76.8%	(4,328/6,013) 72.0%
500kb	(3,526/3,810) 92.5%	(11,494/11,817) 97.2%	(2,355/2,440) 96.5%	(5,740/6,013) 95.5%
	PANC1	HCT116	HEPG2 (ENCODE)	HEK293
5kb	(3,079/8,632) 35.7%	(323/864) 37.4%	(333/2,745) 12.1%	(1,106/6,303) 17.5%
50kb	(5,684/8,632) 65.8%	(456/864) 52.8%	(1,502/2,745) 54.7%	(3,034/6,303) 48.1%
100kb	(6,776/8,632) 78.5%	(621/864) 71.9%	(2,014/2,745) 73.4%	(4,041/6,303) 64.1%
500kb	(8,307/8,632) 96.2%	(831/864) 96.2%	(2,632/2,745) 95.8%	(5,881/6,303) 93.3%

**Supplementary Table 5: All HCT116 TCF7L2 Ingenuity Conical pathways with at least nominal  $P < 0.05$**

Canonical Pathways	P-value	B-H Multiple testing correction p-value	Molecules
Factors Promoting Cardiogenesis in Vertebrates	1.47911E-05	0.003548134	BMP4,WNT3,SMAD5,PRKCZ,NOG,TGFBR2,MAP3K7,PRKCE,PRKCH,BMP7,DKK1,BMP6,PRKD1,TCF7L2
Type II Diabetes Mellitus Signaling	1.94984E-05	0.003548134	PIK3C2B,SOCS1,AKT2,PIK3R1,SOCS6,IKBKE,PRKCZ,MAP3K7,PIK3CG,SH2B2,ACSL5,PRKCE,IRS2,PRKCH,TNFRSF1B,PRKD1
NF- $\kappa$ B Activation by Viruses	4.7863E-05	0.003548134	PIK3C2B,AKT2,PIK3CG,PIK3R1,ITGA6,PRKCE,IKBKE,PRKCH,ITGB5,PRKCZ,PRKD1,ITGB3
HER-2 Signaling in Breast Cancer	7.24436E-05	0.005248075	PIK3C2B,AKT2,PIK3CG,PIK3R1,CDK6,PRKCE,PRKCH,ITGB5,PRKCZ,PRKD1,EGFR,ITGB3
VDR/RXR Activation	9.33254E-05	0.005248075	YY1,CYP24A1,PPARD,RUNX2,PRKCE,KLK6,PRKCH,NCOR2,SEM A3B,KLF4,PRKCZ,PRKD1
Xenobiotic Metabolism Signaling	0.000109648	0.005248075	PIK3R1,ABCC2,MAF,ALDH1L1,CHST15,PRKCZ,ARNT,MAP3K7,PIK3CG,CHST11,PRKCE,HS3ST1,PPP2R2C,ALDH3A1,PRKD1,ALD H1B1,MAP3K9,PIK3C2B,HDAC4,MAP3K12,HSP90AA1,PRKCH,NCOR2,NRIP1,NDST1
Growth Hormone Signaling	0.000114815	0.005248075	SOCS1,PIK3C2B,GHR,PIK3CG,PIK3R1,SOCS6,PRKCE,PRKCH,PRKCZ,ONECUT1,PRKD1
Role of Osteoblasts, Osteoclasts and Chondrocytes in Rheumatoid Arthritis	0.000114815	0.005248075	PIK3C2B,AKT2,BMP4,WNT3,PIK3R1,TAB2,CSNK1A1,WNT16,IKBKE,SMAD5,ITGB3,MAP3K7,RUNX2,PIK3CG,NFATC2,BMP7,DKK1,SFRP1,TNFRSF1B,BMP6,PPP3CA,TCF7L2
Human Embryonic Stem Cell Pluripotency	0.000158489	0.005248075	PIK3C2B,AKT2,BMP4,WNT3,PIK3R1,SMAD3,SMAD7,WNT16,SMAD5,NOG,TGFBR2,NTRK3,PIK3CG,BMP7,BMP6,TCF7L2
Wnt/ $\beta$ -catenin Signaling	0.000234423	0.006456542	GJA1,AXIN2,AKT2,WNT3,PPARD,CSNK1A1,WNT16,BCL9,MYC,TGFBR2,SOX9,MAP3K7,TLK3,BTRC,PPP2R2C,DKK1,SFRP1,TCF7L2
RANK Signaling in Osteoclasts	0.000239883	0.008128305	MAP3K12,MAP3K9,PIK3C2B,AKT2,MITF,MAP3K7,PIK3CG,PIK3R1,TAB2,NFATC2,IKBKE,PPP3CA
Virus Entry via Endocytic Pathways	0.000338844	0.008128305	PIK3C2B,HLA-A,PIK3CG,PIK3R1,ITGA6,PRKCE,PRKCH,CXADR,ITGB5,PRKCZ,PRKD1,ITGB3
Thrombopoietin Signaling	0.000436516	0.01023293	MYC,PIK3C2B,PIK3CG,PIK3R1,PRKCE,IRS2,PRKCH,PRKCZ,PRKD1
Chronic Myeloid Leukemia Signaling	0.000457088	0.012022644	TGFBR2,MYC,BCL2L1,PIK3C2B,AKT2,HDAC4,PIK3CG,PIK3R1,SMAD3,CTBP2,CDK6,IKBKE
LPS-stimulated MAPK Signaling	0.000912011	0.012022644	PIK3C2B,ATF1,MAP3K7,PIK3CG,PIK3R1,PRKCE,IKBKE,PRKCH,PRKCZ,PRKD1
Prolactin Signaling	0.000912011	0.020892961	MYC,SOCS1,PIK3C2B,PIK3CG,PIK3R1,SOCS6,PRKCE,PRKCH,PRKCZ,PRKD1
Huntington's Disease Signaling	0.001819701	0.020892961	NEUROD1,PIK3C2B,GRIN2B,AKT2,HDAC4,VTI1A,PIK3R1,PRKCZ,BCL2L1,DYNC1I2,CPLX2,PIK3CG,PRKCE,PRKCH,NCOR2,DNAJB1,GOSR2,PRKD1,EGFR
Erythropoietin Signaling	0.001862087	0.034673685	SOCS1,PIK3C2B,AKT2,PIK3CG,PIK3R1,PRKCE,PRKCH,PRKCZ,PRKD1
Role of JAK2 in Hormone-like Cytokine Signaling	0.001905461	0.034673685	SOCS1,GHR,SOCS6,SH2B2,PTPN1,IRS2
Molecular Mechanisms of Cancer	0.001995262	0.034673685	SHH,BMP4,SMAD3,PIK3R1,TAB2,SMAD5,HIF1A,PRKCZ,TGFBR2,MYC,MAP3K7,BBC3,PIK3CG,PRKCE,PRKD1,PIK3C2B,AKT2,SMAD7,CDK6,BCL2L1,RBPJ,BMP7,PRKCH,BMP6,GNAL,BCL2L1
Macropinocytosis Signaling	0.002089296	0.034673685	PIK3C2B,PIK3CG,PIK3R1,PRKCE,PRKCH,ITGB5,PRKCZ,PRKD1,ITGB3
Mouse Embryonic Stem Cell Pluripotency	0.002089296	0.034673685	MYC,PIK3C2B,AKT2,ID2,BMP4,LIF,MAP3K7,PIK3CG,PIK3R1,SMAD5,TCF7L2
ErbB4 Signaling	0.002818383	0.034673685	PIK3C2B,PIK3CG,PIK3R1,YAP1,PRKCE,PRKCH,PRKCZ,PRKD1
IL-3 Signaling	0.002818383	0.039810717	PIK3C2B,AKT2,PIK3CG,PIK3R1,PRKCE,PRKCH,PRKCZ,PPP3CA,PRKD1
HGF Signaling	0.002884032	0.039810717	MAP3K12,MAP3K9,PIK3C2B,AKT2,MAP3K7,PIK3CG,PIK3R1,PRKCE,PRKCH,PRKCZ,PRKD1
CDP-diacylglycerol Biosynthesis I	0.002884032	0.039810717	GPAM,CDS1,MBOAT2,AGPAT3
TR/RXR Activation	0.002951209	0.039810717	PIK3C2B,AKT2,LDLR,COL6A3,SLC2A1,PIK3CG,PIK3R1,NCOR2,HIF1A,TBL1XR1
Phosphatidylglycerol Biosynthesis II (Non-plastidic)	0.003715352	0.039810717	GPAM,CDS1,MBOAT2,AGPAT3
Docosahexaenoic Acid (DHA) Signaling	0.005370318	0.048977882	BCL2L1,PIK3C2B,AKT2,PIK3CG,PIK3R1,APP
Glioma Signaling	0.006025596	0.067608298	PIK3C2B,AKT2,PIK3CG,PIK3R1,CDK6,PRKCE,PRKCH,PRKCZ,PRKD1,EGFR
Role of NANOG in Mammalian Embryonic Stem Cell Pluripotency	0.006025596	0.072443596	PIK3C2B,AKT2,BMP4,LIF,WNT3,PIK3CG,PIK3R1,WNT16,BMP7,SMAD5,BMP6
JAK/Stat Signaling	0.00676083	0.072443596	BCL2L1,SOCS1,PIK3C2B,AKT2,PIK3CG,PIK3R1,SOCS6,PTPN1
Telomerase Signaling	0.007079458	0.077624712	MYC,PIK3C2B,AKT2,HDAC4,PIK3CG,PIK3R1,HSP90AA1,PPP2R2C,TERF1,EGFR
Amyotrophic Lateral Sclerosis Signaling	0.007585776	0.077624712	GRIN2B,BCL2L1,PIK3C2B,CACNA1D,GRID1,GRIK4,GDNF,PIK3CG,PIK3R1,PPP3CA
TGF- $\beta$ Signaling	0.007943282	0.081283052	TGFBR2,BMP4,MAP3K7,RUNX2,SMAD3,SMAD7,BMP7,SMAD5,TGIF1
Basal Cell Carcinoma Signaling	0.008912509	0.083176377	SHH,BMP4,GLI2,WNT3,WNT16,BMP7,BMP6,TCF7L2

NF-κB Signaling	0.008912509	0.087096359	TGFBF2,PIK3C2B,AKT2,GHR,BMP4,MAP3K7,NTRK3,PIK3CG,PIK3R1,TAB2,BTRC,TNFRSF1B,PRKCZ,EGFR
Small Cell Lung Cancer Signaling	0.009549926	0.087096359	MYC,BCL2L1,PIK3C2B,AKT2,PIK3CG,PIK3R1,CDK6,IKBKE
PEDF Signaling	0.009549926	0.087096359	BCL2L1,PIK3C2B,AKT2,GDNF,PIK3CG,PIK3R1,IKBKE,ZEB1
mTOR Signaling	0.01	0.087096359	PIK3C2B,AKT2,PIK3R1,FKBP1A,HIF1A,PRR5L,PRKCZ,DGKZ,RPS24,RPS27,PIK3CG,PRKCE,PPP2R2C,PRKCH,PRKD1
Neuregulin Signaling	0.01	0.087096359	MYC,AKT2,PIK3R1,PRKCE,HSP90AA1,PRKCH,PRKCZ,PRKD1,EGFR
Role of Macrophages, Fibroblasts and Endothelial Cells in Rheumatoid Arthritis	0.01023293	0.087096359	SOCS1,PIK3C2B,AKT2,WNT3,PIK3R1,CSNK1A1,WNT16,IKBKE,PRKCZ,MYC,MAP3K7,PIK3CG,PRKCE,NFATC2,PRKCH,DKK1,SFRP1,TNFRSF1B,PPP3CA,TCF7L2,PRKD1
IL-8 Signaling	0.010471285	0.087096359	PIK3C2B,AKT2,ANGPT2,PIK3R1,IKBKE,PRKCZ,ITGB3,RAB11FIP2,BCL2L1,PIK3CG,PRKCE,PRKCH,PRKD1,ITGB5,EGFR
BMP signaling pathway	0.010471285	0.087096359	BMP4,MAP3K7,RUNX2,SMAD7,BMP7,SMAD5,BMP6,NOG
p70S6K Signaling	0.010964782	0.087096359	PIK3C2B,AKT2,PIK3CG,SYK,PIK3R1,PRKCE,PPP2R2C,PRKCH,PRKCZ,PRKD1,EGFR
PTEN Signaling	0.010964782	0.087096359	TGFBF2,BCL2L1,AKT2,GHR,NTRK3,PIK3CG,PIK3R1,IKBKE,BCL2L1,PRKCZ,EGFR
Triacylglycerol Biosynthesis	0.011481536	0.087096359	PPAPDC1A,GPAM,MBOAT2,ELOVL1,AGPAT3 MMP21,SHH,RGS3,BMP4,GLI2,WNT3,PIK3R1,WNT16,PRKCZ,PIK3CG,ADAM19,PRKCE,SEMA3B,PPP3CA,PRKD1,PIK3C2B,NGEF,AKT2,ADAMT5,SEMA3A,NTRK3,SEMA4G,NFATC2,BMP7,PRKCH,BMP6,EPHA2,GNAL
Axonal Guidance Signaling	0.011748976	0.087096359	AKT2,RDH10,PIK3R1,SMAD3,SMAD7,SMAD5,PRKCZ,SMARCA2,PIK3CG,PRKCE,PRKCH,NRIP1,NCOR2,PRKD1
RAR Activation	0.012022644	0.087096359	GRIN2B,PRKCE,PRKCH,PRKCZ,PPP3CA,PRKD1
nNOS Signaling in Neurons	0.012022644	0.087096359	PIK3C2B,PDE2A,AKT2,CACNA1D,GUCY1A3,PIK3CG,PIK3R1,HSF90AA1
Nitric Oxide Signaling in the Cardiovascular System	0.012302688	0.087096359	PIK3C2B,AKT2,SP3,GUCY1A3,PIK3CG,PIK3R1,CSNK1A1,PRKCE,PRKCH,PRKD1,PPP3CA,PRKCZ,EGFR
Gap Junction Signaling	0.012302688	0.087096359	SOCS1,PIK3C2B,PIK3CG,SYK,PIK3R1,SH2B2,IRS2
Role of JAK1 and JAK3 in γC Cytokine Signaling	0.012589254	0.087096359	PIK3C2B,AKT2,PIK3CG,PIK3R1,PRKCE,PRKCH,PRKCZ,PRKD1
VEGF Family Ligand-Receptor Interactions	0.014125375	0.087096359	AKT2,ATF1,PIK3CG,SYK,PIK3R1,SH2B2,NFATC2,IKBKE,IRS2,PRKCZ,PPP3CA
PI3K Signaling in B Lymphocytes	0.014454398	0.09332543	BCL2L1,PIK3C2B,AKT2,PIK3CG,PIK3R1,ITGA6,F3,ITGB5,EGFR,ITGB3
Role of Tissue Factor in Cancer	0.014454398	0.09332543	MAP3K9,AKT2,CDK6,CSNK1A1,PRKCE,GRK5,PRKCH
Pyridoxal 5'-phosphate Salvage Pathway	0.014791084	0.09332543	RUNX1,BCL2L1,PIK3C2B,AKT2,PIK3CG,PIK3R1,PPP3CA
GM-CSF Signaling	0.014791084	0.09332543	RUNX1,KITLG,MYC,PIK3C2B,AKT2,PIK3CG,PIK3R1,TCF7L2
Acute Myeloid Leukemia Signaling	0.015488166	0.09332543	AKT2,PIK3CG,SYK,PIK3R1,PRKCE,PRKCH,FYB,PRKCZ,PRKD1
Fcγ Receptor-mediated Phagocytosis in Macrophages and Monocytes	0.016218101	0.095499259	PIK3C2B,AKT2,HDAC4,LIF,PIK3R1,CSNK1A1,PRKCZ,TGFBF2,MAP3K7,PIK3CG,PRKCE,PRKCH,PRKD1,PPP3CA
Role of NFAT in Cardiac Hypertrophy	0.016595869	0.097723722	PIK3C2B,AKT2,PIK3CG,PIK3R1,PPP2R2C,TNFRSF1B,PRKCZ,KSRI
Ceramide Signaling	0.017782794	0.1	MAP3K9,PIK3C2B,AKT2,PIK3R1,IKBKE,PRKCZ,MAP3K12,MAP3K7,PIK3CG,PRKCE,PRKCH,PPP2R2C,TNFRSF1B,PRKD1
Production of Nitric Oxide and Reactive Oxygen Species in Macrophages	0.019054607	0.104231743	HRH1,PIK3C2B,AKT2,PIK3CG,PIK3R1,PRKCE,NFATC2,IKBKE,PRKCH,PRKCZ,PPP3CA,PRKD1
Gqγ Signaling	0.019054607	0.109395637	FANCE,PIK3C2B,AKT2,GADD45B,HDAC4,SMARCA2,PIK3CG,PIK3R1,CDK6,RF3
Hereditary Breast Cancer Signaling	0.019498446	0.109395637	SOCS1,PIK3C2B,AKT2,PIK3CG,SYK,PIK3R1
IL-2 Signaling	0.022908677	0.109395637	TXNDC2,NXN
Thioredoxin Pathway	0.023442288	0.127350308	SARS,PSTK
Selenocysteine Biosynthesis II (Archaea and Eukaryotes)	0.023442288	0.127350308	MAP3K9,AKT2,CDK6,CSNK1A1,PRKCE,GRK5,PRKCH,UCK2
Salvage Pathways of Pyrimidine Ribonucleotides	0.024547089	0.127350308	BCL2L1,PIK3C2B,AKT2,PIK3CG,PIK3R1,IKBKE
Lymphotoxin β Receptor Signaling	0.025118864	0.130918192	PIK3C2B,AKT2,SLC2A1,PIK3CG,PIK3R1,HIF1A,ARNT
Renal Cell Carcinoma Signaling	0.025703958	0.13121999	PIK3C2B,PIK3CG,PIK3R1,PRKCE,PRKCH,PRKCZ,PRKD1,EGFR
ErbB Signaling	0.026302688	0.13121999	MYC,PIK3C2B,AKT2,PIK3CG,PIK3R1,PRKCE,PRKCH,PRKCZ,PRKD1,ITGB3
P2Y Purigenic Receptor Signaling Pathway	0.026915348	0.133352143	PIK3C2B,AKT2,MITF,PIK3CG,PIK3R1
Melanoma Signaling	0.030199517	0.134586035	AKT2,PIK3CG,PRKCE,PRKCH,PRKCZ,GNAL,PRKD1,EGFR
G Beta Gamma Signaling	0.031622777	0.150660707	MAP3K12,BCL2L1,MAP3K9,PIK3C2B,AKT2,MAP3K7,PIK3CG,SYK,PIK3R1,NFATC2,IKBKE,PPP3CA
B Cell Receptor Signaling	0.031622777	0.153108746	PRKCE,NFATC2,PRKCH,PRKCZ,PPP3CA,PRKD1
Calcium-induced T Lymphocyte Apoptosis	0.033884416	0.153108746	MYC,PIK3C2B,AKT2,PIK3CG,PIK3R1,PRKCZ
Myc Mediated Apoptosis Signaling	0.033884416	0.158124804	MAP3K12,MAP3K9,PIK3C2B,AKT2,MAP3K7,PIK3CG,PIK3R1,IKBKE,PRKCZ
NGF Signaling	0.034673685	0.158124804	GRIN2B,CACNA1D,KCNJ2,ATF1,GUCY1A3,CSNK1A1,PRKCE,PPP2R2C,PRKCH,PRKCZ,PPP3CA,PRKD1
Dopamine-DARPP32 Feedback in cAMP Signaling	0.034673685	0.158124804	PIK3C2B,PIK3CG,PIK3R1,PRKCE,NFATC2,PRKCH,PRKCZ,PPP3CA,PRKD1
fMLP Signaling in Neutrophils	0.036307805	0.158124804	DNAJB8,PIK3C2B,ABCC2,PIK3R1,MAF,PRKCZ,MAP3K7,PIK3CG,PRKCE,PRKCH,DNAJB1,FKBP5,PRKD1
NRF2-mediated Oxidative Stress Response	0.036307805	0.161435856	

Role of Pattern Recognition Receptors in Recognition of Bacteria and Viruses	0.037153523	0.161435856	PIK3C2B,PIK3CG,SYK,PIK3R1,PRKCE,PRKCH,PRKCZ,PRKD1
Cardiomyocyte Differentiation via BMP Receptors	0.03801894	0.163681652	BMP4,MAP3K7,BMP7
Natural Killer Cell Signaling	0.03801894	0.163681652	PIK3C2B,AKT2,PIK3CG,SYK,PIK3R1,PRKCE,PRKCH,PRKCZ,PRKD1
Fc Epsilon RI Signaling	0.039810717	0.163681652	PIK3C2B,AKT2,PIK3CG,SYK,PIK3R1,PRKCE,PRKCH,PRKCZ,PRKD1
S-methyl-5'-thioadenosine Degradation II	0.041686938	0.170215851	MTAP
Thiamin Salvage III	0.041686938	0.172186857	TPK1
ILK Signaling	0.041686938	0.172186857	MYC,PIK3C2B,AKT2,PIK3CG,PIK3R1,SH2B2,MYH3,MYH9,IRS2,PPP2R2C,HIF1A,ITGB5,ITGB3
IL-15 Signaling	0.042657952	0.172186857	BCL2L1,PIK3C2B,AKT2,PIK3CG,SYK,PIK3R1
CD40 Signaling	0.045708819	0.172186857	PIK3C2B,ATF1,MAP3K7,PIK3CG,PIK3R1,IKBKE
Reelin Signaling in Neurons	0.047863009	0.18238957	MAP3K9,PIK3C2B,PIK3CG,PIK3R1,ITGA6,APP,ITGB3
IL-17A Signaling in Airway Cells	0.047863009	0.187068214	PIK3C2B,AKT2,MAP3K7,PIK3CG,PIK3R1,IKBKE
PKCθ Signaling in T Lymphocytes	0.048977882	0.187068214	MAP3K12,MAP3K9,PIK3C2B,MAP3K7,PIK3CG,PIK3R1,NFATC2,IKBKE,PPP3CA
IL-12 Signaling and Production in Macrophages	0.048977882	0.187068214	PIK3C2B,AKT2,PIK3CG,PIK3R1,MAF,PRKCE,IKBKE,PRKCH,PRKCZ,PRKD1
Maturity Onset Diabetes of Young (MODY) Signaling	0.048977882	0.187068214	NEUROD1,CACNA1D,FOXA2

## Supplementary Table 6: All HeLaS3 (exons 1-3) TCF7L2 Ingenuity Conical pathways with at least nominal $P < 0.05$

Ingenuity Canonical Pathways	P-value	B-H Multiple testing correction p-value	Molecules
			CDKN2A, WNT3, CSNK1G1, AXIN1, TGFBR3, PPP2R5B, SOX12, CSNK1A1, WNT16, GSK3A, BCL9, SOX13, CCND1, TCF7, SOX2, TGFBR2, MYC, WNT7B, RARA, PPM1L, CSNK2A1, WNT4, GSK3B, FZD2, WNT5B, SOX4, AKT2, GJA1, AXIN2, APP1, CREBBP, CSNK1D, FZD9, TCF3, CDH2, CDH1, CDH12, CDH5, PPP2R4, PPP2R2B, GNAO1, TGFBR3, TLE3, LEF1, SOX8, SFRP1, DVL2, FZD10, MMP7, FRA1, LRP6, MARK2, FZD1, SOX17, CSNK1E, SOX9, JUN, NLK, MAP3K7, TGFBR2, PPP2R5C, PPP2R2C, SOX18, CTN NB1, SOX7, UBB, PPARD, CSNK1G3, DVL1, HDAC1, GNAQ, MDM2, TCF7L1, FZD8, CSNK2A2, FZD4, WNT3A, SOX6, CD44, TLE4, NR5A2, DVL3, DKK1, PPP2R5E, UBC, PPP2R1B, ACVR2A, WNT11, LRP1, TCF7L2, WNT5A
Wnt/ $\beta$ -catenin Signaling	1.26E-07	7.08E-05	RAF2B, RAF1, SHH, RAPGEF1, BMP4, APH1B, AXIN1, PIK3R1, MAPK3, TAB2, NCSTN, GSK3A, KRAS, RBL1, CCND1, GNA15, GN A13, HIPK2, FASLG, PIK3C2B, SMAD2, ARHGFEF4, CCNE2, AKT2, PRKCO, RALB, PTC1, CREBBP, NFKB2, TCF3, CDH1, CCND 3, MAX, IRS1, ARHGFEF18, MAP2K3, ARHGFEF9, NOTCH1, GNAL, CAMK2G, RAP1B, FYN, RALA, LRP6, PSEN2, FZD1, PRKCC, CH EK1, ARHGFEF19, HHAT, JUN, RHOD, PIK3C3, SOS1, RHOV, BID, PRKCE, ARHGFEF3, CTN NB1, CASP8, PMAIP1, RHOC, GRB2, G NA12, GNAQ, MDM2, SIN3A, BAK1, FADD, FOS, GNAI3, CCNE1, CDKN1A, RASGRF1, RBPJ, BMP7, BMP6, ATR, LRP1, CTN ND1, CDKN2A, GAB2, JAK1, SMAD3, MYC, TGFBR2, PTK2, CTNNA2, CAMK2D, RHOB, MRAS, GSK3B, RASA1, FZD2, BIRC3, RALGDS , CDC25A, ADCY9, CYCS, CDK6, FZD9, RALBP1, PIK3R3, BCL2L1, BMPR1B, CBL, RAB1F, RND3, ARHGFEF16, GNAO1, MAPK10, TGFBR3, LEF1, PRKCH, FNBP1, CDK2, FZD10, RELA, BMP2, ABL1, HIF1A, SMAD5, NFKB1, CDKN2B, PRKAG1, FAS, BCL2, NLK, N FKBA, MAP3K7, TGFBR2, ARHGFEF2, RHOF, CHEK2, PRKCA, ARHGFEF12, PIK3C2A, DVL1, ADCY3, GNAI1, SMAD7, SMAD6, BMP 5, XIAP, FZD8, RHOV, MAPK14, PRKCI, RRSAS2, FZD4, FOXO1, NF1, PRKAG2, BCL2L1, PRKAR1A, WNT5A
Molecular Mechanisms of Cancer	4.47E-06	1.29E-03	SOC31, SOC33, SLC27A2, PRKAB2, MAPK3, PIK3R1, SOCS6, PDPK1, SLC27A4, IKKBK, IKKBG, ACSBG1, ACSL5, ABCC8, PRK AA1, IRS2, NSMAF, TNFRSF11B, PIK3C2B, AKT2, ACSL3, PRKCO, NFKB2, SLC2A4, PIK3R3, IRS1, SLC27A6, MAPK10, PRKCH, SOCS5, RELA, SOCS2, PKM, SMPD1, NFKB1, PRKCC, PRKAG1, SLC27A5, NFKBIA, MAP3K7, SLC2A2, PIK3C3, PRKAA2, PRKCE, ACSL4, TNFRSF1B, SMPD3, PRKCA, PPARG, PIK3C2A, TNFRSF1A, MAP3K1, CD36, IKKBK, CEBPB, ACSBG2, TRAF2, PRKCI I, SH2B2, PRKAG2, ENPP7, ACSL1
Type II Diabetes Mellitus Signaling	9.12E-06	1.74E-03	BMP4, WNT3, AXIN1, TGFBR3, TCF7, TGFBR2, GSK3B, FZD2, SMAD2, CCNE2, PRKCO, FZD9, TCF3, ATF2, BMPR1B, TGFBR3, P RKCH, LEF1, CDK2, FZD10, BMP2, LRP6, SMAD5, FZD1, NOG, PRKCC, MAP3K7, TGFBR2, PRKCE, CTN NB1, PRKCA, DVL1, CDCE 6, TCF7L1, BMP5, FZD8, NKX2-5, CCNE1, MAPK14, PRKCI, FZD4, MEF2C, BMP7, DKK1, BMP6, TCF7L2, ACVR2A, WNT11, LRP1
Factors Promoting Cardiogenesis in Vertebrates	3.09E-05	4.17E-03	RAF1, SOCS1, AXIN1, PIK3R1, MAPK3, KRAS, IL6, CCND1, VEGFA, TLR10, IL1RL2, TRAF4, PLCL1, WNT5B, PIK3C2B, AKT2, PR KCO, CREBBP, CREB3, STAT3, PLCL2, TCF3, ATF2, TRAF6, MAP2K3, SFRP1, CAMK2G, FN1, FGF2, PDIA3, LRP6, FZD1, PRKCC , JUN, CSAR1, F2RL1, PIK3C3, CEBPA, PRKCE, TNFRSF1B, CTN NB1, FCGFR3, PPP3CA, TNFRSF1A, DAAAM1, SMAD7, SMAD6, BMP 5, XIAP, FZD8, RHOV, MAPK14, PRKCI, RRSAS2, FZD4, FOXO1, NF1, PRKAG2, BCL2L1, PRKAR1A, WNT5A
Role of Macrophages, Fibroblasts and Endothelial Cells in Rheumatoid Arthritis	3.63E-05	4.17E-03	RAF1, SHH, MAPK3, GSK3A, NTN1, PTPRC, MYLK, GNB1, CDKN3, DUSP7, GNA13, DUSP12, PLCL1, CDC16, GNG12, PRKCO, C REBBP, CREB3, PTC1, YWHAZ, PTPN3, ITPR1, NFKB2, PLCL2, TCF3, PTP4A1, ATF2, PDE8A, AKAP13, MYL12A, PTPRH, PTP RB, CREM, EYA3, ITPR3, GNB2, ANAPC5, DUSP4, CAMK2G, RAP1B, AKAP12, HIST1H1C, FLNB, AKAP9, PTPN2, PDE7A, PTK2B , PDIA3, PTPN13, PPP1R3C, DUSP6, PTPN14, CDC23, AKAP7, DUSP2, PRKCC, GNG7, TIMM50, MPE1, DUSP5, PTPN14, HTH2, PTPRJ, DCC, PRKCE, CNGB3, CTN NB1, GNB1L, PPP3CA, MTRR3, PTPRK, GNAQ, PLCG1, DUSP21, CALM1 (includes others), GNAI3, PPP1R14D, CDC14B, CNGB1, PTGS2, SFN, TCF7L2, AKAP1, SMAD3, PDE12, PDE3A, GNB2L1, HIST1H1A, TCF 7, PTEN, TGFBR2, YWHAQ, ROCK2, PTK2, TH, PLCD3, PLCE1, CAMK2D, PDE7B, RHO, PPP3R1, RYR3, GSK3B, PPP1C, CDC2 5A, ADCY9, PTPRE, YWHAZ, ITPR2, PDE10A, PDE4B, PTPDC1, PTPRM, GYS2, EPM2A, DUSP9, PYGM, DUSP1, MYL12B, PTPR S, TGFBR3, PPP1R12A, LEF1, PRKCH, RELA, CAMK4, ANAPC1/ANAPC1P1, PDE4A, PPP1CB, PDE1A, NFKB1, PHK2, PRKAG1, NFAT5, GNG11, NFKBIA, DUSP10, PTPN1, TGFBR2, VASP, PRKCA, ATF1, MAP3K1, ADCY3, CHP1, GNAI1, PYGL, PYGB, AKAP6, TCF7L1, NFATC4, PDE4D, PPP1R3D, PRKCI, PTPRU, PRKAG2, NFATC2, PDE5A, PDE8B, PTPRR, PRKAR1A, DUSP16
Protein Kinase A Signaling	7.59E-05	7.24E-03	RAF1, BMP4, JAK1, LIF, T, AXIN1, MAPK3, PIK3R1, KRAS, TCF7, MYC, SOX2, LIFR, MRAS, GSK3B, FZD2, PIK3C2B, AKT2, CREBB P, FZD9, STAT3, TCF3, PIK3R3, LEF1, DVL2, IL6ST, FZD10, ID2, FZD1, SMAD5, FOXD3, ID1, MAP3K7, PIK3C3, SOS1, CTN NB1, ZF P42, PIK3C2A, GRB2, DVL1, TCF7L1, ID3, XIAP, FZD8, WNT3A, MAPK14, RRSAS2, FZD4, DVL3, TCF7L2, ID4
Mouse Embryonic Stem Cell Proliferation	1.17E-04	8.91E-03	RAF1, MAPK3, PIK3R1, PDPK1, KRAS, PTEN, PTPRC, PLCD3, IKKBK, IKKBG, CAMK2D, PLCE1, PPP3R1, MRAS, IRS2, PLCL1, IL 4R, AKT2, C3, ATF3, ITPR2, NFKB2, MALT1, PLCL2, ITPR1, ATF2, CBL, CD180, SYK, IRS1, ITPR3, CAMK2G, FYN, RELA, CAMK4, PD IA3, ABL1, ATF6, NFKB1, PRKCC, NFKBIA, JUN, NFAT5, FOXO3, PPP3CA, VAV2, NFAT1, CHP1, PLCG1, IKKBE, NFATC4, INPP5 D, TLR4, CALM1 (includes others), FOS, RRSAS2, PRKCI, BCL10, VAV3, SH2B2, LYN, NFATC2, PLEKH42
PI3K Signaling in B Lymphocytes	1.26E-04	8.91E-03	PLD2, PRKAB2, PIK3R1, MAPK3, PPP2R5B, PDPK1, EIF4A2, KRAS, RPS11, RPS7, VEGFA, RPS24, EIF3B, RHOB, PROK1, EIF3D , PPM1L, MRAS, PRKAA1, PIK3C2B, AKT2, PRKCO, DDIT4, VEGFC, EIF4G3, EIF3E, PLD1, EIF3M, PIK3R3, ATG13, RPS6KA6, RN D3, PPP2R4, IRS1, EIF4A3, PPP2R2B, RPS15, PRKCH, RPS15A, RPS6KA1, FNBP1, RPS27A, TSC1, ULK1, RPS6KA3, RPS6, FK B P1A, HIF1A, PRRS5, PDGFC, PRKCC, PRKAG1, HMOX1, RPS27, RHOD, PIK3C3, RPS16, RPS6KB2, PRKAA2, EIF3A, RHOU, PRK CE, PPP2R5C, PPP2R2C, GNB1L, RHOF, RPS3, PRKCA, MAPKAP1, EIF3H, PIK3C2A, EIF3F, RHOC, RPS19, RPS27L, DGGK2, RH OV, PRKCI, RRSAS2, RPS5, RPS26, PRKAG2, RPS6KA5, PPP2R5E, PPP2R1B, RPS14, ARHGAP8/RRS1, ARHGAP8
mTOR Signaling	1.82E-04	1.17E-02	RAF1, SOCS1, SOCS3, JAK1, CTGF, MAPK3, PIK3R1, SOCS6, PDPK1, KRAS, YWHAQ, PTK2, MRAS, CSNK2A1, IRS2, IGF1BP1, R ASA1, IGF1BP6, PIK3C2B, AKT2, YWHAZ, STAT3, PIK3R3, IRS1, IGF1BP3, CYR61, SOCS5, SOCS2, IGF1BP2, PRKCC, PRK AG1, JUN, PIK3C3, SOS1, FOXO3, RPS6KB2, IGF1R, PIK3C2A, GRB2, GRB10, CSNK2A2, FOS, NEDD4, PRKCI, RRSAS2, NOV, FO XO1, PRKAG2, SFN, PRKAR1A
IGF-1 Signaling	2.34E-04	1.26E-02	RAF1, LIF, CAMK1D, MAPK3, PIK3R1, GNB2L1, CSNK1A1, HAND1, KRAS, IL6, TGFBR2, GNB1, PLCD3, PLCE1, CAMK2D, HDAC 11, PPP3R1, HDAC7, MRAS, GSK3B, PLCL1, GNG12, ADCY9, PIK3C2B, AKT2, HDAC4, PRKCI, HDAC8, HDAC2, ITPR2, ITPR1, P LCL2, PIK3R3, ITPR3, TGFBR3, CNEB2, MAPK10, PCAN3, PRKCH, MAP2K3, SLC6A1, CAMK2G, IL6ST, CAMK4, PDIA3, PRKAG1, P RKCC, GNG7, GNG11, MAP3K7, PIK3C3, SOS1, IGF1R, TGFBR2, PRKCE, GNB1L, PPP3CA, PRKCA, HDAC9, MEF2B, MEF2B, MEF2B, PIK3C2A, GRB2, MAP3K1, HDAC1, ADCY3, CHP1, GNAI1, SLC8A3, MEF2A, GNAQ, PLCG1, NFATC4, CTF1, GNAI3, CAL M1 (includes others), RCAN1, NKX2-5, MAPK14, PRKCI, RRSAS2, MEF2D, PRKAG2, MEF2C, PRKAR1A
Role of NFAT in Cardiac Hypertrophy	2.51E-04	1.26E-02	GAB2, RAF1, JAK1, MAPK3, PIK3R1, PPP2R5B, PDPK1, GSK3A, KRAS, CCND1, PTEN, YWHAQ, IKKBK, IKKBG, GNB1L, MRAS, G SK3B, THEM4, MCL1, ITGA4, AKT2, YWHAZ, YWHAZ, ITGA5, NFKB2, GYS2, SYNU2, PIK3R3, BCL2L1, PPP2R4, PPP2R2B, HS9 P 0A1, IGTB1, GRSB, ITGA2, MDM2, IKKBE, ITGA3, INPP5D, RRSAS2, FOXO1, CDKN1A, MAP3K8, PTGS2, PPP2R5E, SFN, PPP2R1B , CDKN2A, GADD45B, JMY, GADD45G, PIK3R1, CCND1, FAS, CHEK1, BCL2, PTEN, CCNG1, JUN, GADD45A, PIK3C3, CKNK, GSK 3B, SERPINE5, CTN NB1, HIPK2, TNFRSF10A, CHEK2, PIK3C2B, PMAIP1, AKT2, TP63, PIK3C2A, MED1, THBS1, HDAC1, TNFRS F10B, PERP, CSNK1D, MDM2, RPRM, TP53BP2, TP53I3, SERPINE2, PIK3R3, KAT2B, BCL2L1, PCNA, MDM4, MAPK14, SNAI2, C DKN1A, SFN, ATR, CDK2, DRAM1
PI3K/AKT Signaling	2.75E-04	1.26E-02	RAF1, PLD2, MAPK3, KRAS, GNB1, HDAC7, PLA2G4F, GNA13, GNG12, ITGA4, ARHGFEF4, PRKCO, RALB, CREB3, CREBBP, ITG A5, NFKB2, ITPR1, PLD1, ATF2, PLA2G6, MYL12A, SYK, ITPR3, GNB2, ARHGFEF18, ARHGFEF9, RAP1B, FYN, HLA, GNG7, PRKC Z, TGM2, ARHGFEF19, RHOD, SOS1, RHOV, PRKCE, ARHGFEF3, GNB1L, PPP3CA, ITGB1, FCGR2A, GRB2, RHOC, ITGA2, GNAQ, PLA2G3, PLCG1, ITGA3, PLA2G4A, CALM1 (includes others), MEF2D, LYN, MPRIP, GNB2L1, PLCE1, RHOB, PPP3R1, HDAC11, MRAS, RALGDS, ADCY9, HDAC4, HDAC8, HDAC2, ITP R2, RND3, MYL12B, ARHGFEF16, LAT, PPP1R12B, PPP1R12A, PRKCH, FNBP1, RELA, CAMK4, RPS6KA3, PPP1CB, NFKB1, PLA 2G4E, HMOX1, NFAT5, GNG11, AHNAK, ARHGFEF2, MARCKS, RHOF, PRKCA, HDAC9, ARHGFEF12, MEF2B, MEF2B, PLA2G4C, HDAC1, ADCY3, CHP1, MEF2A, PLA2G1B, NFATC4, RHOV, RRSAS2, PRKCI, NFATC2, MEF2C
Phospholipase C Signaling	3.55E-04	1.45E-02	IL6ST, LIF, SGK1, RPS6KA3, KRAS, NGF, PRKCC, YWHAQ, MYC, FOXO3, MRAS, RPS6KB2, GNA13, EGFR, MEF2B, NBN, MEF2B, YWHAZ, GNA12, CREBBP, CREB3, GNAQ, YWHAZ, MEF2A, ATF2, CTF1, FOS, RPS6KA6, RRSAS2, MEF2D, MEF2C, MAP 3K8, RPS6KA5, RPS6KA1, SFN, WNK1, ELK4
ERK5 Signaling	5.75E-04	2.04E-02	SLIT3, DPYSL2, SHH, RAF1, GLI2, BMP4, ITSN1, MAPK3, PIK3R1, ARPC5, KRAS, SEMA4F, ADAM8, NTN1, GNB1, VEGFA, GNA1 5, BAIAP2, ABLIM3, ARPC1A, GNA13, ITGL1, GNG12, WNT5B, ITGA4, PIK3C2B, AKT2, PRKCO, KALRN, COP55, PTC1H1, ITGA5, PLCL2, MYL12A, GNB2, RTN4, EPHA2, GNAL, RAP1B, FYN, ADAM17, UNC5A, BDNF, PDIA3, EPHA4, FZD1, PLXNA2, ABLIM1, G NG7, PRKCC, MYSM1, PLXNA1, RHOD, SRGAP1, PIK3C3, EFNA5, SOS1, DCC, PRKCE, PSM14, ROBO2, RASSF5, GNB1L, PP P3CA, UNC5C, GLIS1, ITGB1, NR2P, GRB2, GNA12, ITGA2, GNAQ, PLCG1, EPHA3, SLIT2, ITGA3, EFNA1, SEMA3A, GNAI3, WIP F1, WNT3A, TUBA1A, SEMA4D, NR2P3, EPHA5, BMP7, SEMA3C, BMP6, WNT3, EPHB2, GNB2L1, UNC5B, MMP13, WNT16, LIMK 2, PTK2, ROCK2, PLCD3, PLCE1, CFL2, SEMA3D, ADAM28, PROK1, WNT7B, PPP3R1, MRAS, UNC5D, WNT4, ABLI2M, TUBA1C, GSK3B, ADAMT5S, FZD2, RASA1, EPHA7, NGEF, PAPPA, TUBB3, ADAMT51, VEGFC, FZD9, ADAMT5, TUBA1B, PDGFR, PIK3 R3, EPHA6, SDCBP, ADAM12, MYL12B, SEMA6D, GNAO1, PRKCH, FZD10, ERAP2, ADAMT57, MMP7, TUBA3E, PDGFA, BMP2, ABL1, NGF, BCAR1, ROBO1, PDGFC, SEMA4C, PRKAG1, WASL, NFAT5, GNG11, PLXNB1, SEMA3B, SHANK2, SEMA3F, VASP, ACE, PRKCA, PLXNC1, ARHGFEF12, PIK3C2A, CXCR4, C9orf3, CHP1, GNAI1, NFATC4, PLXND1, BMP5, EFNA4, FZD8, PRKCI, R RAS2, FZD4, LINGO1, PRKAG2, NFATC2, SEMA4B, MMP9, WNT11, WNT5A, PRKAR1A
Axonal Guidance Signaling	5.75E-04	2.04E-02	RAF1, PIK3R1, MAPK3, ARPC5, SLC9A1, CLIP1, GNB1, MYLK, GNA15, EZR, BAIAP2, ARPC1A, GNA13, GNG12, ITGA4, MAP3K9, PIK3C2B, ARHGFEF4, ITGA5, NFKB2, KIAA1804, PLD1, CDH1, CDH2, MYL12A, CDH12, CDH5, NCF2, GNB2, ARHGFEF18, PARD3,
Signaling by Rho Family GTPases	6.92E-04	2.14E-02	











## Supplementary Table 7: All HeLaS3 (exons 4-16) TCF7L2 Ingenuity Conical pathways with at least nominal $P < 0.05$

Ingenuity Canonical Pathways	P-value	B-H Multiple testing correction p-value	Molecules
Aryl Hydrocarbon Receptor Signaling	0.00017	0.046	CDKN2A,NQO2,ALDH1L1,NFKB1,CCND1,SMARCA4,ARNT,NR2F1,TGM2,MYC,NCOA7,SP1,GSTM4,CHEK2,AHR,GSTA3,MED1,ALDH8A1,CDK6,SLC35A2,MDM2,FOS,CCND3,NFIB,NCOR2,ATR,GSTP1,CDK2,MGST3
Wnt/ $\beta$ -catenin Signaling	0.00019	0.046	CDKN2A,FZD10,TGFBR3,CSNK1A1,BCL9,SOX13,CCND1,TCF7,SOX17,TGFBR2,MYC,SOX9,MAP3K7,SOX4,AXIN2,AKT2,CSNK1G3,CREBBP,MDM2,FZD9,TCF3,PPP2R2B,TFLE4,CD44,TFLE3,NR5A2,LEF1,DKK1,SFRP1,PPP2R5E,UBC,LRP1,TCF7L2,WNT5A
Type II Diabetes Mellitus Signaling	0.00035	0.050	SOCS1,SLC27A2,SOCS2,PKM,NFKB1,MAP3K7,SLC2A2,ACSL4,IRS2,NSMAF,TNFRSF11B,PPARG,PIK3C2B,AKT2,PIK3C2A,MAP3K1,CD36,IKBKE,CEBPB,ACSBG2,SLC2A4,IRS1,SH2B2,ENPP7,SOCS5
Cell Cycle: G1/S Checkpoint Regulation	0.00120	0.14	CDKN2A,HDAC4,HDAC8,SMAD3,CDK6,MDM2,CCND1,CDKN2B,SKP1/SKP1P2,MYC,NRG1,CCND3,MAX,ATR,CDK2
p53 Signaling	0.00191	0.16	CDKN2A,PIK3C2B,PAI1,AKT2,GADD45B,TP63,JMY,PIK3C2A,MED1,MDM2,CCND1,SERPINE2,BCL2,MDM4,SNAI2,SERPINE5,SFN,ATR,CHEK2,CDK2
Factors Promoting Cardiogenesis in Vertebrates	0.00204	0.16	SMAD2,FZD10,TGFBR3,FZD9,TCF3,TCF7,NOG,ATF2,TGFBR2,NKX2-5,MAP3K7,MEF2C,LEF1,BMP7,DKK1,BMP6,LRP1,TCF7L2,CDK2
ILK Signaling	0.00347	0.21	FLNB,HIF1A,NFKB1,CCND1,PDGFC,MYC,CFL2,RHOB,RHOD,IRS2,ITGB4,NOS2,ACTC1,ITGB1,PIK3C2B,AKT2,PIK3C2A,TMSB10,TMSB4X,CREBBP,ATF2,FOS,RND3,IRS1,SNAI2,SH2B2,PPP2R2B,LEF1,RPS6KA5,PTGS2,PPP2R5E,ITGB6,FNBP1
TR/RXR Activation	0.00380	0.21	PIK3C2B,AKT2,PIK3C2A,NXP2,MED1,MDM2,THRA,PFKP,HIF1A,DIO3,SLC16A3,SCARB1,SREBF1,STRBP,NCOR2,TBL1XR1,THRB,PPARGC1A
Prolactin Signaling	0.00427	0.21	FYN,SOCS1,PIK3C2B,PIK3C2A,GRB2,SOCS2,CREBBP,CEBPB,NR3C1,TCF7,MYC,FOS,SP1,IRS1,STAT1,SOCS5
Human Embryonic Stem Cell Pluripotency	0.00447	0.21	FZD10,FGF2,SMAD3,NGF,PDGFC,TCF7,NOG,TGFBR2,PIK3C2B,SMAD2,AKT2,PIK3C2A,SMAD7,SMAD6,FGFR2,FZD9,TCF3,INHBA,NTRK3,LEF1,BMP7,BMP6,TCF7L2,SALL4,WNT5A
ERK5 Signaling	0.00646	0.26	IL6ST,LIF,YWHAQ,CREBBP,NGF,ATF2,MYC,YWHAQ,FOS,MAP3K8,MEF2C,RPS6KA5,SFN,ELK4
TGF- $\beta$ Signaling	0.00676	0.26	SMAD2,GRB2,SMAD3,CREBBP,SKI,SMAD6,SMAD7,TGIF1,INHBA,BCL2,TGFBR2,NKX2-5,FOS,RUNX2,MAP3K7,BMP7,HNF4A
Molecular Mechanisms of Cancer	0.00724	0.26	CDKN2A,SMAD3,TAB2,CCND1,MYC,TGFBR2,CAMK2D,RHOB,ADCY9,SMAD2,PIK3C2B,AKT2,CREBBP,CDK6,FZD9,TCF3,MAX,CCND3,RND3,IRS1,LEF1,CFLAR,GNAL,FNBP1,CDK2,FZD10,FYN,PSEN2,HIF1A,NFKB1,CDKN2B,BCL2,RHOD,MAP3K7,BID,CHEK2,PAI1,PIK3C2A,GRB2,SMAD7,SMAD6,MDM2,FADD,GNAI3,FOS,BMP7,BMP6,ATR,LRP1,BCL2L1,WNT5A
Small Cell Lung Cancer Signaling	0.00794	0.27	MYC,PIK3C2B,AKT2,MAX,PIK3C2A,CKS1B,CDK6,BID,IKBKE,PTGS2,NFKB1,CDKN2B,CCND1,CDK2,BCL2
Colorectal Cancer Metastasis Signaling	0.01000	0.30	IL6ST,SIAH1,FZD10,MMP20,SMAD3,MMP16,NFKB1,CCND1,PDGFC,TCF7,TGFBR2,MYC,NGG11,ARRB1,RHOB,RHOD,NOS2,STAT1,ADCY9,SMAD2,PIK3C2B,AKT2,PIK3C2A,GRB2,FZD9,IFNGR1,TCF3,TLR4,FOS,TLR5,RND3,LEF1,PTGS2,LRP1,FNBP1,TCF7L2,WNT5A
Protein Kinase A Signaling	0.01023	0.30	SMAD3,TCF7,TGFBR2,YWHAQ,ROCK2,PTPRC,CAMK2D,PDE7B,PPP3R1,CDKN3,ADCY9,YWHAQ,CREBBP,PDE4B,PLCL2,TCF3,PTP4A1,ATF2,EPM2A,MYL12A,DUSP1,PTPRS,LEF1,DUSP4,AKAP12,FLNB,PDIA3,PDE4A,PPP1CB,CDK23,NFKB1,MPPE1,NGG11,PTPRJ,DU SP10,PTPN1,CNGB3,MTMR3,ATF1,MAP3K1,AKAP6,NFATC4,PDE4D,DUSP21,GNAI3,PPP1R14D,CDK14B,PDE5A,NFATC2,CNGB1,PTGS2,SFN,TCF7L2,AKAP1
L-glutamine Biosynthesis II (tRNA-dependent)	0.01175	0.31	QRSL1,PET112
PI3K Signaling in B Lymphocytes	0.01202	0.31	FYN,AKT2,ATF3,ATF1,PDIA3,IKBKE,PLCL2,NFATC4,NFKB1,ATF2,PTPRC,TLR4,FOS,CAMK2D,BCL10,VAV3,SYK,IRS1,PPP3R1,SH2B2,NFATC2,IRS2
Mouse Embryonic Stem Cell Pluripotency	0.01230	0.31	IL6ST,FZD10,PIK3C2B,AKT2,LIF,PIK3C2A,GRB2,CREBBP,FZD9,TCF3,TCF7,LIFR,MYC,ID1,MAP3K7,LEF1,TCF7L2,ID4
Cell Cycle: G2/M DNA Damage Checkpoint Regulation	0.01445	0.34	YWHAQ,CDKN2A,MDM4,YWHAQ,CKS1B,MDM2,SFN,ATR,SKP1/SKP1P2,CHEK2
FXR/RXR Activation	0.01698	0.34	PPARG,MLX1PL,AKT2,SLC4A2,LIPC,CYP27A1,CREBBP,IL33,ABCB4,SCARB1,SREBF1,FOX A2,FBP1,NR5A2,HNF4A,PPARGC1A
RhoGDI Signaling	0.01778	0.34	ARPC5,ROCK2,NGG11,CFL2,RHOB,RHOD,ARHGAP12,ACTC1,ITGB1,ITGA2,CREBBP,RDX,CDH6,ITGA3,CDH19,ARHGAP5,GNAI3,DGKZ,PIP5K1A,MYL12A,CDH9,RND3,CDH10,PPP1R12B,CD44,CDH8,GNAL,FNBP1
Role of JAK2 in Hormone-like Cytokine Signaling	0.01778	0.34	SOCS1,IRS1,SH2B2,PTPN1,SOCS2,IRS2,STAT1,SOCS5
Stearate Biosynthesis I (Animals)	0.01778	0.34	SRD5A3,DHCR24,SLC27A2,ACSL4,ACOT9,ELOVL1,ACSBG2,HNF4A
Myc Mediated Apoptosis Signaling	0.01950	0.34	YWHAQ,CDKN2A,FADD,MYC,PIK3C2B,AKT2,YWHAQ,PIK3C2A,GRB2,BID,SFN,BCL2
Urea Cycle	0.01950	0.34	ASS1,ARG2,CPS1
Thioredoxin Pathway	0.01950	0.34	TXNDC2,TXN,NXN
Thyroid Cancer Signaling	0.02455	0.39	PPARG,MYC,NTRK3,LEF1,NGF,TCF3,CCND1,TCF7,TCF7L2
NRF2-mediated Oxidative Stress Response	0.02512	0.39	FTL,NQO2,DNAJB2,SCARB1,MAP3K7,GSTM4,TXN,FKBP5,ACTC1,GSTA3,PIK3C2B,DNAJB8,PIK3C2A,MAP3K1,CREBBP,SLC35A2,JUNB,MAFK,BACH1,FOS,STIP1,CAT,DNAJC5B,AOX1,ENC1,ABCC4,GSTP1,MGST3
Role of Osteoblasts, Osteoclasts and Chondrocytes in Rheumatoid Arthritis	0.02570	0.39	FZD10,TAB2,CSNK1A1,SP7,NFKB1,TCF7,BCL2,RUNX2,MAP3K7,PPP3R1,TNFRSF11B,ITGB1,PIK3C2B,AKT2,PIK3C2A,ITGA2,SMAD6,IKBKE,FZD9,NFATC4,ITGA3,TCF3,IL33,FOS,NFATC2,BMP7,LEF1,DKK1,SFRP1,BMP6,LRP1,TCF7L2,WNT5A
Polyamine Regulation in Colon Cancer	0.02570	0.39	PPARG,MYC,MAX,AZIN1,SAT1,ODC1
LPS/IL-1 Mediated Inhibition of RXR Function	0.02818	0.42	LIPC,SLC27A2,CHST7,ALDH1L1,ABCA1,MAOB,UST,SCARB1,MAP3K7,GSTM4,ACSL4,XP O1,CHST11,TNFRSF11B,GSTA3,ABCB1,CYP2A7,MAP3K1,ALDH8A1,SLC35A2,ACSBG2,PPARGC1A,IL33,TLR4,SREBF1,CAT,NR5A2,ABCC4,GSTP1,MGST3,PPARGC1A
Ephrin A Signaling	0.03020	0.43	ROCK2,EPHA7,FYN,PIK3C2B,CFL2,PIK3C2A,VAV3,EPHA5,EPHA2,EFNA1
PPAR Signaling	0.03090	0.43	PPARG,GRB2,MED1,CREBBP,IKBKE,NFKB1,PDGFC,IL33,NR2F1,FOS,MAP3K7,PTGS2,NCOR2,CITED2,PPARGC1A,TNFRSF11B

Chondroitin Sulfate Degradation (Metazoa)	0.03311	0.44	HYAL1,CD44,HEXB,HYAL4
Pancreatic Adenocarcinoma Signaling	0.03467	0.44	CDKN2A,SMAD2,PIK3C2B,AKT2,PIK3C2A,GRB2,SMAD3,MDM2,NFKB1,PDGFC,CCND1,CDKN2B,PLD1,BCL2,TGFBR2,PTGS2,STAT1,CDK2
Acute Myeloid Leukemia Signaling	0.03467	0.44	RUNX1,PIK3C2B,AKT2,PIK3C2A,GRB2,TCF3,NFKB1,CCND1,TCF7,MYC,KITLG,PIM1,LEF1,TCF7L2
Actin Nucleation by ARP-WASP Complex	0.03548	0.44	ROCK2,ITGB1,RND3,RHOB,GRB2,RHOD,ARPC5,ITGA2,PPP1R12B,ITGA3,FNBP1
Chronic Myeloid Leukemia Signaling	0.03715	0.44	CDKN2A,PIK3C2B,AKT2,HDAC4,HDAC8,PIK3C2A,GRB2,SMAD3,CDK6,MDM2,IKBKE,NFKB1,CCND1,MECOM,TGFBR2,MYC
Cardiomyocyte Differentiation via BMP Receptors	0.03802	0.44	NKX2-5,MAP3K7,SMAD6,BMP7,ATF2
Regulation of IL-2 Expression in Activated and Anergic T Lymphocytes	0.03890	0.44	SMAD2,FYN,GRB2,SMAD3,MAP3K1,IKBKE,NFATC4,NFKB1,TGFBR2,FOS,BCL10,PPP3R1,VAV3,NFATC2
HIF1α Signaling	0.03890	0.44	PIK3C2B,AKT2,MMP20,PIK3C2A,MAPK4,MMP16,CREBBP,MDM2,HIF1A,PDGFC,SLC2A4,SLC2A3,ARNT,EDN1,SLC2A2,EGLN3,NOS2
Role of Macrophages, Fibroblasts and Endothelial Cells in Rheumatoid Arthritis	0.03981	0.44	IL6ST,FZD10,SOCS1,FGF2,PDIA3,CSNK1A1,NFKB1,CCND1,PDGFC,TCF7,ROCK2,MYC,CAMK2D,MAP3K7,PPP3R1,NOS2,TNFRSF11B,PIK3C2B,IL8,AKT2,PIK3C2A,CREBBP,IKBKE,FZD9,CEBPB,PLCL2,NFATC4,TCF3,ATF2,IL33,TLR4,FOS,TLR5,NFATC2,LEF1,DKK1,SFRP1,IRAK4,LRP1,TCF7L2,WNT5A
Role of IL-17A in Psoriasis	0.04365	0.46	S100A7,IL8,CCL20,CXCL5
Dermatan Sulfate Degradation (Metazoa)	0.04365	0.46	HYAL1,CD44,HEXB,HYAL4
CDK5 Signaling	0.04571	0.46	ITGB1,ADCY9,ITGA2,ITGA6,PPP1CB,ITGA3,NGF,CDK5R1,LAMC1,PPP1R14D,PPP2R2B,LAMB1,LAMA1,PPP2R5E,GNAL
GADD45 Signaling	0.04677	0.47	CCND3,GADD45B,CCND1,ATR,CDK2

**Supplementary Table 8: All MCF7 TCF7L2 Ingenuity Conical pathways with at least nominal  $P < 0.05$**

Ingenuity Canonical Pathways	P-value	B-H Multiple testing correction p-value	Molecules
VDR/RXR Activation	5.37032E-07	0.000281838	SERPINB1,IL12A,CYP24A1,PDGFA,CLK6,HES1,PRKCZ,NCOA2,GADD45A,RUNX2,CSNK2A1,TGFB2,CEBPA,PRKCE,NCOR1,SEMA3B,PRKD1,PRKCA,IFNG,LRP5,PPARD,MED1,IGFBP5,CEBPB,THBD,KLF4,SULT2A1,NCOA3,PRKCI,FOXO1,IGFBP3,NCOA1,PRKCH,NCOR2,RXRA,S100G
Factors Promoting Cardiogenesis in Vertebrates	4.2658E-06	0.001122018	FZD10,NODAL,BMP4,AXIN1,ACVR2B,NOG,TCF7,PRKCZ,TGFBR2,MAP3K7,TGFB2,PRKCE,GSK3B,ACVR1C,PRKD1,PRKCA,LRP5,ACVR1,FZD9,TCF7L1,TCF3,BMP5,ATF2,CCNE1,PRKCI,TGFB3,MEF2C,LEF1,BMP7,PRKCH,DKK1,BMP6,LRP1,WNT11,ACVR2A,TCF7L2,CDK2
Wnt/ $\beta$ -catenin Signaling	5.01187E-05	0.008709636	AXIN1,SOX12,CSNK1A1,TLE1,BCL9,WNT9A,SOX13,CCND1,TCF7,MYC,TGFB2,SOX2,CSNK2A1,DKK2,GSK3B,SOX4,AKT2,AXIN2,APPL2,FZD9,TCF3,CDH1,CDH12,PPP2R3A,PPP2R2B,TGFB3,TLE3,LEF1,SFRP1,FZD10,ACVR2B,SOX9,JUN,CDH3,MAP3K7,TGFB2,AKT3,SOX14,ACVR1C,SOX5,LRP5,PPARD,CSNK1G3,WNT2B,GNAQ,ACVR1,TCF7L1,WNT3A,WNT10A,TLE4,CD44,DKK1,TCF7L2,LRP1,WNT11,ACVR2A,WNT5A
Human Embryonic Stem Cell Pluripotency	0.000104713	0.011220185	FZD10,NODAL,BMP4,CLK6,AXIN1,PDGFA,PIK3R1,SMAD3,WNT9A,NGF,TCF7,NOG,TGFBR2,SOX2,TGFB2,PDGFRA,AKT3,GSK3B,PIK3C2B,AKT2,PIK3C2A,WNT2B,ACVR1,SMAD7,SMAD6,PIK3C2G,FGFR2,FZD9,TCF7L1,TCF3,BMP5,INHBA,PDGFB,WNT3A,FOXO1,WNT10A,NTRK3,S1PR1,TGFB3,LEF1,BMP7,BMP6,ZIC3,WNT11,TCF7L2,WNT5A,SALL4
Molecular Mechanisms of Cancer	0.000107152	0.011220185	SHH,BMP4,AXIN1,SUV39H1,PIK3R1,TAB2,ARHGEF1,KRAS,MAPK13,CCND1,PLCB1,GNA13,HIPK2,PRKD1,FASLG,PIK3C2B,AKT2,TFDP1,PTCH1,TCF3,CDH1,CCND3,MAX,IRS1,ARHGEF6,GNA1,PSEN2,GNA14,PRKOC,HAT,JUN,BBC3,RHOV,BID,PRKCE,GRB2,RHOC,GNA12,GNAQ,PIK3C2G,FADD,FOS,CCNE1,RASGRP1,RASGRF1,RBPJ,BMP7,BMP6,ATR,LRP1,GAB2,JAK1,DIRAS3,SMAD3,MYC,TGFBR2,E2F6,CAMK2D,GNAT1,RHOB,GSK3B,ADCY9,CDK6,FZD9,RALBP1,BCL2L1,CBL,RND3,ARHGEF16,MAPK10,TGFB3,LEF1,PRKCH,CDK2,FZD10,ABL1,HIF1A,BCL2,RHOT1,MAP3K7,PRKAR1B,TGFB2,AKT3,RHOF,PRKCA,LRP5,PIK3C2A,SMAD7,SMAD6,BMP5,XIAP,RHOV,PLCB4,PRKCI,FOXO1,PRKAG2,BCL2L1,WNT5A,PRKAR1A
Heparan Sulfate Biosynthesis (Late Stages)	0.00030903	0.026915348	GAL3ST2,SULT1C4,HS2ST1,CHST12,GLCE,PRDX6,CHST15,SULT2A1,HS3ST3A1,SULT2B1,AADAC,HS6ST1,HS3ST3B1,EXT2,UST,CHST11,HS6ST2,EXTL3,HS3ST1,HS6ST3,SULT1B1
Cholecystokinin/Gastrin-mediated Signaling	0.000457088	0.033884416	DIRAS3,KRAS,EPHA4,IL1F10,BCAR1,PRKCZ,ROCK2,JUN,RHOB,RHOT1,RHOV,PRKCE,PLCB1,GNA13,RHOF,PRKD1,PRKCA,RHOC,GRB2,ITPR2,GNA12,GNAO,COCK,ITPR1,ATF2,ROCK1,FOS,RHOV,PLCB4,PRKCI,RND3,MEF2D,MAPK10,IL1B,MEF2C,PRKCH
Type II Diabetes Mellitus Signaling	0.000562341	0.037153523	SOC1,PRKAB1,PRKAB2,SLC27A2,PIK3R1,PKM,SOC2,PRKCZ,MAP3K7,SLC2A2,PRKAA2,PRKCE,AKT3,IRS2,SMPD3,PRKD1,PRKCA,TFNRSF11B,PPARG,PIK3C2B,AKT2,ACSL3,PIK3C2A,MAP3K1,CD36,PIK3C2G,IKBKE,CEBPB,ACSBG2,SLC2A4,PRKCI,IRS1,SH2B2,MAPK10,PRKAG2,PRKCH,INSR,SOC5,ACSL1
Aryl Hydrocarbon Receptor Signaling	0.000724436	0.042657952	HSPB3,ALDH4A1,GSTM5,IL6,CCND1,SMARCA4,ARNT,TGM2,NR2F1,MYC,JUN,TFF1,NCOA2,ALDH1A3,ALDH3A2,TGFB2,GSTM4,NFE2L2,ALDH3A1,FASLG,AHR,GSTA3,TFDP1,MED1,CDK6,SLC35A2,NCOA3,CYP1B1,FOS,CCNE1,CCND3,NFIA,TGFB3,HSP90AA1,IL1B,NFIB,NCOR2,DCT,NR1P1,RXRA,ATR,ESR1,GSTP1,CDK2
Glioblastoma Multiforme Signaling	0.000812831	0.042657952	FZD10,AXIN1,PDGFA,DIRAS3,PIK3R1,KRAS,WNT9A,CCND1,PTEN,MYC,E2F6,RHOB,RHOT1,RHOV,IGF1R,PDGFRA,AKT3,PLCB1,GSK3B,RHOF,PIK3C2B,AKT2,PIK3C2A,GRB2,ITPR2,RHOC,WNT2B,CDK6,PIK3C2G,PLCG1,FZD9,PLCL2,ITPR1,TCF3,PDGFB,PLCZ1,RHOV,PLCB4,CCNE1,WNT3A,FOXO1,WNT10A,RND3,LEF1,WNT11,CDK2,WNT5A
Heparan Sulfate Biosynthesis	0.001	0.045708819	GAL3ST2,SULT1C4,XYL1,HS2ST1,CHST12,GLCE,PRDX6,CHST15,SULT2A1,HS3ST3A1,SULT2B1,AADAC,HS3ST3B1,HS6ST1,EXT2,UST,CHST11,HS6ST2,EXTL3,HS3ST1,HS6ST3,SULT1B1
Axonal Guidance Signaling	0.001047129	0.045708819	SHH,BMP4,PIK3R1,KRAS,NTN1,ADAMTS2,BAIAP2,PLCB1,GNA13,MYL10,PRKD1,ITGA4,PIK3C2B,AKT2,KALRN,PTCH1,PLCL2,SRGAP3,ARHGEF6,RTN4,EPHA2,GNA1,NRP1,LRR4C,UNC5A,SEMA6A,EPHA4,GNA14,PLXNA2,ABLIM1,PRKACZ,ACTR3,SRGAP1,PLXNA1,EFNA5,PFN2,PRKCE,RASSF5,UNC5C,ADAM2,NRP2,GRB2,GNA12,ITGA2,PIK3C2G,GNAQ,PLCG1,EPHA3,EFNA1,PLCZ1,SEMA3A,WNT3A,SEMA4D,NTRK3,ADAM10,BMP7,SEMA3C,BMP6,GNB2L1,LIMK2,WNT9A,ROCK2,GNAT1,SEMA3D,PPP3R1,GSK3B,FARP2,EPHA7,FZD9,DPYSL5,ADAMTS9,PDGFB,EPHA6,SDCBP,PRKCH,ERAP2,FZD10,ADAMTS7,PDGFA,TUBA3E,ABL1,NGF,BCAR1,ROBO1,EPHB6,GNG11,WASL,NFAT5,GLI3,PRKAR1B,AKT3,SEMA3B,SHANK2,PRKCA,SEMA3E,PLXNC1,PIK3C2A,C9orf3,WNT2B,NFATC4,BMP5,EFNA4,ROCK1,PLCB4,PRKCI,WNT10A,TUBB6,LINGO1,PRKAG2,NFATC2,EPHB3,SEMA4B,WNT11,PRKAR1A,WNT5A
Prolactin Signaling	0.001202264	0.047863009	PIK3C2B,SOC1,PIK3C2A,GRB2,PRL,PIK3R1,SOC2,PIK3C2G,PLCG1,KRAS,CEBPB,NR3C1,IRF1,PRKCZ,TCF7,MYC,FOS,PRKCI,JUN,IRS1,PRKCE,PRKCH,PRLR,STAT1,SOC5,PRKD1,PRKCA
Small Cell Lung Cancer Signaling	0.001698244	0.064565423	PIK3C2B,AKT2,TRAF3,PIK3C2A,TFDP1,PIK3R1,SUV39H1,PIK3C2G,CDK6,ABL1,IKBKE,CCND1,SKP2,BCL2,PTEN,MYC,BCL2L1,PIAS3,CCNE1,MAX,TRAF4,CKS1B,AKT3,BID,RXRA,CDK2
HER-2 Signaling in Breast Cancer	0.002344229	0.081283052	PIK3R1,PARDB6,KRAS,CCND1,PRKCZ,PRKCE,AKT3,GSK3B,ITGB4,PRKD1,ITGB5,PRKCA,PIK3C2B,AKT2,PIK3C2A,GRB2,CDK6,PIK3C2G,PLCG1,AREG/AREG,ITGB2,CCNE1,PRKCI,FOXO1,PRKCH,ITGB6,PAR3
Role of NFAT in Cardiac Hypertrophy	0.002570396	0.081283052	LIF,CAMK1D,PIK3R1,GNB2L1,CSNK1A1,KRAS,MAPK13,IL6,TGFBR2,CAMK2D,PPP3R1,HDAC11,PLCB1,GSK3B,PRKD1,ADCY9,PIK3C2B,AKT2,HDAC4,HDAC8,ITPR2,ITPR1,PLCL2,MAPK10,TGFB3,RCAN3,PRKCH,SLC8A1,IL6ST,PRKCZ,GNG11,MAP3K7,IGF1R,PRKAR1B,TGFB2,AKT3,PRKCE,PRKCA,PIK3C2A,GRB2,MAP3K1,PIK3C2G,GNAQ,PLCG1,NFATC4,PLCZ1,CALM1 (includes others),PLCB4,PRKCI,MEF2D,PRKAG2,MEF2C,PRKAR1A

Mouse Embryonic Stem Cell Pluripotency	0.002630268	0.081283052	IL6ST,FZD10,ID2,LIF,JAK1,BMP4,AXIN1,PIK3R1,KRAS,MAPK13,TCF7,MYC,LIFR,SOX2,ID1,MAP3K7,AKT3,GSK3B,PIK3C2B,AKT2,PIK3C2A,GRB2,PIK3C2G,FZD9,TCF7L1,TCF3,ID3,XIAP,WNT3A,LEF1,TCF7L2,ID4
PI3K Signaling in B Lymphocytes	0.003311311	0.097723722	BLNK,PIK3R1,ABL1,KRAS,PRKCZ,PTEN,PTPRC,NFAT5,JUN,CAMK2D,PPP3R1,AKT3,PLCB1,IRS2,VAV2,AKT2,ITPR2,PLCG1,IKBKE,ITPR1,NFATC4,PLCL2,ATF2,PLCZ1,CALM1 (includes others),FOS,PLCB4,PRKCI,CBL,CD180,DAPP1,BCL10,VAV3,SYK,IRS1,SH2B2,LYN,NFATC2,PLEKHA2
Ethanol Degradation IV	0.003630781	0.097723722	ALDH4A1,ACSL3,ACSS3,ALDH1A3,ALDH3A2,CAT,ACSS1,ALDH3A1,ACSL1
PPARα/RXRα Activation	0.004265795	0.108893009	PRKAB1,PRKAB2,SMAD3,KRAS,IL6,ACVR2B,GNA14,ABCA1,TGFBR2,NR2F1,CHD5,JUN,MAP3K7,GPD2,TGFB2,PRKAR1B,PRKAA2,PLCB1,NCOR1,ACVR1C,ITGB5,PRKCA,ADCY9,GRB2,MED1,GNAQ,CD36,ACVR1,PLCG1,NR2C2,IKBKE,IL1R1,PLCL2,TGS1,NCOA3,PLCZ1,CAND1,PLCB4,IRS1,PRKAG2,TGFB3,IL1B,HSP90AA1,MEF2C,NCOR2,INSR,RXRA,ACVR2A,PRKAR1A
Growth Hormone Signaling	0.004365158	0.108893009	PIK3C2B,SOC31,PIK3C2A,PIK3R1,SOC32,PIK3C2G,PLCG1,SLC2A4,ONECUT1,PRKCZ,FOS,PRKCI,IRS1,CEBPA,IGF1R,IGFBP3,PRKCE,PRKCH,RPS6KA2,SAT1,SOC35,A2M,PRKD1,PRKCA
Gαq Signaling	0.004786301	0.108893009	RGS18,DIRAS3,PIK3R1,GNB2L1,GNA14,CHRM3,AVPR1A,PRKCZ,ROCK2,GNNG11,RHOB,RHOT1,PPP3R1,RHOU,PRKCE,AKT3,PLCB1,GSK3B,RHOF,PRKD1,AVPR1B,PRKCA,PIK3C2B,AKT2,PIK3C2A,ITPR2,RHOC,PIK3C2G,GNAQ,PLCG1,IKBKE,NFATC4,ITPR1,PLD1,ROCK1,CALM1 (includes others),RHOF,PLCB4,PRKCI,RND3,CALCR,NFATC2,PRKCH,AGTR1
Chondroitin Sulfate Degradation (Metazoa)	0.005128614	0.108893009	HYAL1,CD44,HEXB,HEXA,SPAM1,ARSB,HYAL4
Chondroitin Sulfate Biosynthesis (Late Stages)	0.005495409	0.108893009	GAL3ST2,SULT1C4,CHSY1,HS2ST1,CHST12,CHST15,SULT2A1,HS3ST3A1,SULT2B1,HS3ST3B1,HS6ST1,UST,CHST11,HS6ST2,HS3ST1,HS6ST3,SULT1B1
Oxidative Ethanol Degradation III	0.005754399	0.108893009	ALDH4A1,ACSL3,ACSS3,ALDH1A3,ALDH3A2,ACSS1,ALDH3A1,ACSL1
Methionine Degradation I (to Homocysteine)	0.005754399	0.108893009	SUV39H2,SUV39H1,PRMT8,FTSJ1,AHCYL2,MAT2A,EHMT1,AHCY
Thrombin Signaling	0.00616595	0.108893009	CAMK1D,DIRAS3,PIK3R1,GNB2L1,KRAS,ARHGEF1,MAPK13,GATA2,ROCK2,MYLK,CAMK2D,GNAT1,RHOB,PLCB1,GNA13,MYL10,PRKD1,ADCY9,PIK3C2B,AKT2,ITPR2,ITPR1,PLCL2,RND3,ARHGEF16,ARHGEF6,PPP1R12B,PRKCH,GNA14,F2RL2,PPP1CB,GNA14,PRKCZ,GNNG11,RHOT1,RHOU,AKT3,PRKCE,GATA6,RHOF,PRKCA,PIK3C2A,RHOC,GRB2,GNA12,PIK3C2G,GNAQ,PLCG1,PLCZ1,ROCK1,RHOF,PLCB4,PRKCI,GATA3
Dermatan Sulfate Biosynthesis (Late Stages)	0.006309573	0.108893009	GAL3ST2,SULT1C4,HS2ST1,CHST12,CHST15,SULT2A1,HS3ST3A1,SULT2B1,HS3ST3B1,HS6ST1,UST,CHST11,HS6ST2,HS6ST3,HS3ST1,SULT1B1
Ephrin A Signaling	0.006309573	0.108893009	VAV2,EPHA7,PIK3C2B,PIK3C2A,PIK3R1,PIK3C2G,EPHA4,EPHA3,BCAR1,EFNA4,EFNA1,ROCK1,ROCK2,EPHA6,VAV3,EFNA5,ADAM10,EPHA2
Renin-Angiotensin Signaling	0.006606934	0.108893009	PIK3R1,SHC3,KRAS,MAPK13,PRKCZ,JUN,PRKAR1B,PRKCE,STAT1,PRKD1,AGT,PRKCA,NOX1,ADCY9,PIK3C2B,PIK3C2A,GRB2,ITPR2,MAP3K1,GNAQ,REN,PIK3C2G,PLCG1,ITPR1,ATF2,FOS,PRKCI,MAPK10,PRKAG2,PRKCH,PTGER2,AGTR1,AGTR2,PRKAR1A
TR/RXR Activation	0.006606934	0.108893009	NXP2,TRH,PIK3R1,UCP1,HIF1A,DIO2,KLF9,NCOA2,SCARB1,AKT3,NCOR1,TBL1XR1,PIK3C2B,AKT2,PIK3C2A,MED1,PIK3C2G,PCK1,PFKP,DIO3,NCOA3,UCP3,SREBF1,ENO1,NCOA1,NCOR2,RXRA,THRB
Cell Cycle: G1/S Checkpoint Regulation	0.006606934	0.108893009	RBL2,HDAC4,HDAC8,TFDP1,SUV39H1,SMAD3,ABL1,CDK6,CCND1,SKP2,MYC,E2F6,CCNE1,CCND3,MAX,HDAC11,TGFB3,TGFB2,GSK3B,ATR,CDK2
p53 Signaling	0.007079458	0.112460497	JMY,GADD45G,PIK3R1,CCND1,BCL2,PTEN,JUN,GADD45A,STAG1,BBC3,AKT3,GSK3B,HIPK2,PIK3C2B,AKT2,TP63,PIK3C2A,TOPBP1,MED1,THBS1,PERP,PIK3C2G,RPRM,BCL2L1,KAT2B,MDM4,SNAI2,ATR,CDK2,DRAM1
Neuregulin Signaling	0.007943282	0.11939881	NRG2,BTC,PIK3R1,KRAS,PRKCZ,CDK5R1,TMEFF2,PTEN,MYC,ERBB4,PRKCE,AKT3,PRKD1,PRKCA,ITGA4,AKT2,GRB2,DCN,ITGA2,PLCG1,HBEGF,AREG/AREG,PRKCI,NRG3,TGFA,HSP90AA1,PRKCH,EREG
Acetate Conversion to Acetyl-CoA	0.007943282	0.11939881	ACSL3,ACSS3,ACSS1,ACSL1
Glioma Signaling	0.008317638	0.1216186	CAMK1D,PDGFA,PIK3R1,SUV39H1,ABL1,KRAS,CCND1,PRKCZ,PTEN,E2F6,CAMK2D,IGF1R,PDGFA,AKT3,PRKCE,PRKD1,PRKCA,PIK3C2B,AKT2,RBL2,PIK3C2A,TFDP1,GRB2,PIK3C2G,CDK6,PLCG1,PDGFB,CALM1 (includes others),PRKCI,PRKCH
Role of JAK2 in Hormone-like Cytokine Signaling	0.009120108	0.124738351	EPO,SOC31,JAK1,PRL,IRS1,PTPN1,SH2B2,SOC32,IRS2,PRLR,STAT1,SOC35,SIRPA
Dermatan Sulfate Degradation (Metazoa)	0.009120108	0.124738351	IDS,HYAL1,CD44,HEXB,HEXA,SPAM1,HYAL4
Macropinocytosis Signaling	0.009332543	0.124738351	PIK3C2B,PIK3C2A,RAB5A,PDGFA,PIK3R1,USP6NL,PIK3C2G,PLCG1,KRAS,NGF,PDGFB,PRKCZ,ITGB2,PRKCI,ABI1,HGF,PRKCE,PRKCH,ITGB4,ITGB6,ITGB5,PRKD1,PRKCA
HGF Signaling	0.01	0.12793813	PIK3R1,ETS2,KRAS,IL6,CCND1,PRKCZ,ELF3,JUN,MAP3K7,HGF,PRKCE,AKT3,PRKD1,PRKCA,MAP3K9,PIK3C2B,AKT2,PIK3C2A,GRB2,MAP3K1,PIK3C2G,PLCG1,ATF2,ELF1,FOS,PRKCI,MAPK10,MAP3K8,PRKCH,ELF5,CDK2
Aldosterone Signaling in Epithelial Cells	0.010471285	0.12793813	HSPB3,DNAJC17,ASIC2,SGK1,PIK3R1,DNAJC12,ASIC3,HSPB8,KRAS,DNAJC15,SLC9A1,PRKCZ,HSPA4,DNAJC1,PRKCE,PLCB1,SCNN1B,PRKD1,AHCY,PRKCA,PIK3C2B,DNAJB8,PIK3C2A,CRYAA,ITPR2,SLC12A2,PIK3C2G,PLCG1,DNAJC25,PLCL2,ITPR1,PLCZ1,PLCB4,PIP5K1A,NEDD4,ODF1,PRKCI,HSPA13,HSP90AA1,DNAJC5B,PRKCH,DNAJB6,PIP4K2A,DNAJC7
RhoA Signaling	0.010471285	0.12793813	SEPT9,PPP1CB,ARHGEF1,LIMK2,ROCK2,MYLK,ACTR3,PLXNA1,BAIP2,IGF1R,PFN2,ARHGAP12,CDC42EP1,GNA13,MYL10,DLIC1,ARHGAP6,NRP2,RTKN,GNA12,RDX,CDC42EP3,SEPT4,TTN,PLD1,ROCK1,KTN1,RHPN2,PIP5K1A,RAPGEF2,RND3,PPP1R12B,ARHGAP35,PIP4K2A,CDC42EP4
Role of Macrophages, Fibroblasts and Endothelial Cells in Rheumatoid Arthritis	0.010471285	0.12793813	SOC31,TRAF3,AXIN1,PIK3R1,PRSS2,CSNK1A1,KRAS,IL6,WNT9A,CCND1,TCF7,ROCK2,MYC,CAMK2D,PPP3R1,TRAF4,PLCB1,DKK2,GSK3B,PRKD1,TNFRSF11B,PIK3C2B,AKT2,IL6R,FZD9,PLCL2,TCF3,PDGFB,ATF2,PRKCH,LEF1,SFRP1,IL6ST,FZD10,PDGFA,IL1F10,PRKCZ,NFAT5,JUN,F2RL1,MAP3K7,CEBPA,PRKCE,AKT3,NOS2,PRKCA,LRP5,PIK3C2A,WNT2B,DAAM1,IL15,PIK3C2G,GNAQ,PLCG1,IKBKE,CEBPA,NFATC4,TCF7L1,IL1R1,PLCZ1,ROCK1,CALM1 (includes others),FOS,PLCB4,PRKCI,WNT3A,WNT10A,NFATC2,IL1B,DKK1,IRAK4,WNT11,LRP1,TCF7L2,RYK,WNT5A,IRAK2
Protein Kinase A Signaling	0.010715193	0.12793813	SHH,SMAD3,GNB2L1,TCF7,NTN1,PTEN,TGFB2,MYLK,PTPRC,ROCK2,CAMK2D,RHO,PPP3R1,RYR3,PLCB1,GNA13,GSK3B,MYL10,EYA2,PRKD1,ADCY9,PTPRG,ITPR2,PTCH1,YWHAZ,PTPN3,ANAPC7,ITPR1,PLCL2,TCF3,PTPDC1,TTN,ATF2,PDE8A,AKAP13,EPM2A,TGFB3,PTPR3,PRKCH,LEF1,DUSP4,PTPRA,SIRPA,PTPN21,AKAP12,FLNB,ANAPC1/ANAPC1P1,PTPN13,PPP1R3C,DUSP6,PT



			PN14,PDE4A,PPP1CB,CDC23,PRKCZ,PHKA2,AKAP11,MPPE1,DUSP5,GN11,HHAT,NFAT5,GLI3,DUSP10,PTPN1,PRKAR1B,TGFB2,PRKCE,CNGB3,PRKCA,MTMR3,PTPRK,MAP3K1,GNAQ,PLCG1,AKAP6,TCF7L1,NFATC4,PDE4D,ROCK1,PLCZ1,CALM1 (includes others),AKAP2/PALM2-AKAP2,PLCB4,PRKCI,CDC14B,PRKAG2,NFATC2,PDE8B,PTPRR,EYA1,PTPRT,TCF7L2,DUSP16,PRKAR1A
G Beta Gamma Signaling	0.011220185	0.128824955	GNB2L1,KRAS,GNA14,PRKCZ,GN11,GNAT1,PRKAR1B,PRKCE,AKT3,GNA13,CAV2,CAV3,PRKD1,PRKCA,AKT2,GRB2,GNA12,GNAQ,PLCG1,HBEGF,KCNJ3,PRKCI,ARHGFE6,PRKAG2,PRKCH,KCNJ6,GNAL,PRKAR1A
Thyroid Cancer Signaling	0.012022644	0.134276496	PPARG,KLK3,GDNF,KRAS,TCF7L1,NGF,TCF3,CCND1,TCF7,MYC,CDH1,NTRK3,LEF1,RXRA,TCF7L2
Transcriptional Regulatory Network in Embryonic Stem Cells	0.012022644	0.134276496	LHX5,TRIM24,CDX2,MEIS1,TCF7L1,HOXB1,SET,FOXC1,ONECUT1,SOX2,CDY1,GATA6,SKIL,ZIC3,ZFH3
ErbB Signaling	0.012882496	0.135831345	NRG2,BTC,PIK3R1,KRAS,MAPK13,PRKCZ,JUN,ERBB4,PRKCE,GSK3B,PRKD1,PRKCA,PIK3C2B,PIK3C2A,GRB2,PIK3C2G,PLCG1,HBEGF,AREG/AREGB,FOS,PRKCI,FOXO1,NRG3,TGFA,MAPK10,PRKCH,EREG
Xenobiotic Metabolism Signaling	0.013182567	0.135831345	LIPC,CAMK1D,PIK3R1,MAF,GCLC,KRAS,IL6,MAPK13,CHST15,ARNT,HS6ST1,MAOB,CAMK2D,NR1I2,ALDH3A2,CHST11,HS6ST3,HS3ST1,ALDH3A1,AHR,PRKD1,MAP3K9,PIK3C2B,HDAC4,MED1,GRIP1,SULT2A1,HS3ST3B1,PPP2R3A,PPP2R2B,NCOA1,HSP90AA1,PRKCH,RXRA,GSTP1,ALDH4A1,GAL3ST2,SULT1C4,GSTM5,HS2ST1,FMO5,HS3ST3A1,PRKCZ,UST,MAP3K7,ALDH1A3,GSTM4,PRKCE,HS6ST2,SMOX,NOS2,NFE2L2,CITED2,PRKCA,GSTA3,PIK3C2A,MAP3K1,PIK3C2G,CHST12,CYP1B1,ESD,SULT2B1,PRKCI,CAT,IL1B,MAP3K8,NCOR2,NRIP1,DNAJC7,SULT1B1
Cardiac Hypertrophy Signaling	0.013182567	0.135831345	DIRAS3,PIK3R1,GNB2L1,KRAS,MAPK13,IL6,TGFB2,ROCK2,RHOB,GNAT1,PPP3R1,PLCB1,GSK3B,GNA13,MYL10,ADCY9,PIK3C2B,MAP3K9,IL6R,PLCL2,ATF2,RND3,IRS1,TGFB3,MAPK10,GNAL,EIF2B4,GNA14,JUN,GN11,RHOT1,MAP3K7,TGFB2,IGF1R,PRKAR1B,RHOU,RHOF,ADRB2,CACNA1D,PIK3C2A,MAPKAPK3,RHOC,GRB2,GNA12,MAP3K1,GNAQ,PIK3C2G,PLCG1,NFATC4,PLCZ1,ROCK1,CALM1 (includes others),RHOU,PLCB4,MEF2D,PRKAG2,MEF2C,MAP3K8,ADRA2C,PRKAR1A
IGF-1 Signaling	0.013489629	0.135831345	SOC51,JAK1,PIK3R1,SOC52,KRAS,PRKCZ,JUN,PRKAR1B,IGF1R,CSNK2A1,AKT3,IRS2,PIK3C2B,AKT2,PIK3C2A,GRB2,PIK3C2G,YWHAZ,IGFBP5,IGFBP2,FOS,NEDD4,PRKCI,NOV,FOXO1,IRS1,IGFBP3,PRKAG2,SOC55,PRKAR1A
Thrombopoietin Signaling	0.013489629	0.135831345	GAB2,PIK3C2B,PIK3C2A,GRB2,PIK3R1,PIK3C2G,PLCG1,KRAS,PRKCZ,MYC,FOS,JUN,PRKCI,PRKCE,IRS2,PRKCH,STAT1,PRKD1,PRKCA
Colorectal Cancer Metastasis Signaling	0.013803843	0.135831345	MMP20,JAK1,AXIN1,MMP16,DIRAS3,PIK3R1,SMAD3,GNB2L1,KRAS,IL6,WNT9A,CCND1,TCF7,TGFB2,MYC,RHOB,GSK3B,ADCY9,PIK3C2B,AKT2,ADRBK2,IL6R,FZD9,TCF3,BCL2L1,CDH1,RND3,TGFB3,MAPK10,LEF1,PTGER2,IL6ST,FZD10,JUN,GN11,ARRB1,RHOT1,TGFB2,PRKAR1B,RHOU,AKT3,STAT1,RHOF,NOS2,MMP17,IFNG,LRP5,PIK3C2A,GRB2,RHOC,GNAT2,PIK3C2G,TCF7L1,FO S,RHOU,WNT3A,WNT10A,PRKAG2,TCF7L2,LRP1,WNT11,PRKAR1A,WNT5A
Cysteine Biosynthesis III (mammalia)	0.014454398	0.139636836	SUV39H2,SUV39H1,PRMT8,FTSJ1,AHCYL2,MAT2A,EHMT1,PHRYA
Chondroitin Sulfate Biosynthesis	0.015848932	0.148593564	GAL3ST2,SULT1C4,XYL1,CHSY1,HS2ST1,CHST12,CHST15,SULT2A1,HS3ST3A1,SULT2B1,HS6ST1,HS3ST3B1,UST,CHST11,HS6ST2,HS3ST1,HS6ST3,SULT1B1
Actin Nucleation by ARP-WASP Complex	0.016595869	0.154525444	RHOC,GRB2,GNA12,DIRAS3,ITGA2,KRAS,ROCK2,ROCK1,RHOU,ACTR3,WASL,RND3,RHOB,RHOT1,BAIAP2,PPP1R12B,RHOU,RHOF,ITGA4
CXCR4 Signaling	0.016982437	0.155238701	PIK3R1,DIRAS3,GNB2L1,KRAS,GNA14,BCAR1,PRKCZ,ROCK2,JUN,GN11,GNAT1,RHOB,RHOT1,RHOU,AKT3,PRKCE,PLCB1,GNA13,RHOF,MYL10,PRKD1,PRKCA,ADCY9,PIK3C2B,AKT2,PIK3C2A,ITPR2,RHOC,GNA12,PIK3C2G,GNAQ,ITPR1,ROCK1,FOS,RHOU,PLCB4,PRKCI,RND3,MAPK10,LYN,PRKCH,ELMO1,GNAL
Dopamine Degradation	0.019498446	0.174180687	ALDH4A1,MAOB,ALDH1A3,ALDH3A2,COMT,SMOX,ALDH3A1,LRTOMT,SULT1B1
RAR Activation	0.019952623	0.176603782	TRIM24,RDH10,PIK3R1,SMAD3,NR2F2,MAPK13,PRKCZ,SMARCA4,PTEN,NR2F1,JUN,ALDH1A3,RDH16,TGFB2,PRKAR1B,CSNK2A1,PRKCE,AKT3,NCOR1,NTSC1B,CITED2,PRKD1,PRKCA,ADCY9,AKT2,RDH14,MED1,MAP3K1,SMAD7,SMAD6,KAT2B,FOS,PRKCI,TAF4,SMARCA2,CRAP2,MAPK10,IGFBP3,NCOA1,TGFB3,PRKAG2,PRKCH,NCOR2,NRIP1,RXRA,CARM1,PRKAR1A
Chronic Myeloid Leukemia Signaling	0.020417379	0.178648757	GAB2,SUV39H1,SMAD3,PIK3R1,ABL1,KRAS,CCND1,TGFB2,MYC,E2F6,HDA C11,CTBP2,TGFB2,AKT3,PIK3C2B,AKT2,RBL2,HDAC4,HDAC8,TFDP1,PIK3C2A,GRB2,CDK6,PIK3C2G,IKBKE,MECOM,BCL2L1,TGFB3
Dermatan Sulfate Biosynthesis	0.023442288	0.198152703	GAL3ST2,SULT1C4,XYL1,CHSY1,HS2ST1,CHST12,CHST15,SULT2A1,HS3ST3A1,SULT2B1,HS6ST1,HS3ST3B1,UST,CHST11,HS6ST2,HS3ST1,HS6ST3,SULT1B1
Role of NANOG in Mammalian Embryonic Stem Cell Pluripotency	0.023442288	0.198152703	IL6ST,FZD10,LIF,JAK1,BMP4,AXIN1,PIK3R1,KRAS,WNT9A,SOX2,LIFR,AKT3,GATA6,GSK3B,PIK3C2B,AKT2,PIK3C2A,GRB2,WNT2B,CDX2,PIK3C2G,FZD9,TCF7L1,BMP5,WNT3A,WNT10A,BMP7,BMP6,WNT11,SALL4,WNT5A,TCL1A
Basal Cell Carcinoma Signaling	0.02630268	0.215774441	SHH,FZD10,BMP4,AXIN1,PTCH1,WNT2B,FZD9,TCF7L1,WNT9A,TCF3,BMP5,TCF7,WNT3A,GLI3,WNT10A,LEF1,BMP7,GSK3B,BMP6,WNT11,TCF7L2,WNT5A,VAV2,CD3E,GRB2,SMAD3,MAP3K1,PLCG1,TOB1,IKBKE,KRAS,NFATC4,TGFB R2,CALM1 (includes others),FOS,JUN,NFAT5,BCL10,VAV3,PPP3R1,ZAP70,MAPK10,TGFB3,TGFB2,NFATC2,CARD11
Regulation of IL-2 Expression in Activated and Anergic T Lymphocytes	0.026915348	0.217770977	IL12A,PIK3R1,MAF,CLU,MAPK13,PRKCZ,PON1,JUN,TGFB2,PRKCE,AKT3,SERPINA1,NOS2,STAT1,PRKD1,PRKCA,PPARG,IFNG,PIK3C2B,AKT2,PIK3C2A,RA B7A,PIK3C2G,IKBKE,CEBPB,IRF1,STAT4,FOS,PRKCI,IL12B,MAPK10,NCOA1,TGFB3,MAP3K8,PRKCH,IRF8,RXRA
IL-12 Signaling and Production in Macrophages	0.028840315	0.229614865	JAK1,POLR2D,PRKAB2,PRKAB1,CD3E,SGK1,PIK3R1,SMAD3,PBX1,KRAS,IL6,MAPK13,TAF13,TSC2D23,PGR,TGFB2,HSPA4,HMGB1,PPP3R1,PIK3C2B,AKT2,MED1,PCK1,NCOA3,BCL2L1,KAT2B,TAF4,SMARCA2,TGFB3,NCOA1,MAPK10,HSP90AA1,ESR1,PRL,NR3C1,SMARCA4,BCL2,JUN,NFAT5,NCOA2,MAP3K7,TGFB2,CEBPA,PRKAA2,AKT3,NCOR1,FKBP5,NOS2,STAT1,AGT,ADRB2,IFNG,PIK3C2A,GRB2,MAP3K1,PIK3C2G,IKBKE,NFATC4,CEBPB,TSG101,FOS,PRKAG2,NFATC2,IL1B,NCOR2,NRIP1,A2M
Glucocorticoid Receptor Signaling	0.029512092	0.234422882	PIK3C2B,SOC51,AKT2,JAK1,PIK3C2A,GRB2,PIK3R1,SOC52,PIAS1,GNAQ,PIK3C2G,KRAS,IL6,STAT4,PIAS3,BCL2L1,FOS,PTPN1,AKT3,STAT1,SOC55
JAK/Stat Signaling	0.030199517	0.234422882	NODAL,BMP4,GRB2,SMAD3,SMAD6,ACVR1,SMAD7,KRAS,ACVR2B,MAPK13,INHBB,INHBA,TGIF1,SMURF1,BCL2,TGFB2,FOS,JUN,RUNX2,MAP3K7,TGFB3,TGFB2,BMP7,ACVR1C,ACVR2A
TGF-β Signaling	0.030902954	0.23659197	

Antiproliferative Role of TOB in T Cell Signaling	0.031622777	0.23659197	PABPC1,TGFB2,CCNE1,SMAD3,TGFB3,TGFB2,TOB1,TWGS1,CDK2,SKP2,BMP4,AXIN1,PIK3R1,TAB2,CSNK1A1,IL6,WNT9A,TCF7,RUNX2,PPP3R1,DKK2,GSK3B,TNFRSF11B,PIK3C2B,AKT2,FZD9,TCF3,CBL,MAPK10,LEF1,SFRP1,FZD10,IL1F10,BCL2,SMURF1,JUN,NFAT5,MAP3K7,AKT3,IFNG,LRP5,PIK3C2A,WNT2B,ITGA2,SMAD6,PIK3C2G,IKBKE,TCF7L1,NFATC4,IL1R1,BMP5,XIAP,CALM1 (includes others),FOS,WNT3A,FOXO1,WNT10A,CALCR,NFATC2,IL1B,BMP7,DKK1,BMP6,TCF7L2,LRP1,WNT11,WNT5A
Role of Osteoblasts, Osteoclasts and Chondrocytes in Rheumatoid Arthritis	0.031622777	0.23659197	PIK3C2B,AKT2,JAK1,PIK3C2A,GRB2,ITPR2,PIK3R1,MAP3K1,PIK3C2G,PLCG1,ITPR1,MAPK13,FOS,JUN,CSNK2A1,AKT3,STAT1,PRKCA
EGF Signaling	0.033884416	0.240990543	GRIN2B,GRM2,SLC1A4,GRID2,GLS,SLC1A3,SLC38A1,GRIP1,GRINA,GRM7,CALM1 (includes others),GNG11,GRIK4,GRID1,GLUL,SLC1A2,GRIK2,GRIK1
Glutamate Receptor Signaling	0.033884416	0.240990543	ALDH4A1,MAOB,ALDH1A3,ALDH3A2,SAT1,SMOX,ALDH3A1
Putrescine Degradation III	0.033884416	0.240990543	ALDH4A1,ACSL3,ACSS3,RDH14,DHRS2,ALDH1A3,ALDH3A2,ACSS1,ALDH3A1,ACSL1,DHRS4
Ethanol Degradation II	0.035481339	0.244906324	DOK5,PIK3C2B,PIK3C2A,GDNF,ARTN,GRB2,ITPR2,GFRA3,PIK3R1,PIK3C2G,PLCG1,KRAS,ITPR1,FOS,JUN,IRS1,GFRA1,MAPK10,IRS2,DOK1,FRS2
GDNF Family Ligand-Receptor Interactions	0.035481339	0.244906324	LIPC,SLC27A2,CHST15,ABCA1,ABCB9,HS6ST1,MAOB,CYP2A13/CYP2A6,SCARB1,NR1I2,ALDH3A2,CHST11,XPO1,HS6ST3,HS3ST1,FABP7,ALDH3A1,TNFRSF11B,ACSL3,SULT2A1,HS3ST3B1,NCOA1,RXRA,ACOX3,ABCC4,GSTP1,ALDH4A1,GAL3ST2,SULT1C4,SLC10A1,GSTM5,HS2ST1,IL1F10,FMO5,HS3ST3A1,JUN,UST,ALDH1A3,MAP3K7,GSTM4,HS6ST2,SMOX,GSTA3,CYP2A7,MAP3K1,SLC35A2,IL1R1,CHST12,ACSBG2,SULT2B1,SREBF1,CAT,IL1B,SULT1B1,ACSL1
LPS/IL-1 Mediated Inhibition of RXR Function	0.038904514	0.26915348	DIRAS3,GNB2L1,ARHGEF1,LIMK2,GNA14,CDH11,ROCK2,GNG11,ACTR3,WASL,GNAT1,RHOB,CDH3,RHOT1,RHOV,ARHGAP12,GNA13,RHOF,MYL10,DLG1,ITGA4,PRKCA,ARHGAP6,RHOC,GNA12,ITGA2,RDX,CDH6,GNAQ,CDH18,GRIP1,ROCK1,DGKZ,PIP5K1A,RHOV,CDH1,CDH12,RND3,ARHGEF16,ARHGEF6,CD44,PPP1R12B,ARHGAP35,PIP4K2A,ESR1,GNAL
RhoGDI Signaling	0.040738028	0.271643927	PIK3C2B,AKT2,PIK3C2A,TFDP1,GRB2,ITPR2,SUV39H1,PIK3R1,ABL1,PIK3C2G,CDK6,PLCG1,KRAS,ITPR1,CCND1,TGFA,AKT3,RASSF5,RXRA,PRKCA
Non-Small Cell Lung Cancer Signaling	0.040738028	0.271643927	F2RL2,JAK1,PIK3R1,KRAS,PRKCZ,F2RL1,PLCB1,AKT3,PRKCE,EEF2K,PRKD1,PRKCA,AGT,PIK3C2B,AKT2,PIK3C2A,GRB2,GNAQ,YWHAZ,PIK3C2G,PLCG1,PLCL2,PLD1,PLCZ1,PLCB4,PRKCI,PPP2R3A,SYK,IRS1,PPP2R2B,LYN,PRKCH,AGTR1
p70S6K Signaling	0.042657952	0.278612117	UXS1,UGDH
UDP-D-xylose and UDP-D-glucuronate Biosynthesis	0.043651583	0.282487997	COMT,LRTOMT
L-DOPA Degradation	0.043651583	0.282487997	FZD10,AXIN1,PIK3R1,SUV39H1,ABL1,KRAS,WNT9A,CCND1,TCF7,BCL2,PTEN,ARRB1,EDN1,PRKAR1B,PMS2,AKT3,GSK3B,PIK3C2B,AKT2,PIK3C2A,TFDP1,FGF9,WNT2B,PIK3C2G,FZD9,TCF7L1,TCF3,WNT3A,WNT10A,CD44,PRKAG2,LEF1,WNT11,TCF7L2,PRKAR1A,WNT5A
Ovarian Cancer Signaling	0.044668359	0.282487997	GRM2,POLR2D,PIK3R1,GRID2,GNB2L1,KRAS,GNA14,PRKCZ,GNG11,CAMK2D,GRID1,GNAT1,PRKAR1B,AKT3,PRKCE,PLCB1,GNA13,GRIK2,PRKD1,GRIK1,PRKCA,ADCY9,PIK3C2B,GRIN2B,AKT2,PIK3C2A,GRB2,ITPR2,GNA12,PIK3C2G,GNAQ,PLCG1,PLCL2,ITPR1,ATF2,PLCZ1,GRM7,CALM1 (includes others),PLCB4,PRKCI,GRIK4,PRKAG2,PRKCH,GNAL,PRKAR1A
CREB Signaling in Neurons	0.044668359	0.282487997	PIK3C2B,HSD17B3,AKT2,HSD17B13,PIK3C2A,PIK3R1,TERT,PIK3C2G,KRAS,CND1,ATF2,FOS,JUN,CYP19A1,IGF1R,AKT3,HSD17B12,AKR1C4,ESR1
Estrogen-Dependent Breast Cancer Signaling	0.046773514	0.28840315	MAP3K9,DAPK1,AKT2,SGK1,CSNK1A1,CDK6,LIMK2,PRKX,NEK2,PDXK,PIM1,PRPF4B,PRKAA2,PRKCE,MAP3K8,PRKCH,ACVR2A,CDK2,DYRK1A
Pyridoxal 5'-phosphate Salvage Pathway	0.046773514	0.28840315	BCL2L1,PIK3C2B,AKT2,FOXO1,PIK3C2A,PIK3R1,PIK3C2G,IL1B,BID,AKT3,GSK3B,BCL2,APP
Docosahexaenoic Acid (DHA) Signaling	0.050118723	0.299916252	

**Supplementary Table 9: All PANC1 TCF7L2 Ingenuity Canonical pathways with at least nominal  $P < 0.05$**

Ingenuity Canonical Pathways	P-value	B-H Multiple testing correction p-value	Molecules
Molecular Mechanisms of Cancer	4.89779E-06	0.002691535	RAP2B,RAF1,SHH,RAPGEF1,BMP4,AXIN1,PIK3R1,TAB2,CDKN2C,KRAS,G SK3A,RBL1,CCND1,HIPK2,FASLG,PRKD1,SMAD2,PIK3C2B,CCNE2,AKT2,C REBBP,PTCH1,NFKB2,TCF3,CDH1,MAX,IRS1,ARHGEF6,CFLAR,ARHGEF9, GNAL,CAMK2G,MAP2K6,RAP1B,RAP2A,LRP6,BMPR2,PSEN2,MAP3K5,PR KCZ,CHEK1,HHAT,JUN,BBC3,SOS1,RHO,UB,PRKCE,ARHGEF3,CASP8,P AK2,GRB2,GNA12,MDM2,BAK1,SIN3A,PRKCG,FADD,FOS,GNAI3,CCNE1,R ASGRF1,RBPJ,BMP7,BMP6,ATR,CASP7,LRP1,CTNND1,BIRC2,GAB2,JAK1, SMAD3,MYC,TGFBR2,PTK2,CTNNA2,CAMK2D,RHOB,GNAT1,MRAS,FZD2, BIRC3,E2F2,ADCY9,CYCS,CDK6,FZD9,APC,PIK3R3,BCL2L1,BMPR1B,CBL, RND3,ARHGEF16,GNAO1,TGFB3,FZD5,LEF1,FNBP1,RELA,BMP2,ABL1,HIF 1A,NFKB1,RHOH,BCL2,NFKBIA,MAP3K7,RHOT1,TGFB2,RHOF,PAK4,LRP5, ARHGEF12,PIK3C2A,GNAI1,SMAD7,SMAD6,BMP5,XIAP,GNAI2,FZD8,MAP K14,PRKCI,FOXO1,NF1,PRKAG2,PIK3CB,BCL2L1
Factors Promoting Cardiogenesis in Vertebrates	1.25893E-05	0.003467369	BMP4,MYL2,AXIN1,TGFBR3,BMP2,LRP6,BMPR2,NOG,TCF7,PRKCZ,TGFB R2,MAP3K7,TGFB2,PRKCE,FZD2,ACVR1C,PRKD1,SMAD2,LRP5,CCNE2,F ZD9,TCF3,BMP5,ACVR1B,APC,PRKCG,ATF2,FZD8,BMPR1B,CCNE1,MAPK 14,PRKCI,TGFB3,FZD5,LEF1,MEF2C,BMP7,DKK1,BMP6,GATA4,WNT11,LRP 1,TCF7L2
Wnt/ $\beta$ -catenin Signaling	2.29087E-05	0.004265795	CSNK1G1,AXIN1,TGFBR3,SOX12,CSNK1A1,WNT16,GSK3A,BCL9,CCND1,T CF7,SOX2,MYC,TGFBR2,RARA,PPM1L,CSNK2A1,FZD2,SOX4,AKT2,AXIN2, CREBBP,CSNK1D,FZD9,TCF3,ACVR1B,APC,CDH2,CDH1,CDH12,GNAO1,P PP2R2B,TGFB3,LEF3,LEF1,SOX8,FZD5,DVL2,SFRP1,MMP7,SFRP2,LRP6,B MPR2,SOX9,JUN,MAP3K7,DKK3,CDH3,TGFB2,SOX14,PPP2R2C,ACVR1C, UBB,LRP5,PPAR,CSNK1G3,WNT2B,HDAC1,MDM2,FZD8,WNT10A,SOX6, TLE4,CD44,NR5A2,BTRC,DKK1,PPP2R5E,UBC,WNT11,LRP1,TCF7L2
Prolactin Signaling	6.60693E-05	0.009120108	SOCS3,RAF1,SOCS1,PRL,PIK3R1,SOCS6,SOCS2,PDPK1,KRAS,NR3C1,TC F7,PRKCZ,MYC,JUN,SP1,SOS1,MRAS,PRKCE,STAT1,STAT5B,PRKD1,STA T5A,PIK3C2B,PIK3C2A,GRB2,CREBBP,PLCG1,CEBPB,STAT3,PRKCG,PIK3 R3,FOS,PRKCI,IRS1,PIK3CB,SOCS5
mTOR Signaling	0.000169824	0.015135612	PRKAB2,PRKAB1,PIK3R1,PDPK1,EIF4A2,KRAS,RPS7,VEGFA,RPS24,RHO B,EIF3B,EIF4G2,PPM1L,MRAS,PRKD1,PIK3C2B,AKT2,RHEB,DDIT4,EIF4G3 ,VEGFC,EIF3E,PLD1,PIK3R3,ATG13,RPS6KA6,RND3,IRS1,PPP2R2B,RPS1 5,RPS15A,RPS6KA1,FNBP1,EIF3K,NAPEPLD,FKBP1A,RPS13,HIF1A,PRR5 L,PDGFC,RHOH,PRKCZ,RPS27,MTOR,RHOT1,RPS9,RPS16,PRKAA2,EIF3 A,RPTOR,RHO,PRKCE,RPS20,PPP2R2C,RHOF,GNB1L,RPS3,EIF3H,PIK3 C2A,EIF3F,RPS19,PRKCG,RPS12,PRKCI,RPS10,RPS5,RPS26,PRKAG2,PR R5,RPS6KA4,PIK3CB,PPP2R5E,RPS14
Signaling by Rho Family GTPases	0.000194984	0.015135612	RAF1,MAP3K11,MYL2,SEPT9,PIK3R1,DIAPH3,GNB2L1,PIKFYVE,CLIP1,RO CK2,GNB1,MYLK,PTK2,MAP3K10,STMN1,CFL2,GNAT1,RHOB,EZR,BAIAP2, MRAS,ARPC1A,ACTG2,MYL10,ACTR2,PIK3C2B,MAP3K9,CFL1,SEPT7,RDX ,CDH18,WASF1,NFKB2,PLD1,PIK3R3,CDH2,MYL12A,PIP5K1A,CDH1,CDH1 2,RND3,MYL12B,ARHGEF16,ARHGEF6,GNAO1,PPP1R12B,CDH8,GNB2,AR HGEF9,FNBP1,GNAL,RELA,NFKB1,RHOH,PRKCZ,CDH11,NGG7,CDH7,JUN ,WASL,NGG11,CDH3,RHOT1,CIT,RHO,ARHGEF3,GNB1L,RHOF,ITGB1,PA K4,PAK2,ARHGEF12,PIK3C2A,GNA12,ACTB,ITGA2,GNAI1,CDH6,VIM,ITGA 3,NGG5,GNAI2,GNAI3,FOS,PRKCI,CDH9,PIK3CB,CDC42EP4
PEDF Signaling	0.000213796	0.015135612	RAF1,RELA,GDNF,BDNF,PIK3R1,KRAS,NGF,NFKB1,TCF7,BCL2,TCF12,RO CK2,IKBK,IKBK,SOD2,MRAS,CASP8,FASLG,PPARG,PIK3C2B,AKT2,PI K3C2A,SERPINF1,IKBKE,ZEB1,NFKB2,PNPLA2,PIK3R3,BCL2L1,MAPK14,PI K3CB,WASF2,CFLAR,CASP7
Hypoxia Signaling in the Cardiovascular System	0.000218776	0.015135612	EPO,UBE2H,UBE2A,UBE2D2,HIF1A,CREB5,ARNT,UBE2F,PTEN,VEGFA,HS P90B1,NFKBIA,JUN,HSP90AB1,UBE2B,EDN1,UBE2V1,COPS5,CREBBP,UB E2R2,CREB3,CSNK1D,BIRC6,MDM2,UBE2S,SLC2A4,ATF2,HSP90AA1,UBE 2E1,LDHA,UBE2I
Huntington's Disease Signaling	0.000288403	0.017782794	VT1A,SGK1,PIK3R1,GNB2L1,PDPK1,HSPA5,CREB5,CDK5R1,GNB1,MAP3 K10,HSPA4,VAMP3,TCERG1,POLR2H,PRKD1,PIK3C2B,AKT2,HDAC4,HDAC 2,HDAC8,CYCS,CLTC,CREB3,CREBBP,TBP,DNM3,ITPR1,UBE2S,STX1A, RPH3A,NAPG,ATF2,HDAC5,HSPA8,PIK3R3,DYNC112,BCL2L1,HTT,GNB2,C APN2,POLR2I,BDNF,NGF,PRKCZ,NGG7,TGM2,MTOR,JUN,NGG11,SP1,SO S1,IGF1R,PRKCE,NCOR1,DNAJB1,GNB1L,CASP8,BET1L,EGFR,NEUROD1, HDAC9,GRIN2B,UBB,PIK3C2A,YKT6,GRB2,GLS,HDAC1,HIP1,HSPA2,SNAP 25,NGG5,SIN3A,PRKCG,CASP12,PRKCI,CAPNS1,HAP1,PIK3CB,NCOR2,U BC,GOSR2,CASP7
Thrombin Signaling	0.000446684	0.020417379	RAF1,MFRIP,MYL2,PIK3R1,GNB2L1,PDPK1,KRAS,PLCH2,GATA2,ROCK2, GNB1,MYLK,PTK2,PLCD3,PLCE1,CAMK2D,GNAT1,RHOB,MRAS,MYL10,PR KD1,ADCY9,PIK3C2B,AKT2,ITPR2,TBP,ITPR1,NFKB2,PIK3R3,MYL12A,HDAC 3,MYL12B,ARHGEF16,GNAO1,ARHGEF6,GNB2,PPP1R12B,ARHGEF9,GNA L,FNBP1,CAMK2G,RELA,F2RL2,GATA5,PDIA3,NFKB1,RHOH,NGG7,PRKCZ ,NGG11,RHOT1,SOS1,RHO,PRKCE,ARHGEF3,RHOF,GNB1L,EGFR,ARH GEF12,PIK3C2A,GRB2,GNAI2,GNAI1,PLCG1,NGG5,PRKCG,GNAI2,GNAI3, MAPK14,PRKCI,PIK3CB,GATA3,GATA4
ILK Signaling	0.000446684	0.020417379	MYL2,PIK3R1,PDPK1,GSK3A,CREB5,CCND1,PTEN,MYC,NCK2,PTK2,VEGF A,CFL2,RHOB,PPM1L,IRS2,ACTG2,ITGB4,ITGB5,PIK3C2B,AKT2,CFL1,FER MT2,CREB3,CREBBP,VEGFC,NFKB2,ATF2,PIK3R3,CDH1,RND3,IRS1,ARH GEF6,PPP2R2B,MYH3,RSU1,LEF1,ACTN4,ITGB6,FNBP1,MAP2K6,REL2,FL NB,BMP2,ITGB8,HIF1A,MYH11,NFKB1,RHOH,PDGFC,MTOR,JUN,RHOT1,P PAP2B,RHO,PPP2R2C,RHOF,NOS2,NACA,MUC1,ITGB1,PNX,PIK3C2A,A CTB,VIM,FOS,LIMS1,SH2B2,MYH9,PIK3CB,RPS6KA4,PPP2R5E
EIF2 Signaling	0.000457088	0.020417379	RAF1,RPL22,RPL27A,EIF1,PIK3R1,PDPK1,EIF4A2,KRAS,EIF2A,RPS7,RPS2 4,EIF3B,EIF4G2,EIF1AX,PAIP1,EIF5,MRAS,RPL12,RPL8,EIF2AK1,PIK3C2B, AKT2,RPL3,RPL27,RPL37,EIF4G3,RPL23A,EIF3E,RPLP0,PIK3R3,RPL15,RP

			L10,RPS15,RPS15A,RPL13A,RPLP1,EIF3K,RPL31,EIF2B4,RPL22L1,RPS13,RPL37A,RPS27,RPS9,SOS1,RPS16,RPL35,RPLP2,EIF3A,RPS20,RPS3,EIF3H,PIK3C2A,EIF3F,RPL34,GRB2,RPL17,RPS19,EIF2C2,RPL21,RPS12,RPS10,RPS5,RPS26,RPL36A,PIK3CB,EIF2AK3,RPS14
Growth Hormone Signaling	0.000489779	0.020417379	SOCS3,SOCS1,PIK3R1,SOCS6,SOCS2,PDPK1,PRKCZ,IGF1R,CEBPA,PRKCE,STAT5B,STAT1,PRKD1,STAT5A,PIK3C2B,PIK3C2A,PLCG1,STAT3,SLC2A4,PRKCG,PIK3R3,FOS,RPS6KA6,IGF2,PRKCI,IRS1,IGFBP3,PIK3CB,RPS6KA4,RPS6KA1,A2M,SOCS5
Role of JAK2 in Hormone-like Cytokine Signaling	0.00060256	0.021877616	EPO,STAT5A,SOCS1,SOCS3,JAK1,PRL,SOCS2,SOCS6,STAT3,SH2B1,IRS1,SH2B2,PTPN1,IRS2,STAT5B,STAT1,SOCS5,HLTF
			SLIT3,RAF1,SHH,GLI2,BMP4,PIK3R1,KRAS,PLCH2,ADAM8,NCK2,VEGFA,GNB1,BAIAP2,ARPC1A,MYL10,PRKD1,ACTR2,PIK3C2B,AKT2,CFL1,COPS5,PTCH1,MMP2,MYL12A,ARHGFEF6,GNB2,RTN4,EPHA2,GNAL,NRP1,RAP1B,ADAM17,LRRC4C,BDNF,PDIA3,ABLIM1,GNNG7,PRKCZ,HKR1,EFNB2,SRGA P1,PLXNA1,EFNA5,SOS1,PFN2,PRKCE,PSMD14,ROBO2,GNB1L,UNC5C,G LIS1,ITGB1,EPHB4,PAK2,NRP2,ADAM2,GRB2,GNA12,ITGA2,PLCG1,SLIT2,I TGA3,ROBO3,EFNA1,PRKCG,SEMA3A,GNAI3,TUBA1A,GLIS2,EPHA5,BMP 7,SEMA3C,BMP6,MYL2,GNB2L1,WNT16,ROCK2,PTK2,PLCD3,MICAL1,PLC E1,SEMA3D,GNAT1,CFL2,UNC5D,MRAS,TUBA1C,ABLIM2,FZD2,EPHA7,PA PPA,NGEF,VEGFC,FZD9,ADAMTS9,TUBA1B,PDGFB,PIK3R3,ADAM18,EPH A6,SDCBP,ADAM12,MYL12B,GNAO1,FZD5,ERAP2,ADAMTS7,MMP7,TUBA 3E,BMP2,ABL1,NGF,ROBO1,BCAR1,PDGFC,WASL,NFAT5,GNNG1,GLI3,SD C2,SEMA3B,SEMA3F,VASP,PXN,PAK4,ARHGFEF12,PIK3C2A,C9orf3,WNT28 ,CHP1,GNAI1,EFNA3,NFATC4,PLXND1,BMP5,GNG5,EFNA4,GNAI2,FZD8,P RKCI,WNT10A,PRKAG2,NFATC2,EPHB3,PIK3CB,SEMA4B,WNT11
Axonal Guidance Signaling	0.000616595	0.021877616	RELA,RAF1,ATF7,PDIA3,PIK3R1,ABL1,PDPK1,ATF6,KRAS,NFKB1,PLEKHA 3,PLCH2,PRKCZ,PTEN,PTPRG,PLCD3,IKBK,IKBKB,NFKBIA,JUN,NFAT5,CAMK2 D,PLCE1,CARD10,FOXO3,MRAS,IRS2,AKT2,ATF3,ATF1,ITPR2,CHP1,PLCG 1,IKBKE,NFATC4,MALT1,NFKB2,ITPR1,ATF2,FOS,CALM1 (includes others),PRKCI,CBL,CD180,BCL10,IRS1,SH2B2,LYN,NFATC2,PIK3CB,PLEK HA1,CAMK2G
PI3K Signaling in B Lymphocytes	0.000630957	0.021877616	RAF1,GAB2,RELA,SMAD3,PIK3R1,ABL1,KRAS,RBL1,NFKB1,CCND1,TGFB R2,MYC,IKBK,CTBP2,SOS1,TGFB2,MRAS,STAT5B,E2F2,STAT5A,HDAC9, PIK3C2B,AKT2,RBL2,HDAC4,HDAC2,PIK3C2A,HDAC8,GRB2,HDAC1,CDK6, MDM2,IKBKE,NFKB2,SIN3A,HDAC5,PIK3R3,BCL2L1,TGFB3,PIK3CB
Chronic Myeloid Leukemia Signaling	0.000776247	0.024547089	RAPGEF1,RAF1,GRIN2A,AXIN1,GNB2L1,KRAS,MAP4K4,CREB5,GNB1,NCK 2,PTK2,VEGFA,ROCK2,CFL2,GNAT1,MRAS,ARPC1A,EPHA7,ACTR2,AKT2, NDCBF,CFL1,CREB3,CREBBP,VEGFC,STAT3,PDGFB,ATF2,EPHA6,SDCBP, GNAO1,GNB2,DOK1,EPHA2,GNAL,RAP1B,ABL1,PDGFC,BCAR1,GNNG7,EF NB2,WASL,GNNG11,SORBS1,SDC2,EFNA5,SOS1,GNB1L,ITGB1,GRIN2B,PA K4,PXN,EPHB4,PAK2,GRB2,GNA12,ITGA2,GNAI1,EFNA3,ITGA3,GNNG5,EFN A4,EFNA1,GNAI2,GNAI3,EPHA5,EPHB3
Ephrin Receptor Signaling	0.000794328	0.024547089	SOCS1,SOCS3,RELA,PRKAB1,PRKAB2,PIK3R1,SOCS6,PKM,SOCS2,PDPK 1,SMPD1,MAP3K5,NFKB1,PRKCZ,IKBK,MTOR,NFKBIA,MAP3K7,PRKAA2, PRKCE,IRS2,NSMAF,SMPD3,PRKD1,TNFRSF11B,PPARG,PIK3C2B,AKT2,P IK3C2A,MAP3K1,CD36,IKBKE,CEBPB,NFKB2,ACSBG2,SLC2A4,PRKCG,PIK 3R3,TRAF2,PRKCI,IRS1,SH2B2,PRKAG2,PIK3CB,SOCS5,ENPP7,ACSL1
Type II Diabetes Mellitus Signaling	0.000933254	0.026915348	NOS1,RELA,TRAF3,PIK3R1,ABL1,NFKB1,CCND1,PTEN,BCL2,PTK2,MYC,IK BK,IKBKB,TRAF4,BID,PIK3C2B,AKT2,CCNE2,PIK3C2A,CYCS,CDK6,IKB KE,NFKB2,SIN3A,PIK3R3,BCL2L1,TRAF2,CCNE1,MAX,CKS1B,PIK3CB,BIR C2
Small Cell Lung Cancer Signaling	0.001230269	0.033113112	RAF1,SOCS1,SOCS3,JAK1,CTGF,PIK3R1,SOCS6,SOCS2,PDPK1,KRAS,IG FBP7,PRKCZ,PTK2,YWHAQ,JUN,FOXO3,SOS1,MRAS,CSNK2A1,IGF1R,IRS 2,IGFBP1,PIK3C2B,AKT2,PXN,PIK3C2A,GRB2,YWHAZ,STAT3,GRB10,PIK3 R3,FOS,PRKCI,FOXO1,IRS1,IGFBP3,PRKAG2,PIK3CB,SFN,CYR61,SOCS5 IL6ST,LIF,SGK1,KRAS,CREB5,NGF,PRKCZ,YWHAQ,MYC,FOXO3,MRAS,FO SL1,EGFR,MEF2B,MEF2B,GNB12,CREBBP,CREB3,YWHAZ,MEF2A,ATF2,FOS,RPS6KA6,MEF 2C,RPS6KA4,MAP3K8,RPS6KA1,SFN,ELK4,MAP2K5
IGF-1 Signaling	0.001318257	0.033113112	MYL2,GNB2L1,PIKFYVE,GNB1,ROCK2,RHO,GNAT1,CFL2,EZR,MRAS,AR HGAP12,ARPC1A,ACTG2,MYL10,ACTR2,CFL1,CREBBP,RDX,CDH18,WASF 1,ARHGAP5,PIP5K1A,MYL12A,CDH2,CDH1,CDH12,RND3,MYL12B,ARHGE F16,GNAO1,ARHGFEF6,CDH8,GNB2,PPP1R12B,WASF2,ARHGFEF9,GNAL,F NBP1,RHOH,CDH11,GNNG7,CDH7,GNNG11,WASL,RHOT1,CDH3,RHO,ARH GEF3,GNB1L,RHOF,ITGB1,PAK4,PAK2,ARHGFEF12,GNA12,ACTB,ITGA2,G NAI1,ARHGAP4,CDH6,ITGA3,GNNG5,GNAI2,GNAI3,CDH9,CD44
ERK5 Signaling	0.001348963	0.033113112	RAP2B,RAPGEF1,RAF1,MAP3K11,MRIIP,ARHGAP26,MYL2,PIK3R1,KRAS, PTEN,NCK2,MYLK,PTK2,TSPAN3,RHO,ITGA9,GRB7,CAV1,MRAS,ITGA9, ARPC1A,ACTG2,ITGB4,TSPAN4,ITGB5,ACTR2,PIK3C2B,AKT2,TSPAN5,ITG A6,TSPAN2,BCAR3,TNK2,PIK3R3,ARHGAP5,MYL12A,RND3,MYL12B,PPP1 R12B,CAPN2,ITGA1,ACTN4,ITGB6,FNBP1,RAP1B,RAP2A,ABL1,ITGB8,BCA R1,RHOH,ARF6,WASL,RHOT1,SOS1,RHO,VCL,RHOF,VASP,ITGB1,PXN,P AK4,PAK2,PIK3C2A,GRB2,ASAP1,ACTB,ITGA2,PLCG1,ITGA3,CAPNS1,LIM S1,PIK3CB,NEDD9
RhoGDI Signaling	0.001380384	0.033113112	MAP4K2,RELA,PAK4,PAK2,CYCS,MAP3K1,IKBKE,NFKB2,NFKB1,XIAP,FAD D,TANK,FOS,TRAF2,IKBK,IKBKB,JUN,NFKBIA,CRADD,BID,CASP8,BIRC3,CASP7 ,BIRC2
Integrin Signaling	0.001479108	0.033884416	EPO,RELA,SOCS3,SOCS1,RAF1,PIK3R1,PDPK1,KRAS,NFKB1,PRKCZ,JUN ,NFKBIA,SOS1,MRAS,PRKCE,STAT5B,PRKD1,STAT5A,PIK3C2B,AKT2,PIK3 C2A,GRB2,PLCG1,NFKB2,PRKCG,PIK3R3,FOS,PRKCI,CBL,PIK3CB
TNFR1 Signaling	0.001513561	0.033884416	PPARA,RAF1,RELA,MAP4K4,KRAS,IL1F10,NFKB1,PDGFC,NR2F1,IKBK,H SP90B1,NFKBIA,JUN,HSP90AB1,NR0B2,MAP3K7,SOS1,MRAS,NCOR1,STA T5B,CITED2,TNFRSF11B,PPARG,STAT5A,MED1,GRB2,PPARD,CREBBP,N R1H3,IKBKE,NFKB2,PDGFB,FOS,IL18,TRAF2,HSP90AA1,NCOR2,NR1P 1
Erythropoietin Signaling	0.001949845	0.040738028	GADD45B,GADD45G,ABL1,CREB5,CBX5,RAD50,SMC1A,CHEK1,NFKBIA,J UN,GADD45A,BID,BRAT1,BLM,SMC3,CREBBP,CREB3,MDM2,CDK1,ATF2, MDM4,MAPK14,SMC2,H2AFX,TP53BP1,TLK1,TLK2
PPAR Signaling	0.001995262	0.040738028	PIK3R1,PARD6B,KRAS,GSK3A,MAP3K5,ITGB8,CCND1,PRKCZ,SOS1,MRA S,PRKCE,ITGB4,PRKD1,ITGB5,EGFR,ITGB1,PIK3C2B,CCNE2,AKT2,PIK3C 2A,GRB2,CDK6,PLCG1,MMP2,MDM2,AREG,AREGB,PRKCG,PIK3R3,CCNE 1,PRKCI,FOXO1,PIK3CB,ITGB6
ATM Signaling	0.002187762	0.041686938	STAT5A,PIK3C2B,RELA,HSD17B3,AKT2,HSD17B13,PIK3C2A,PIK3R1,CREB
HER-2 Signaling in Breast Cancer	0.002187762	0.041686938	
Estrogen-Dependent Breast	0.002290868	0.042657952	

Cancer Signaling			3,CREBBP,TERT,KRAS,NFKB2,CREB5,NFKB1,CCND1,ATF2,PIK3R3,FOS,JUN,SP1,MRAS,IGF1R,HSD17B2,PIK3CB,STAT5B,HSD17B2,EGFR RAF1,MAP3K11,MYL2,PIK3R1,GNB2L1,HAND1,KRAS,IL6,PLCH2,TGFBR2,GNB1,ROCK2,PLCD3,MAP3K10,PLCE1,GNAT1,RHOB,MRAS,MYL10,ADRA1B,ADCY9,MAP3K9,PIK3C2B,CREBBP,IL6R,ATF2,PIK3R3,MYL12A,RND3,MYL12B,IRS1,GNAO1,TGFB3,GNB2,RPS6KA1,GNAL,FNBP1,HSPB1,MAP2K6,EIF2B4,PDIA3,ATF6,MAP3K5,RHOH,GNB7,MTOR,GNB11,ADRB1,JUN,RHOT1,MAP3K7,SOS1,IGF1R,RHO, TGFB2,RHOF,GNB1L,ADRB2,CACNA1D,MEF2B,MEF2B,PIK3C2A,GRB2,GNA12,MAP3K1,CHP1,GNAI1,MEF2A,PLCG1,NFATC4,GNB5,GNAI2,GNAI3,CALM1 (includes others),MAPK14,PRKAG2,ADRA2C,PIK3CB,MAP3K8,MEF2C,GATA4
Cardiac Hypertrophy Signaling	0.002398833	0.042657952	MAP3K11,AXIN1,PIK3R1,MLLT4,PDPK1,KRAS,TGFBR2,PTK2,MAP3K10,CTNNA2,RHOB,MRAS,TUBA1C,MTMR2,ACTG2,JUP,PIK3C2B,MAP3K9,ITGA6,GSN,TUBA1B,PIK3R3,CDH1,CDH1,RND3,TGFB3,ACTN4,FNBP1,MAP2K6,TUBA3E,MAP3K5,BCAR1,RHOH,WASL,SORBS1,RHOT1,MAP3K7,PPAP2B,TGFB2,RHO, RHOF,RAB8B,ITGB1,EPN1,PXN,PAK4,PAK2,PIK3C2A,TJP1,ACTB,MAP3K1,ITGA2,ITGA3,MAPK14,TUBA1A,MAP3K8,PIK3CB,A2M,CTNND1
Germ Cell-Sertoli Cell Junction Signaling	0.002511886	0.042657952	RAF1,EIF1,PIK3R1,PDPK1,EIF4A2,KRAS,PAIP2,EIF2A,RPS7,RPS24,EIF3B,EIF4G2,EIF1AX,PPM1L,PAIP1,MRAS,PIK3C2B,AKT2,EIF4G3,EIF3E,PIK3R3,IRS1,PPP2R2B,RPS15,RPS15A,EIF3K,EIF2B4,RPS13,PRKCZ,MTOR,RPS27,RPS9,RPS16,SOS1,EIF3A,RPS20,PPP2R2C,RPS3,ITGB1,PIK3C2A,EIF3H,EIF3F,GRB2,ITGA2,RPS19,EIF2C2,ITGA3,RPS12,RPS10,MAPK14,RPS5,RP S26,PIK3CB,PPP2R5E,RPS14
Regulation of eIF4 and p70S6K Signaling	0.002570396	0.043651583	GAB2,RAF1,RELA,JAK1,PIK3R1,GDF15,PDPK1,KRAS,GSK3A,MAP3K5,NFKB1,CCND1,PRKCZ,PTEN,BCL2,YWHAQ,IKBKG,MTOR,HSP90B1,NFKBIA,HSP90AB1,FOXO3,SOS1,PPM1L,MRAS,PPP2R2C,THEM4,ITGB1,RHEB,AKT2,GRB2,ITGA2,YWHAZ,MDM2,IKBKE,NFKB2,ITGA3,SYNJ2,PIK3R3,BCL2L1,FOXO1,LIMS1,PPP2R2B,HSP90AA1,PIK3CB,MAP3K8,PPP2R5E,SFN
PI3K/AKT Signaling	0.002691535	0.043651583	MAP2K6,RUNX1,RAF1,RELA,PIK3R1,KRAS,NFKB1,CCND1,TCF7,MYC,MTOR,PIM1,RARA,SOS1,MRAS,CEBPA,JUP,STAT5B,STAT5A,PIK3C2B,AKT2,PIK3C2A,GRB2,NFKB2,STAT3,TCF3,PIK3R3,KITLG,PIK3CB,LEF1,MAP2K5,TCF7L2,PIM2
Acute Myeloid Leukemia Signaling	0.002884032	0.043651583	RAF1,RELA,PIK3R1,ABL1,PDPK1,KRAS,CREB5,NFKB1,CCND1,PTEN,BCL2,HSP90B1,MTOR,NFKBIA,HSP90AB1,SOS1,MRAS,PIK3C2B,CCNE2,AKT2,PIK3C2A,GRB2,CREBBP,CREB3,MDM2,NFKB2,SIN3A,ATF2,PIK3R3,CCNE1,FOXO1,HSP90AA1,PIK3CB,LEF1
Prostate Cancer Signaling	0.002951209	0.043651583	BMPR1B,BMP4,MYL2,MAP3K7,BMP2,SMAD6,BMPR2,BMP7,BMP5,GATA4,ATF2
Cardiomyocyte Differentiation via BMP Receptors	0.003019952	0.043651583	MAP2K6,RAF1,BMP4,SMAD3,BMP2,SKI,BMPR2,KRAS,HOXC9,TGIF1,BCL2,TGFBR2,JUN,RUNX2,MAP3K7,SOS1,TGFB2,MRAS,SERPINE1,ACVR1C,SMAD2,GRB2,CREBBP,HDAC1,SMAD7,SMAD6,ACVR1B,INHBB,INHBA,FOS,BMPR1B,MAPK14,TGFB3,SMURF2,BMP7
TGF-β Signaling	0.003019952	0.043651583	IL6ST,RAF1,ID2,JAK1,BMP4,LIF,T,AXIN1,PIK3R1,BMPR2,KRAS,TCF7,MYC,LIFR,SOX2,ID1,MAP3K7,SOS1,MRAS,FZD2,PIK3C2B,AKT2,PIK3C2A,GRB2,CREBBP,FZD9,STAT3,TCF3,XIAP,APC,PIK3R3,FZD8,MAPK14,PIK3CB,FZD5,LEF1,DVL2,TCF7L2,ID4
Mouse Embryonic Stem Cell Pluripotency	0.003162278	0.045708819	RAF1,GAB2,PIK3R1,KRAS,PRKCZ,MYC,JUN,SOS1,MRAS,PRKCE,IRS2,STAT1,STAT5B,PRKD1,PIK3C2B,STAT5A,PIK3C2A,GRB2,PLCG1,STAT3,PRKCG,PIK3R3,FOS,PRKCI,PIK3CB
Thrombopoietin Signaling	0.003467369	0.047863009	RAP1B,RAF1,RAPGEF1,MAP3K11,PIK3R1,ETS2,KRAS,MAP3K5,IL6,CCND1,PRKCZ,PTK2,ELF4,MAP3K10,JUN,ELF3,MAP3K7,HGF,SOS1,MRAS,PRKCE,PRKD1,ETS1,MAP3K9,PIK3C2B,AKT2,PXN,PIK3C2A,GRB2,MAP3K1,PLCG1,STAT3,PRKCG,ATF2,MET,PIK3R3,FOS,PRKCI,PIK3CB,MAP3K8
HGF Signaling	0.003981072	0.05370318	STAT5A,RELA,SOC3,PIK3C2B,JAK1,PIK3C2A,PIK3R1,SOC2,STAT3,NFKB2,NFKB1,PIK3R3,IRS1,PIK3CB,IRS2,STAT5B,STAT1
IL-9 Signaling	0.004570882	0.060255959	RAF1,RELA,MAP4K4,KRAS,MAP3K5,NFKB1,DIFFA,BCL2,IKBKG,NFKBIA,MRAS,BID,PRKCE,CASP8,BIRC3,FASLG,AIFM1,CYCS,BIRC6,PLCG1,BCL2L1,IKBKE,NFKB2,XIAP,BAK1,CDK1,PARP1,BCL2L1,CASP12,CAPNS1,CAPN2,SPTAN1,RPS6KA1,BCL2L1,CASP7,BIRC2
Apoptosis Signaling	0.004786301	0.0616595	RAF1,ADAM17,PIK3R1,PDPK1,KRAS,PRKCZ,CDK5R1,TMEFF2,PTEN,MYC,HSP90B1,MTOR,HSP90AB1,ERBB4,SOS1,GRB7,MRAS,PRKCE,ERRF1,STAT5B,PRKD1,EGFR,ITGB1,STAT5A,AKT2,GRB2,ITGA2,PLCG1,ITGA3,PRKCG,AREG,AREGB,PIK3R3,PICK1,PRKCI,HSP90AA1
Neuregulin Signaling	0.005888437	0.072443596	MAP2K6,RAF1,RELA,MAP3K11,PIK3R1,TAB2,MAP3K5,NFKB1,MAP3K10,IKBKG,JUN,NFKBIA,MAP3K7,BIRC3,MAP3K9,PIK3C2B,AKT2,PIK3C2A,MITF,CHP1,MAP3K1,IKBKE,NFKB2,GSN,XIAP,PIK3R3,CALM1 (includes others),FOS,TRAF2,MAPK14,CBL,NFATC2,MAP3K8,PIK3CB,BIRC2
RANK Signaling in Osteoclasts	0.005888437	0.072443596	FLNB,AP2A1,PIK3R1,ABL1,KRAS,ITGB8,PRKCZ,CD55,CAV1,MRAS,PRKCE,ITGB4,ACTG2,PRKD1,ITGB5,ITGB1,PIK3C2B,AP2B1,PIK3C2A,ACTB,CLTC,ITGA2,ITGA6,PLCG1,ITGA3,AP2S1,PRKCG,PIK3R3,PRKCI,CLTA,CLTCL1,TFRC,ITGA1,PIK3CB,ITGB6,CXADR
Virus Entry via Endocytic Pathways	0.006025596	0.072443596	
Embryonic Stem Cell Differentiation into Cardiac Lineages	0.006456542	0.075857758	SOX2,HOXB5,ISL1,T,MESP1,GATA4,SP4
IL-15 Production	0.006606934	0.075857758	RELA,MAP3K11,JAK1,TWF1,IL15,NFKB2,IL6,NFKB1,FRK,PRKCZ,PTK2,PRKCI,PTK7,STAT1
Role of NFAT in Cardiac Hypertrophy	0.00691831	0.075857758	RAF1,LIF,PIK3R1,GNB2L1,CSNK1A1,HAND1,KRAS,IL6,PLCH2,TGFBR2,GNB1,PLCD3,PLCE1,CAMK2D,MRAS,PRKD1,ADCY9,PIK3C2B,AKT2,HDAC4,HDAC2,HDAC8,ITPR2,ITPR1,HDAC5,PIK3R3,TGFB3,GNB2,RCAN3,CAMK2G,IL6ST,MAP2K6,PDIA3,PRKCZ,GNB7,GNB11,MAP3K7,SOS1,TGFB2,GNB1,PRKCE,GNB1L,HDAC9,PIK3C2A,MEF2B,MEF2B,GRB2,MAP3K1,CHP1,HDAC1,MEF2A,GNAI1,PLCG1,NFATC4,GNB5,PRKCG,GNAI2,CALM1 (includes others),GNAI3,MAPK14,PRKCI,PRKAG2,MEF2C,PIK3CB,GATA4
Renal Cell Carcinoma Signaling	0.00691831	0.075857758	RAF1,RAPGEF1,PIK3R1,KRAS,HIF1A,ARNT,VEGFA,JUN,HGF,SOS1,MRAS,EGLN3,ETS1,PIK3C2B,UBB,PAK4,AKT2,PAK2,PIK3C2A,SLC2A1,GRB2,CREBBP,PDGFB,PIK3R3,MET,FOS,CUL2,PIK3CB,UBC
p53 Signaling	0.007413102	0.079432823	GADD45B,JMY,GADD45G,PIK3R1,RRM2B,CCND1,BCL2,PTEN,CHEK1,JUN,GADD45A,STAG1,BBC3,CCNK,HIPK2,WT1,PIK3C2B,AKT2,TP63,PIK3C2A,TOPBP1,MED1,HDAC1,CSNK1D,PERP,RPRM,MDM2,TP53BP2,PIK3R3,BCL2

			L1,PCNA,MDM4,MAPK14,PIK3CB,SFN,ATR,DRAM1
Death Receptor Signaling	0.008128305	0.085113804	RELA,TNFSF10,MAP4K4,MAP3K5,NFKB1,BCL2,TANK,IKBKG,NFKBIA,CRA DD,BID,CASP8,BIRC3,FASLG,TNFRSF21,CYCS,IKBKE,NFKB2, XIAP,FADD, TRAF2,CLLAR,CASP7,BIRC2,HSPB1
PTEN Signaling	0.008317638	0.085113804	MAST2,RAF1,RELA,PIK3R1,TGFBF3,BMPR2,PDPK1,KRAS,GSK3A,NFKB1, BCAR1,CCND1,PRKCZ,PTEN,BCL2,TGFBF2,PTK2,FGFR3,IKBKG,FOXO3,S OS2,CSNK2A1,IGF1R,MRAS,FASLG,EGFR,ITGB1,AKT2,GRB2,ITGA2,FGFR 2,IKBKE,NFKB2,CNKSR3,FOXG1,ITGA3,SYNJ2,PIK3R3,BCL2L1,BMPR1B,C BL,FOXO1,PIK3CB,MAGI2,BCL2L1
Hereditary Breast Cancer Signaling	0.00851138	0.085113804	GADD45B,GADD45G,PIK3R1,KRAS,DDB2,CCND1,RAD50,SMARCA4,PTEN, CHEK1,GADD45A,MRAS,SLC19A1,POLR2H,BLM,PIK3C2B,HDAC9,UBB,AK T2,HDAC4,C17orf70,HDAC8,PIK3C2A,HDAC2,WEE1,HDAC1,CREBBP,CDK6 ,FANCC,FANCL,CDK1,HDAC5,PIK3R3,MSH2,H2AFX,C19orf40,MSH6,PIK3C B,UBC,SFN,POLR21,HLTF,ATR
TWEAK Signaling	0.00851138	0.085113804	RELA,TRAF3,CYCS,IKBKE,NFKB2,NFKB1,XIAP,FADD,TRAF2,IKBKG,NFKBI A,BID,CASP8,BIRC3,CASP7,BIRC2
JAK/Stat Signaling	0.008709636	0.085113804	SOCS3,RAF1,SOCS1,JAK1,PIK3R1,SOCS6,PIAS1,SOCS2,KRAS,IL6,MTOR, SOS1,PTPN1,MRAS,STAT5B,STAT1,PIK3C2B,STAT5A,AKT2,PIK3C2A,GRB 2,STAT3,STAT4,PIK3R3,FOS,BCL2L1,PIK3CB,SOCS5
NF-κB Activation by Viruses	0.008912509	0.085113804	RAF1,RELA,PIK3R1,KRAS,NFKB1,PRKCZ,IKBKG,NFKBIA,ITGAV,MRAS,PR KCE,PRKD1,ITGB5,ITGB1,PIK3C2B,AKT2,PIK3C2A,ITGA2,MAP3K1,ITGA6,T BP,IKBKE,NFKB2,ITGA3,PRKCG,PIK3R3,TRAF2,PRKCI,PIK3CB,ITGA1
Human Embryonic Stem Cell Pluripotency	0.009120108	0.087096359	BMP4,AXIN1,PIK3R1,SMAD3,WNT16,PDPK1,GSK3A,TCF7,TGFBF2,FGFR3, SOX2,MRAS,FZD2,PIK3C2B,SMAD2,AKT2,FGFR2,FZD9,TCF3,APC,PDGFB, INHBA,PIK3R3,BMPR1B,TGFBF3,LEF1,FZD5,BDNF,BMP2,BMPR2,NGF,PDG FC,NOG,TGFB2,PIK3C2A,WNT2B,SMAD7,SMAD6,BMP5,FZD8,FOXO1,WNT 10A,S1PR1,PIK3CB,BMP7,BMP6,TCF7L2,ZIC3,WNT11,SALL4
Role of Macrophages, Fibroblasts and Endothelial Cells in Rheumatoid Arthritis	0.009549926	0.089125094	SOCS1,RAF1,AXIN1,PIK3R1,KRAS,IL6,CREB5,PLCH2,CCND1,VEGFA,TRA F4,PRKD1,PIK3C2B,AKT2,CREB3,CREBBP,STAT3,TCF3,ATF2,SFRP1,CAM K2G,MAP2K6,PDIA3,LRP6,PRKCZ,JUN,CCL2,F2RL1,CEBPA,PRKCE,IL15,P LCG1,PRKCG,FOS,CALM1 (includes others),TRAF2,CSF1,TCF7L2,LRP1,IRAK4,IRAK2,RYK,SOCS3,TRAF3,MMP3 ,CSNK1A1,WNT16,TCF7,CEBPB,MYC,ROCK2,PLCD3,IKBKG,PLCE1,TRAF3 IP2,CAMK2D,MRAS,FZD2,TNFRSF11B,IL8,MIF,IL6R,VEGFC,FZD9,PDGFB, APC,PIK3R3,IL18,GNAO1,LEF1,FZD5,IL6ST,RELA,SFRP2,IL1F10,NFKB1,P DGFC,IRAK1,NFAT5,NFKBIA,DKK3,MAP3K7,NOS2,LRP5,PIK3C2A,WNT2B, CHP1,IKBKE,CEBPB,NFATC4,FZD8,PRKCI,MAPK14,WNT10A,NFATC2,PIK3 CB,DKK1,WNT11
TNFR2 Signaling	0.009772372	0.091201084	TANK,FOS,RELA,IKBKG,TRAF2,JUN,NFKBIA,MAP3K1,IKBKE,NFKB2,NFKB 1,BIRC3,XIAP,BIRC2
Actin Nucleation by ARP-WASP Complex	0.01	0.091201084	ITGB1,ACTR2,GRB2,GNA12,ITGA2,WASF1,KRAS,ITGA3,RHOH,ROCK2,NC K2,WASL,RND3,RHOB,RHOT1,SOS1,BAIAP2,MRAS,PPP1R12B,RHOJ,ARP C1A,RHOF,FNBP1,VASP
Role of Oct4 in Mammalian Embryonic Stem Cell Pluripotency	0.011481536	0.1	NR6A1,KDM5B,FOXA1,NR2F2,CDX2,MEF2A,SH3GLB1,HOXB1,IGF2BP1,PA RP1,NR2F1,SOX2,AQR,CCNF,FOXA2,RARA,NR5A2,NR5A1,PHB,SALL4
IL-8 Signaling	0.011481536	0.1	RAF1,MYL2,PIK3R1,GNB2L1,CXCL1,KRAS,MAP4K4,CCND1,GNB1,PTK2,V EGFA,ROCK2,IKBKG,RHOB,ITGAV,MRAS,ITGB5,PRKD1,IL8,PIK3C2B,AKT2 ,VEGFC,MMP2,PLD1,PIK3R3,BCL2L1,CDH1,RND3,MYL12B,GNB2,FNBP1,R ELA,NAPEPLD,NFKB1,PDGFC,RHOH,PRKCZ,GNG7,IRAK1,BCL2,MTOR,JUN N,GNG11,RHOT1,RHOJ,PRKCE,GNB1L,RHOF,VASP,LASP1,EGFR,PAK2,P IK3C2A,GNA12,GNAI1,IKBKE,GNG5,PRKCG,GNAI2,GNAI3,FOS,PRKCI,PIK 3CB,IRAK4,IRAK2
Glioblastoma Multiforme Signaling	0.011748976	0.1	RAF1,AXIN1,PIK3R1,NF2,WNT16,KRAS,PLCH2,CCND1,PTEN,MYC,PLCD3, PLCE1,RHOB,MRAS,FZD2,E2F2,PIK3C2B,AKT2,ITPR2,CDK6,FZD9,ITPR1,T CF3,PDGFB,APC,PIK3R3,IGF2,RND3,LEF1,FZD5,FNBP1,PDIA3,PDGFC,RH OH,MTOR,RHOT1,SOS1,IGF1R,RHOJ,RHOF,EGFR,PIK3C2A,GRB2,WNT2 B,PLCG1,MDM2,FZD8,CCNE1,NF1,WNT10A,FOXO1,PIK3CB,WNT11
PPARα/RXRα Activation	0.011748976	0.1	PPARA,RAF1,PRKAB2,PRKAB1,SMAD3,TGFBF3,KRAS,MAP4K4,IL6,PLCH2 ,ABCA1,NR2F1,TGFBF2,PLCD3,IKBKG,PLCE1,NR0B2,MRAS,ITGB5,ACDY9 ,SMAD2,MED1,CREBBP,NFKB2,NCOA3,ACVR1B,IRS1,TGFB3,HSP90AA1 ,MAP2K6,RELA,PDIA3,BMPR2,NFKB1,HSP90B1,NFKBIA,JUN,CHD5,HSP90 AB1,MAP3K7,FASN,SOS1,TGFB2,PRKAA2,NCOR1,GOT2,STAT5B,ACVR1C ,GRB2,ACOX1,CD36,CKAP5,PLCG1,IKBKE,TGS1,MAPK14,PRKAG2,MEF2C ,NCOR2
NRF2-mediated Oxidative Stress Response	0.012302688	0.101391139	RAF1,PIK3R1,GCLC,KRAS,DNAJC15,SOD2,SCARB1,ABCC1,MRAS,FOSL1, DNAJA2,ACTG2,DNAJC16,PRKD1,PIK3C2B,DNAJC9,CREBBP,JUNB,TXNR D1,PIK3R3,STIP1,DNAJC5B,DNAJB6,SQSTM1,ENC1,ABCC4,MGST3,MAP2 K5,FTH1,MAP2K6,PIIB,ABCC2,NQO2,MAP3K5,DNAJA1,PRKCZ,MAFG,CUL 3,JUN,MAP3K7,VCP,PRKCE,DNAJB1,FKBP5,NFE2L2,GSTA3,DNAJB8,UBB, PIK3C2A,GSTA4,ACTB,MAP3K1,SLC35A2,MAFK,GSTO1,PRKCG,FOS,MAP K14,PRKCI,PIK3CB,E1F2AK3,DNAJB5,DNAJC7
CD27 Signaling in Lymphocytes	0.012302688	0.101391139	MAP2K6,RELA,MAP3K9,MAP3K11,CYCS,MAP3K1,IKBKE,NFKB2,MAP3K5,N FKB1,BCL2L1,FOS,MAP3K10,TRAF2,IKBKG,JUN,NFKBIA,MAP3K7,BID,MAP 3K8,CASP8,MAP2K5
Colorectal Cancer Metastasis Signaling	0.012589254	0.101391139	MMP20,JAK1,ADRBK1,MMP3,AXIN1,SMAD3,MMP16,PIK3R1,GNB2L1,WNT 16,KRAS,IL6,CCND1,TCF7,VEGFA,GNB1,TGFBF2,MYC,RHOB,MRAS,FZD2, ADCY9,SMAD2,PIK3C2B,AKT2,IL6R,VEGFC,FZD9,MMP2,NFKB2,STAT3,TC F3,APC,PIK3R3,BCL2L1,CDH1,RND3,TGFB3,GNB2,LEF1,FZD5,FNBP1,SIA H1,IL6ST,RELA,MMP7,LRP6,NFKB1,RHOH,PDGFC,GNG7,GNG11,JUN,ARR B1,RHOT1,SOS1,RHOJ,TGFB2,RHOF,STAT1,GNB1L,NOS2,PTGER4,MMP1 7,EGFR,LRP5,PIK3C2A,GRB2,WNT2B,GNG5,FZD8,FOS,WNT10A,MSH2,MS H6,PRKAG2,PIK3CB,WNT11,LRP1,TCF7L2
Aryl Hydrocarbon Receptor Signaling	0.012589254	0.101391139	ALDH4A1,RELA,NQO2,IL6,NFKB1,CCND1,SMARCA4,CHEK1,ARNT,TGM2, MYC,NR2F1,HSP90B1,NCOA7,JUN,HSP90AB1,SP1,NR0B2,ALDH1A3,RARA ,TGFB2,NFE2L2,FASLG,AHR,GSTA3,CCNE2,MED1,GSTA4,TYR,CDK6,SLC 35A2,MDM2,NFKB2,CYP1B1,GSTO1,NCOA3,FOS,CCNE1,ALDH1L2,NFIA,T GFB3,HSP90AA1,NFIB,ALDH18A1,NR1P1,NCOR2,ATR,MGST3,HSPB1
Telomerase Signaling	0.013182567	0.103038612	RAF1,PIK3R1,TERT,ABL1,ETS2,PDPK1,KRAS,MYC,ELF4,HSP90B1,ELF3,H SP90AB1,SP1,PPM1L,SOS1,MRAS,PPP2R2C,POT1,EGFR,ETS1,HDAC9,PI K3C2B,AKT2,HDAC4,HDAC2,PIK3C2A,HDAC8,GRB2,HDAC1,HDAC5,PIK3R 3,TERF2,PPP2R2B,HSP90AA1,PIK3CB,TINF2,PPP2R5E

Role of PKR in Interferon Induction and Antiviral Response	0.013803843	0.106414302	MAP2K6,RELA,TRAF3,CYCS,TAB2,IKBKE,NFKB2,NFKB1,ATF2,FADD,TRAF2,IKBKG,MAPK14,NFKBIA,MAP3K7,BID,CASP8,STAT1
Transcriptional Regulatory Network in Embryonic Stem Cells	0.013803843	0.106414302	GBX2,LHX5,TRIM24,CDX2,HAND1,MEIS1,OTX1,EOMES,STAT3,HOXB1,GSX2,SOX2,ISL1,CDYL,SKIL,GATA4,ZIC3,ZFH3
RhoA Signaling	0.014125375	0.107398941	MPRIIP,SEPT9,MYL2,PIKFYVE,RAPGEF6,ROCK2,PTK2,MYLK,CFL2,PLXNA1,EZR,BAIAP2,CIT,IGF1R,ARHGAP12,PFN2,ARPC1A,ACTG2,MYL10,SEMA3F,ACTR2,NGEF,ARHGEF12,NRP2,CFL1,GNA12,RTKN,ACTB,SEPT7,ARHGAP4,RDX,WASF1,LPAR3,PLD1,ARHGAP5,KTN1,MYL12A,PIP5K1A,RHPN2,RND3,MYL12B,PPP1R12B,CDC42EP4
B Cell Receptor Signaling	0.014454398	0.107894672	RAF1,GAB2,MAP3K11,PIK3R1,PDPK1,KRAS,GSK3A,BCL6,CREB5,PTEN,PAK5,PTPRC,MAP3K10,IKBKG,CAMK2D,MRAS,ETS1,PIK3C2B,MAP3K9,AKT2,CREB3,CREBBP,NFKB2,MALT1,TCF3,ATF2,SYNJ2,PIK3R3,BCL2L1,CAMK2G,MAP2K6,RELA,ABL1,MAP3K5,NFKB1,MTOR,NFKBIA,NFAT5,JUN,CARD10,MAP3K7,SOS1,PIK3C2A,FCGR2A,GRB2,MAP3K1,IKBKE,NFATC4,CALM1 (includes others),MAPK14,FOXO1,BCL10,LYN,NFATC2,MAP3K8,PIK3CB
RAN Signaling	0.014791084	0.108642562	KPNB1,KPNA5,KPNA4,KPNA6,KPNA2,TNPO1,RANGAP1,RANBP2,XPO1
NGF Signaling	0.014791084	0.108642562	RAP1B,RAF1,RELA,MAP3K11,PIK3R1,PDPK1,KRAS,SMPD1,MAP3K5,CREB5,NGF,NFKB1,PRKCZ,ROCK2,MAP3K10,IKBKG,MAP3K7,TRAF4,SOS1,MRAS,SMPD3,PIK3C2B,MAP3K9,AKT2,PIK3C2A,GRB2,MAP3K1,CREB3,CREBBP,PLCG1,IKBKE,NFKB2,ATF2,PIK3R3,RPS6KA6,TRIO,MAP3K8,PIK3CB,RPS6KA4,RPS6KA1
Glioma Signaling	0.015848932	0.113501082	RAF1,PIK3R1,ABL1,CDKN2C,KRAS,RBL1,CCND1,PDGFC,PRKCZ,PTEN,MTOR,CAMK2D,SOS1,MRAS,IGF1R,PRKCE,E2F2,PRKD1,EGFR,PIK3C2B,AKT2,RBL2,PIK3C2A,GRB2,CDK6,PLCG1,MDM2,PDGFB,SIN3A,PRKCG,PIK3R3,CALM1 (includes others),IGF2,PRKCI,PIK3CB,CAMK2G
Neurotrophin/TRK Signaling	0.016595869	0.118850223	MAP2K6,RAF1,BDNF,PIK3R1,PDPK1,KRAS,MAP3K5,CREB5,NGF,JUN,SOS1,MRAS,SORCS1,PIK3C2B,PIK3C2A,SPRY1,GRB2,CREB3,CREBBP,PLCG1,ATF2,PIK3R3,FOS,SPRY2,PIK3CB,RPS6KA1,MAP2K5
Glucocorticoid Receptor Signaling	0.017782794	0.124451461	RAF1,TAF11,JAK1,PRKAB2,PRKAB1,CD3E,SGK1,SMAD3,PIK3R1,KRAS,IL6,KRT32,HSPA5,TGFB2,HSPA4,IKBKG,HMGB1,MRAS,POLR2H,SERPINE1,CDKN1C,IL8,PIK3C2B,STAT5A,SMAD2,AKT2,MED1,CDK7,CREBBP,TBP,STAT3,TAF15,NCOA3,HSPA8,PIK3R3,BCL2L1,DUSP1,TGFB3,HSP90AA1,POLR21,UBE2I,RELA,PRL,NFKB1,NR3C1,SMARCA4,BCL2,GT2F2B,HSP90B1,JUN,NFAT5,NFKBIA,CCL2,HSP90AB1,MAP3K7,ANXA1,SOS1,FOXO3,PRKAA2,CEBPA,TGFB2,NCOR1,STAT5B,STAT1,FKBP5,NOS2,ADRB2,TAF12,PIK3C2A,GRB2,MAP3K1,CHP1,IKBKE,CEBPB,NFATC4,HSPA2,FOS,TRAF2,SCGB1A1,MAPK14,PRKAG2,NFATC2,PIK3CB,NCOR2,NR1P1,A2M,HLTF
Role of Osteoblasts, Osteoclasts and Chondrocytes in Rheumatoid Arthritis	0.018620871	0.128528666	BMP4,MMP3,AXIN1,PIK3R1,TAB2,CSNK1A1,WNT16,SP7,IL6,TCF7,IKBKG,RUNX2,BIRC3,FZD2,TNFRSF11B,PIK3C2B,AKT2,FZD9,TCF3,GSN,APC,PIK3R3,IL18,BMPR1B,CBL,LEF1,FZD5,SFRP1,MAP2K6,RELA,ADAM17,SFRP2,BMP2,LRP6,BMPR2,IL1F10,MAP3K5,NFKB1,BCL2,NFKBIA,JUN,NFAT5,DKK3,MAP3K7,ITGB1,LRP5,PIK3C2A,ITGA2,WNT2B,DLX5,CHP1,SMAD6,IKBKE,NFATC4,ITGA3,BMP5,XIAP,FZD8,CALM1 (includes others),FOS,TRAF2,MAPK14,WNT10A,FOXO1,CSF1,NFATC2,PIK3CB,BMP7,DKK1,BMP6,WNT11,LRP1,TCF7L2,BIRC2
Sertoli Cell-Sertoli Cell Junction Signaling	0.018620871	0.128528666	RAF1,MAP3K11,AXIN1,TGFB3,MLL2,GSK3A,KRAS,PTEN,OCN,MAP3K10,CTNNA2,SPTB,MRAS,TUBA1C,MTMR2,ACTG2,JUP,MAP3K9,AKT2,TJP2,TUBA1B,ATF2,CDH1,ZAK,TGFB3,GUCY1A2,ACTN4,SPTAN1,SPTBN1,NOS1,TUBA3E,SYMPK,MAP3K5,BCAR1,JUN,CLDN4,SORBS1,MAP3K7,PPAP2B,PVRL1,NOS2,RAB8B,ITGB1,CLDN10,EPN1,TJP1,ACTB,MAP3K1,ITGA2,ITGA3,EPB41,MAPK14,PRKG1,TUBA1A,CLDN1,PRKAG2,MAP3K8,MAGI2,A2M,CLDN2,CLDN3
Protein Kinase A Signaling	0.019498446	0.131825674	RAF1,SHH,GSK3A,CREB5,PLCH2,GNB1,MYLK,PTPRC,TDP2,CDKN3,MYL10,EYA2,PRKD1,PTPRG,PDE2A,PPP1R1B,CREBBP,PTCH1,CREB3,YWHAZ,ITPR1,NFKB2,TCF3,PTP4A1,CNGA3,ATF2,PDE8A,AKAP13,PTPRH,MYL12A,GNB2,HIST1H1D,CAMK2G,RAP1B,AKAP12,FLNB,HIST1H1C,PDE7A,PDIA3,DUSP6,PPP1R3C,PTPN14,ODC23,AKAP7,GNG7,PRKCZ,TIMM50,DUSP5,HAT,PTPRJ,PRKCE,CNGB3,GNB1L,MTMR3,PTPRK,PLCG1,PRKCG,CALM1 (includes others),GNAI3,PPP1R14D,CDC14B,SFN,EYA1,CDC27,TCF7L2,AKAP11,MYL2,SMAD3,GNB2L1,TCF7,PTEN,TGFB2,PTK2,YWHAQ,ROCK2,PLCD3,TH,CAMK2D,PLCE1,PDE7B,RYR3,HIST1H1B,ADCY9,ITPR2,PDE10A,PTPDC1,MYL12B,DUSP1,TGFB3,PTPRS,LEF1,RELA,H3F3A,H3F3B,ANAPC1/ANAPC1P1,PDE4A,NFKB1,NFAT5,GNG11,NFKBIA,GLI3,DUSP10,PTPN1,TGFB2,VASP,PXN,ATF1,MAP3K1,CHP1,GNAI1,AKAP6,PYGB,NFATC4,PDE4D,GNG5,GNAI2,PRKCI,PRKAG2,NFATC2,PDE5A
FLT3 Signaling in Hematopoietic Progenitor Cells	0.020417379	0.134276496	GAB2,RAF1,PIK3R1,PDPK1,KRAS,CREB5,MTOR,SOS1,MRAS,STAT1,STAT5B,PIK3C2B,STAT5A,AKT2,PIK3C2A,GRB2,CREBBP,CREB3,STAT3,ATF2,STAT4,PIK3R3,RPS6KA6,CBL,MAPK14,PIK3CB,RPS6KA4,RPS6KA1
Induction of Apoptosis by HIV1	0.020417379	0.134276496	RELA,SLC25A13,CYCS,IKBKE,NFKB2,MAP3K5,NFKB1,DFFA,BAK1,XIAP,BCL2,FADD,BCL2L1,TRAF2,IKBKG,NFKBIA,BBC3,BID,SLC25A10,CASP8,BIRC3,FASLG,TNFRSF11B,BIRC2
Cell Cycle: G1/S Checkpoint Regulation	0.020417379	0.134276496	HDAC9,CCNE2,RBL2,HDAC4,HDAC8,HDAC2,SMAD3,HDAC1,ABL1,CDK6,MDM2,RBL1,CCND1,SKP1/SKP1P2,SIN3A,HDAC5,MYC,CCNE1,MAX,TGFB3,TGFB2,BTRC,ATR,E2F2
CREB Signaling in Neurons	0.022387211	0.144543977	RAF1,GRIN2A,GRM3,PIK3R1,GNB2L1,KRAS,CREB5,PLCH2,GRIA4,GNB1,PLCD3,PLCE1,CAMK2D,GNAT1,MRAS,POLR2H,PRKD1,GRIK1,ADCY9,PIK3C2B,AKT2,ITPR2,CREB3,CREBBP,TBP,ITPR1,ATF2,PIK3R3,GNAO1,GNB2,RPS6KA1,POLR21,GNAL,CAMK2G,PDIA3,PRKCZ,GNG7,GT2F2B,GNG11,GRI1,SOS1,PRKCE,GRIK2,GNB1L,GRIN2B,PIK3C2A,GRB2,GNA12,GNAI1,PLCG1,GNG5,PRKCG,GNAI2,CALM1 (includes others),GNAI3,PRKCI,GRIK4,PRKAG2,PIK3CB
Role of JAK family kinases in IL-6-type Cytokine Signaling	0.023988329	0.151356125	IL6ST,SOCS1,SOCS3,STAT5A,JAK1,MAPK14,IL6R,OSMR,STAT3,IL6,STAT1,STAT5B
VDR/RXR Activation	0.024547089	0.151705037	SERPINB1,CYP24A1,CCNC,HES1,PRKCZ,GT2F2B,GADD45A,SP1,RUNX2,CEBPA,CSNK2A1,TGFB2,PRKCE,NCOR1,SEMA3B,IGFBP1,PRKD1,WT1,LRP5,PPARD,MED1,CEBPB,NCOA3,PRKCG,PRKCI,FOXO1,COL13A1,IGFBP3,NCOR2,HSD17B2
Regulation of IL-2 Expression in Activated and Anergic T Lymphocytes	0.024547089	0.151705037	RELA,RAF1,CD3E,SMAD3,KRAS,NFKB1,TGFB2,CD28,IKBKG,NFAT5,JUN,NFKBIA,SOS1,TGFB2,MRAS,SMAD2,GRB2,CHP1,MAP3K1,TOB1,PLCG1,IKBKE,NFKB2,MALT1,NFATC4,FOS,CALM1 (includes others)

			others),BCL10,TGFB3,NFATC2
BMP signaling pathway	0.025118864	0.153461698	RELA,RAF1,BMP4,BMP2,BMPR2,KRAS,HOXC9,NFKB1,NOG,JUN,RUNX2,MAP3K7,SOS1,MRAS,FST,GRB2,CREBBP,SMAD6,SMAD7,NFKB2,BMP5,XIAP,ATF2,BMPR1B,MAPK14,PRKAG2,BMP7,BMP6
G Beta Gamma Signaling	0.027542287	0.169044093	RAF1,GNB2L1,PDPK1,KRAS,NGG7,PRKCZ,GNB1,GNAT1,SOS1,CAV1,MRAS,PRKCE,CAV2,GNB1L,PRKD1,EGFR,AKT2,GRB2,GNA12,GNAI1,PLCG1,KCNJ3,NGG5,PRKCG,GNAI2,GNAI3,PRKCI,ARHGFEF6,GNAO1,GNB2,PRKAG2,GNAL
TR/RXR Activation	0.028183829	0.170215851	NXP2,PIK3R1,HIF1A,DIO2,NRGN,SLC16A3,MTOR,ADRB1,SCARB1,FASN,NCOR1,TBL1XR1,PIK3C2B,AKT2,UCP2,PIK3C2A,GPS2,SLC2A1,MED1,MDM2,THRA,PFKP,THRSP,NCOA3,PIK3R3,COL6A3,SREBF1,ENO1,SREBF2,PIK3CB,NCOR2,THRB
Oncostatin M Signaling	0.028840315	0.171001532	IL6ST,MT2A,STAT5A,RAF1,EPAS1,JAK1,MMP3,GRB2,KRAS,STAT3,SOS1,MRAS,OSMR,STAT5B,STAT1
Cholecystokinin/Gastrin-mediated Signaling	0.030199517	0.17538805	MAP2K6,RAF1,KRAS,IL1F10,BCAR1,RHOH,PRKCZ,ROCK2,PTK2,JUN,RHOB,RHOT1,SOS1,RHO,MRAS,SST,PRKCE,RHOF,PRKD1,EGFR,PXN,MEF2B,MEF2B,GRB2,ITPR2,GNA12,MEF2A,ITPR1,PRKCG,ATF2,FOS,IL18,MAPK14,PRKCI,RND3,MEF2C,MAP2K5,FNBP1
Basal Cell Carcinoma Signaling	0.030199517	0.17538805	SHH,BMP4,GLI2,AXIN1,BMP2,WNT16,TCF7,HKR1,GLI3,FZD2,GLIS1,WNT2B,PTCH1,FZD9,TCF3,BMP5,APC,FZD8,GLIS2,WNT10A,LEF1,FZD5,BMP7,DVL2,BMP6,TCF7L2,WNT11
Gα12/13 Signaling	0.030902954	0.17538805	RAF1,RELA,F2RL2,MYL2,PIK3R1,KRAS,MAP3K5,NFKB1,CDH11,PTK2,ROCK2,IKBK,CDH7,NFKBIA,JUN,F2RL1,CDH3,MRAS,MYL10,PIK3C2B,PXN,AKT2,PIK3C2A,MEF2B,MEF2B,MEF2B,GNA12,MAP3K1,CDH6,MEF2A,CDH18,IKBKE,NFKB2,LPAR3,PIK3R3,CDH1,MYL12A,CDH2,CDH9,CDH12,MYL12B,CDH8,PIK3CB,MEF2C
Cell Cycle: G2/M DNA Damage Checkpoint Regulation	0.030902954	0.17538805	CDK7,WEE1,YWHAZ,MDM2,RPRM,SKP1/SKP1P2,CDK1,PRKCZ,CHEK1,YWHAQ,MDM4,GADD45A,CKS1B,TOP2A,BTRC,RPS6KA1,SFN,ATR
Methionine Degradation I (to Homocysteine)	0.031622777	0.17538805	AHCYL1,SUV39H2,MGMT,PRMT5,FTSJ1,MAT2B,MAT2A,AHCY
CNTF Signaling	0.031622777	0.17538805	IL6ST,PIK3C2B,RAF1,JAK1,PIK3C2A,GRB2,PIK3R1,CNTRF,KRAS,STAT3,LIFFR,PIK3R3,MTOR,RPS6KA6,SOS1,MRAS,PIK3CB,RPS6KA4,RPS6KA1,STAT1
Semaphorin Signaling in Neurons	0.031622777	0.17538805	ITGB1,PAK4,ARHGFEF12,PAK2,CFL1,DPYSL3,DPYSL4,RHOH,ROCK2,PTK2,MET,SEMA3A,CFL2,RND3,RHOB,RHOT1,PLXNA1,RHO,RFHF,FNBP1,NRP1
VEGF Signaling	0.033113112	0.179473363	RAF1,EIF2B4,PIK3R1,EIF1,KRAS,HIF1A,PDGFC,ELAVL1,BCL2,ARNT,VEGFA,PTK2,ROCK2,EIF1AX,FOXO3,SOS1,MRAS,VCL,ACTG2,PIK3C2B,PXN,AKT2,PIK3C2A,GRB2,ACTB,VEGFC,PLCG1,PIK3R3,BCL2L1,FOXO1,PIK3CB,ACTN4,SFN
p70S6K Signaling	0.035481339	0.192309173	RAF1,F2RL2,JAK1,PDIA3,PIK3R1,PDPK1,KRAS,PLCH2,PRKCZ,YWHAQ,PLCD3,MTOR,PLCE1,F2RL1,SOS1,PPM1L,MRAS,PRKCE,PPP2R2C,EEF2K,PRKD1,EGFR,PIK3C2B,AKT2,PIK3C2A,GRB2,GNAI1,YWHAZ,PLCG1,PLD1,PRKCG,GNAI2,PIK3R3,GNAI3,PRKCI,IRS1,PPP2R2B,LYN,PIK3CB,PPP2R5E,SFN,AGTR1
IL-3 Signaling	0.036307805	0.195433946	RAF1,GAB2,RAPGEF1,JAK1,PIK3R1,KRAS,PRKCZ,JUN,SOS1,MRAS,PRKCE,STAT1,STAT5B,PRKD1,PIK3C2B,STAT5A,AKT2,PIK3C2A,GRB2,CHP1,STAT3,PRKCG,PIK3R3,FOS,PRKCI,FOXO1,PIK3CB
Epithelial Adherens Junction Signaling	0.037153523	0.195433946	RAP1B,RAPGEF1,MYL2,TUBA3E,TGFBR3,BMPR2,MLL24,KRAS,MYH11,CLIP1,TCF7,PTEN,TGFBR2,CTNNA2,WASL,SORBS1,HGF,BAIAP2,TGFB2,MRAS,PVRL1,ARPC1A,TUBA1C,VCL,JUP,ACTG2,ACV1C,EGFR,ACTR2,EPN1,DL1,AKT2,LMO7,ACTB,WASF1,TCF3,TUBA1B,APC,ACV1B,MET,CDH2,CDH1,TUBA1A,MYH3,MYH9,LEF1,ACTN4,MAGI2,TCF7L2,CTNND1
Macropinocytosis Signaling	0.037153523	0.195884467	PIK3R1,KRAS,ITGB8,NGF,PDGFC,PRKCZ,ARF6,HGF,MRAS,PRKCE,ITGB4,ITGB5,PRKD1,ITGB1,PIK3C2B,PIK3C2A,PLCG1,PDGFB,PRKCG,MET,PIK3R3,PRKCI,CSF1,PIK3CB,ACTN4,ITGB6
IL-17A Signaling in Fibroblasts	0.03801894	0.195884467	RELA,IKBKE,IL6,CEBPB,NFKB2,NFKB1Z,NFKB1,FOS,IKBK,TRAF3IP2,NFKBIA,JUN,MAPK14,CCL2,MAP3K7
Role of NFAT in Regulation of the Immune Response	0.03801894	0.195884467	RAF1,CSNK1G1,CD3E,PIK3R1,GNB2L1,CSNK1A1,GSK3A,KRAS,GNB1,CD28,IKBK,GNAT1,MRAS,XPO1,PIK3C2B,AKT2,ITPR2,CSNK1D,ITPR1,NFKB2,ATF2,PIK3R3,GNAO1,GNB2,RCAN3,GNAL,RELA,NFKB1,NGG7,NFKBIA,JUN,NFAT5,NGG11,SOS1,GNB1L,PIK3C2A,MEF2B,MEF2B,MEF2B,FCGR2A,GNA12,CSNK1G3,CHP1,GNAI1,MEF2A,PLCG1,IKBKE,NFATC4,NGG5,GNAI2,FOS,CALM1 (includes others),GNAI3,LYN,NFATC2,MEF2C,PIK3CB,GATA4
EGF Signaling	0.038904514	0.198609492	PIK3C2B,RAF1,AKT2,JAK1,PIK3C2A,ITPR2,GRB2,PIK3R1,MAP3K1,PLCG1,ITPR1,STAT3,PIK3R3,FOS,MTOR,JUN,MAPK14,SOS1,CSNK2A1,PIK3CB,STAT1,EGFR
CXCR4 Signaling	0.038904514	0.198609492	RAF1,MYL2,PIK3R1,GNB2L1,KRAS,ROCK2,PTK2,GNB1,RHOB,GNAT1,MRAS,MYL10,PRKD1,ADCY9,PIK3C2B,AKT2,ITPR2,ITPR1,PIK3R3,MYL12A,RND3,MYL12B,GNAO1,GNB2,ELMO1,FNBP1,GNAL,BCAR1,RHOH,PRKCZ,NGG7,JUN,NGG11,RHOT1,RHO,PRKCE,GNB1L,RHOF,PXN,PAK4,PAK2,PIK3C2A,GNA12,GNAI1,NGG5,PRKCG,GNAI2,FOS,GNAI3,PRKCI,LYN,PIK3CB
Phospholipase C Signaling	0.040738028	0.206062991	RAF1,MPRIP,MYL2,CD3E,GNB2L1,KRAS,CREB5,GNB1,PLCE1,RHOB,MRAS,MYL10,PRKD1,ADCY9,HDAC4,HDAC2,HDAC8,ITPR2,CREB3,CREBBP,NFKB2,ITPR1,PLD1,ATF2,HDAC5,PLA2G6,MYL12A,RND3,MYL12B,ARHGFEF6,ARHGFEF6,GNB2,PPP1R12B,ARHGFEF9,FNBP1,RAP1B,RELA,NAPEPLD,NFKB1,RHOH,PRKCZ,NGG7,TGM2,NGG11,NFAT5,AHNAK,RHOT1,SOS1,RHO,PRKCE,ARHGFEF3,MARCKS,RHOF,GNB1L,ITGB1,HDAC9,ARHGFEF12,MEF2B,FCGR2A,GRB2,ITGA2,HDAC1,CHP1,MEF2A,PLCG1,NFATC4,ITGA3,NGG5,PRKCG,PLA2G4A,CALM1 (includes others),PRKCI,LYN,NFATC2,MEF2C
IL-1 Signaling	0.044668359	0.222330989	MAP2K6,RELA,TAB2,GNB2L1,NFKB1,NGG7,IRAK1,GNB1,IKBK,NGG11,JUN,NFKBIA,GNAT1,MAP3K7,MRAS,GNB1L,ADCY9,GNA12,MAP3K1,GNAI1,IKBKE,NFKB2,NGG5,GNAI2,GNAI3,FOS,MAPK14,GNAO1,GNB2,PRKAG2,IRAK4,GNAL,IRAK2
Role of Tissue Factor in Cancer	0.045708819	0.223357222	CTGF,PIK3R1,CXCL1,KRAS,PTEN,VEGFA,MTOR,ARRB1,CFL2,F2RL1,ITGA V,MRAS,STAT5B,ITGB5,EGFR,ITGB1,STAT5A,PIK3C2B,IL8,AKT2,PIK3C2A,CFL1,GNA12,ITGA6,VEGFC,ITGA3,F3,FRK,PIK3R3,BCL2L1,RPS6KA6,MAPK14,CSF1,LYN,RPS6KA4,PIK3CB,RPS6KA1,CYR61



Lymphotoxin $\beta$ Receptor Signaling	0.047863009	0.234422882	RELA,PIK3C2B,TRAF3,AKT2,PIK3C2A,CYCS,PIK3R1,CREBBP,CXCL1,PDPK1,IKBKE,NFKB2,NFKB1,PIK3R3,BCL2L1,IKBK,TRAF2,NFKBIA,TRAF4,PIK3CB,BIRC2
Ephrin A Signaling	0.048977882	0.234422882	EPHA7,PIK3C2B,NGEF,PIK3C2A,CFL1,PIK3R1,EFNA3,BCAR1,EFNA4,EFNA1,PIK3R3,ROCK2,PTK2,EPHA6,CFL2,EFNA5,EPHA5,PIK3CB,EPHA2
Docosahexaenoic Acid (DHA) Signaling	0.048977882	0.234422882	PIK3C2B,AKT2,PIK3C2A,CYCS,PIK3R1,SERPINF1,PDPK1,GSK3A,PNPLA2,APP,BCL2,PIK3R3,BCL2L1,FOXO1,BID,PIK3CB
Ceramide Signaling	0.048977882	0.234422882	RAF1,RELA,PIK3R1,SMPD1,KRAS,NFKB1,PRKCZ,KSR1,BCL2,JUN,PPM1L,MRAS,PPP2R2C,SMPD3,NSMAF,TNFRSF11B,PIK3C2B,AKT2,PIK3C2A,CYCS,MAP3K1,NFKB2,PIK3R3,FOS,PPP2R2B,S1PR1,PIK3CB,PPP2R5E,ENPP7

## Supplementary Table 10: All HEK293 TCF7L2 Ingenuity Conical pathways with at least nominal $P < 0.05$

Canonical Pathways	P-value	B-H Multipule testing correction p-value	Molecules
			CDKN2A, TGFB3, CSNK1A1, WNT16, TLE1, BCL9, SOX13, CCND1, TCF7, MYC, TGFB R2, SOX2, RARA, CSNK2A1, DKK2, SOX4, AKT2, AXIN2, GJA1, TCF3, CDH2, CDH12, CD H5, TGFB3, TLE3, FZD3, SOX8, LEF1, FZD10, TCF4, SFRP2, SOX1, FZD1, KREMN1, EP 300, SOX17, SOX9, NLK, JUN, MAP3K7, SOX3, RARB, SOX14, PPP2R5C, SOX18, CTNN B1, ACVR1C, SOX5, PPARD, CSNK1G3, WNT2B, PPP2R5A, FZD8, WNT8A, FZD4, WNT 10A, SOX6, TLE4, NR5A2, BTRC, DKK1, PPP2R5E, PPP2R1B, ACVR2A, WNT11, TCF7L 2, FZD7, WNT5A
Wnt/ $\beta$ -catenin Signaling	1.8197E-10	9.33254E-08	FZD10, TCF4, BMP4, TGFB3, BMP2, FZD1, NOG, TCF7, TGFB2, MAP3K7, PRKCE, CT NNB1, ACVR1C, PRKD1, PRKCA, TBX5, PRKCQ, TCF3, BMP5, ATF2, FZD8, CCNE1, BM PR1B, MAPK14, FZD4, FZD3, TGFB3, MEF2C, LEF1, BMP7, PRKCH, DKK1, BMP6, WNT1 1, ACVR2A, TCF7L2, FZD7
Factors Promoting Cardiogenesis in Vertebrates	6.91831E-07	0.000177828	BMP4, PIK3R1, SMAD3, WNT16, TCF7, SOX2, TGFB2, PIK3C2B, AKT2, FGFR2, TCF3, I NHBA, BMPR1B, TGFB3, FZD3, LEF1, FZD10, TCF4, KLK3, FGF2, BDNF, BMP2, FZD1, N GF, PDGFC, NOG, PIK3C3, CTNNB1, PIK3C2A, WNT2B, SMAD7, PIK3C2G, SMAD6, BM P5, FZD8, WNT8A, FZD4, FOXO1, WNT10A, NTRK3, S1PR1, PIK3CB, BMP7, BMP6, WNT 11, TCF7L2, FZD7, WNT5A, SALL4
Human Embryonic Stem Cell Pluripotency	2.75423E-06	0.000467735	SLIT3, SHH, GLI2, BMP4, PIK3R1, NTN1, GNB1, EPHB1, BAIAP2, PLCB1, SRGAP2, PLCL 1, PRKD1, GNG12, ITGA4, PIK3C2B, AKT2, PRKCQ, KALRN, SEMA5A, PTOH1, SRGAP3 ,ADAMTS6, RTN4, EPHA2, NRP1, RAP1B, FYN, BDNF, SEMA6A, EPHA4, PLXNA2, FZD1 ,ABLIM1, EIF4E, GNG7, EFN2, ACTR3, PLXNA1, PIK3C3, EFNA5, DCC, PFN2, PRKCE, PSMD14, ROBO2, PPP3CA, UNC5C, GLIS1, ITGB1, NRP2, GRB2, PIK3C2G, EPHA3, SLI T2, EFNA1, PLCZ1, SEMA3A, NTRK3, EPHA5, BMP7, SEMA3C, BMP6, FZD7, UNC5B, G NB2L1, CXCL12, WNT16, PTK2, PLCE1, SEMA3D, SUFU, ADAM28, PROK1, PPP3R1, A DAMTS5, EPHA7, ADAMTS1, VEGFC, ADAMTS9, ADAM12, PTPN11, SEMA6D, FZD3, P RKCH, ERAP2, FZD10, ADAMTS7, BMP2, NGF, PDGFC, ROBO1, WASL, EPHA8, GLI3, S EMA3B, PRKCA, SEMA3E, ARHGEF12, PLXNC1, PIK3C2A, C9orf3, WNT2B, GNAI1, EF NA3, BMP5, PLXND1, EFNA4, ROCK1, FZD8, WNT8A, PLCB4, FZD4, WNT10A, NFATC2, PIK3CB, WNT11, PRKAR1A, WNT5A
Axonal Guidance Signaling	7.4131E-06	0.000954993	FZD10, SHH, TCF4, GLI2, BMP4, BMP2, WNT16, FZD1, TCF7, GLI3, SUFU, CTNNB1, GLI S1, WNT2B, PTOH1, TCF3, BMP5, FZD8, WNT8A, FZD4, WNT10A, FZD3, LEF1, BMP7, B MP6, WNT11, TCF7L2, FZD7, WNT5A
Basal Cell Carcinoma Signaling	1.99526E-05	0.002041738	MAP2K6, FGF2, PIK3R1, FGF8, MAP3K5, CREB5, FGF13, EP300, FGF18, PIK3C3, HGF, FGF12, FRS2, PRKCA, FGF19, FGF16, PIK3C2B, AKT2, PIK3C2A, GRB2, FGF9, MAP3K1 ,PIK3C2G, FGF2, ITPR1, FGF1, ATF2, MET, MAPK14, PTPN11, PIK3CB, RPS6KA5
FGF Signaling	9.54993E-05	0.007762471	EPHA7, FYN, PIK3C2B, PIK3C2A, PIK3R1, EFNA3, PIK3C2G, EPHA4, EPHA3, EFNA4, E FNA1, ROCK1, PTK2, EPHA8, PTPN11, PIK3C3, VAV3, EFNA5, EPHA5, PIK3CB, EPHA2 BMP4, PIK3R1, TAB2, CSNK1A1, WNT16, SP7, IL6, TCF7, IKKB, RUNX2, PPP3R1, DKK 2, TRAF5, ADAMTS5, PIK3C2B, AKT2, TCF3, IL7, BMPR1B, FZD3, LEF1, MAP2K6, FZD10 , TCF4, SFRP2, BMP2, FZD1, MAP3K5, NFKB1, JUN, MAP3K7, PIK3C3, CTNNB1, PPP3C A, ITGB1, CTSK, PIK3C2A, WNT2B, DLX5, SMAD6, PIK3C2G, IKBKE, TNFRSF11A, BMP 5, XIAP, IL17A, FOS, FZD8, WNT8A, MAPK14, FZD4, WNT10A, FOXO1, CSF1, NFATC2, IL 1B, BMP7, PIK3CB, DKK1, BMP6, WNT11, TCF7L2, WNT5A, FZD7
Ephrin A Signaling	0.000107152	0.007762471	SHH, CREB5, NTN1, GNB1, PTPRC, PLCB1, CDKN3, PLCL1, EYA2, PRKD1, GNG12, PTP RG, PRKCQ, PTOH1, ITPR1, TCF3, PTP4A1, CNGA3, ATF2, PDE8A, AKAP13, PTPRB, C REM, EYA3, DUSP4, PTPRA, AKAP12, RAP1B, FLNB, TCF4, PTPN13, DUSP6, PTPN14 , CDC23, GNG7, EP300, DUSP5, HHAT, DCC, PRKCE, CNGB3, CTNNB1, PPP3CA, MTMR 3, AKAP5, PTPRK, PLCZ1, ADD3, CDC14B, EYA1, PTPRT, TCF7L2, PDE3A, SMAD3, GN B2L1, TCF7, PTEN, PTK2, YWHAQ, TGFB2, PLCE1, CAMK2D, ADCY5, PPP3R1, PDE1 1A, PPP1R14C, PTPRD, YWHAQ, ITPR2, PDE10A, PDE4B, EPM2A, PTPN11, TGFB3, PP P1R12A, PRKCH, LEF1, PDE4A, NFKB1, PHKA2, GLI3, DUSP10, PTPN1, PRKCA, RYR2, MAP3K1, GNAI1, PYGB, AKAP6, PDE4D, ROCK1, AKAP2, PALM2- AKAP2, PLCB4, PTPRU, NFATC2, PDE5A, AKAP9, PRKAR1A
Protein Kinase A Signaling	0.000331131	0.016982437	IL6ST, FZD10, TCF4, ID2, BMP4, LIF, T, PIK3R1, FZD1, TCF7, SOX2, MYC, ID1, MAP3K7, P IK3C3, CTNNB1, PIK3C2B, AKT2, PIK3C2A, GRB2, PIK3C2G, TCF3, XIAP, FZD8, MAPK1 4, FZD4, PTPN11, FZD3, PIK3CB, LEF1, TCF7L2, ID4, FZD7
Mouse Embryonic Stem Cell Pluripotency	0.000338844	0.016982437	TRAF3, PIK3R1, CSNK1A1, CXCL12, WNT16, IL6, CREB5, CCND1, TCF7, MYC, IKKB, T RAF3IP2, PLCE1, CAMK2D, PROK1, PPP3R1, TRAF4, PLCB1, DKK2, TRAF5, PLCL1, PR KD1, PIK3C2B, AKT2, PRKCQ, IL6R, VEGFC, TCF3, IL7, ATF2, FZD3, PRKCH, LEF1, IL6S T, MAP2K6, FZD10, TCF4, SFRP2, FN1, FGF2, FZD1, NFKB1, PDGFC, EP300, ROR2, NLK , JUN, MAP3K7, PIK3C3, CEBPA, PRKCE, NOS2, CTNNB1, PPP3CA, PRKCA, PIK3C2A, WNT2B, DAAM1, PIK3C2G, IKBKE, IL17A, PLCZ1, ROCK1, FZD8, FOS, PLCB4, WNT8A, MAPK14, FZD4, WNT10A, TLR5, CSF1, NFATC2, IL1B, PIK3CB, DKK1, WNT11, TCF7L2, FZD7, WNT5A
Role of Macrophages, Fibroblasts and Endothelial Cells in Rheumatoid Arthritis	0.000371535	0.016982437	LIF, CAMK1D, PIK3R1, GNB2L1, CSNK1A1, HAND1, IL6, CABIN1, TGFB2, GNB1, PLCE 1, CAMK2D, ADCY5, PPP3R1, PLCB1, PLCL1, PRKD1, GNG12, PIK3C2B, AKT2, HDAC4, PRKCQ, HDAC2, HDAC8, ITPR2, ITPR1, TGFB3, PRKCH, SLC8A1, MAP2K6, IL6ST, GN G7, EP300, MAP3K7, PIK3C3, IGF1R, CAMK1G, PRKCE, PPP3CA, PRKCA, AKAP5, PIK3 C2A, GRB2, MAP3K1, GNAI1, PIK3C2G, PLCZ1, PLCB4, MAPK14, MEF2C, PIK3CB, RCA N2, PRKAR1A
Role of NFAT in Cardiac Hypertrophy	0.000457088	0.016982437	CDKN2A, JMY, GADD45G, PIK3R1, CCND1, EP300, PTEN, JUN, GADD45A, BBC3, PIK3 C3, CCKN, ADOK3, CTNNB1, WT1, PIK3C2B, PMAIP1, AKT2, TP63, PIK3C2A, MED1, PIK 3C2G, PERP, RPRM, TP53BP2, KAT2B, MAPK14, CCND2, SNAI2, PIK3CB, ATR, DRAM1 SERPINB1, CYP24A1, HES1, EP300, GADD45A, RUNX2, CEBPA, CSNK2A1, PRKCE, S EMA3B, CALB1, PRKD1, PRKCA, WT1, PRKCQ, MED1, PPARD, IGFBP5, KLF4, SULT2A 1, COL13A1, FOXO1, NCOA1, IGFBP3, PRKCH, NCOA2, RXRA, S100G
Role of NFAT in Cardiac Hypertrophy	0.000457088	0.016982437	LIPC, CAMK1D, PIK3R1, MAF, IL6, CHST15, ARNT, MAOB, CAMK2D, CHST11, HS3ST1, AHR, PRKD1, PIK3C2B, PRKCQ, HDAC4, MED1, ALDH8A1, GRIP1, NDS1, SULT2A1, H S3ST3B1, ALDH1A2, NCOA1, HSP90AA1, PRKCH, RXRA, HS3ST5, MAP2K6, MAP2K6, CHST7, NQO2, HS2ST1, ALDH1L1, MAP3K5, FMO5, NFKB1, EP300, CUL3, MAP3K7, PIK 3C3, CAMK1G, HS6ST2, PRKCE, FMO1, PPP2R5C, NOS2, NFE2L2, CITED2, PRKCA, G STA3, PIK3C2A, MGMT, GSTA4, MAP3K1, PIK3C2G, CHST12, CYP1B1, PPP2R5A, ESD
Xenobiotic Metabolism Signaling	0.000524807	0.016982437	

			,SULT2B1,MAPK14,MGST2,HS3ST2,IL1B,PIK3CB,MAP3K8,NCOR2,PPP2R5E,PPP2R1B,DNAJC7,MAOA,PPARGC1A
Molecular Mechanisms of Cancer	0.000562341	0.016982437	CDKN2A,RAPGEF1,SHH,BMP4,SMAD3,DIRAS3,PIK3R1,TAB2,CCND1,MYC,TGFBF R2,PTK2,E2F6,CTNNA2,CAMK2D,RHOB,SUFU,ADCY5,PLCB1,PRKD1,PIK3C2B,AK T2,PRKCQ,PTCH1,CDK6,TCF3,RALBP1,RASGRF2,BMPR1B,CCND3,CCND2,PT PNI1,ARHGEP16,IRS1,TGFB3,FZD3,PRKCH,LEF1,MAP2K6,RAP1B,FYN,FZD10,T CF4,BMP2,PSEN2,MAP3K5,FZD1,E2F3,NFKB1,CDKN2B,EP300,JUN,HHAT,NLK,B BC3,MAP3K7,PIK3C3,RHOU,PRKCE,BID,CASP8,CTNNA1,PRKCA,PAIP1,ARHG EF12,PIK3C2A,GRB2,GNAI1,SMAD7,PIK3C2G,SMAD6,BMP5,XIAP,FZD8,FOS,PLC B4,CCNE1,MAPK14,FZD4,FOXO1,RBPJ,PIK3CB,BMP7,BMP6,ATR,BCL2L11,PRKA R1A,PSEN1,FZD7,WNT5A
Glioblastoma Multiforme Signaling	0.000588844	0.016982437	CDKN2A,FZD10,PIK3R1,DIRAS3,NF2,WNT16,FZD1,E2F3,CCND1,PDGFC,PTEN,M YC,E2F6,PLCE1,RHOB,PIK3C3,RHOU,IGF1R,PLCB1,CTNNA1,PLCL1,PIK3C2B,AK T2,PIK3C2A,GRB2,ITPR2,WNT2B,CDK6,PIK3C2G,ITPR1,TCF3,PLCZ1,FZD8,WNT8 A,PLCB4,CCNE1,FZD4,FOXO1,WNT10A,FZD3,LEF1,PIK3CB,WNT11,WNT5A,FZD7 CDKN2A,HSPB3,NFIX,NQO2,ALDH1L1,IL6,NFKB1,CCND1,SMARCA4,EP300,ARNT T,MYC,NR2F1,TGM2,JUN,RARA,RARB,NFE2L2,AHR,GSTA3,MED1,GSTA4,CDK6, ALDH8A1,CYP1B1,FOS,CCNE1,CCND2,CCND3,MGST2,NFIA,ALDH1A2,TGFB3,H SP90AA1,IL1B,NFIB,DHFR,NCOR2,DCT,RXRA,ATR,ESR1
Aryl Hydrocarbon Receptor Signaling	0.000588844	0.016982437	GBX2,LHX5,CDX2,HAND1,MEIS1,OTX1,EOMES,HOBX1,FOXC1,SOX2,ISL1,KAT6 A,CDYL,PAX6,GATA6,SIX3,ZFH3
Transcriptional Regulatory Network in Embryonic Stem Cells	0.000724436	0.019498446	CAMK1D,GRM3,BDNF,PIK3R1,GRIA1,GRIA4,TACR1,PLCE1,CAMK2D,GPR37,PIK3 C3,CAMK1G,PLCB1,PRKCE,PLCL1,PRKD1,PRKCA,GRIN2B,PIK3C2B,PRKCQ,PIK 3C2A,GRM8,ITPR2,PIK3C2G,ITPR1,GRIN3A,PLCZ1,FOS,PLCB4,PIK3CB,PRKCH, PRKAR1A,GRIA3
Neuropathic Pain Signaling In Dorsal Horn Neurons	0.000776247	0.019952623	CHST7,XYL1,HS2ST1,EXT1,CHST12,GLCE,NDST4,CHST15,SULT2A1,SULT2B1, HS3ST3B1,EXT2,HS3ST2,CHST11,B3GAT1,HS6ST2,EXTL3,HS3ST1,EXTL2,B3GA T2,HS3ST5
Heparan Sulfate Biosynthesis Role of Oct4 in Mammalian Embryonic Stem Cell Pluripotency	0.000977237	0.023988329	NR6A1,FOXA1,FAM208A,BMI1,PHC1,CDX2,NR2F2,SH3GLB1,HOXB1,PARP1,SOX 2,NR2F1,FOXA2,RARA,JARID2,NR5A2,NR5A1,SALL4
Neurotrophin/TRK Signaling	0.00128825	0.028183829	MAP2K6,PIK3C2B,PIK3C2A,KLK3,BDNF,GRB2,SPRY1,PIK3R1,PIK3C2G,MAP3K5, CREB5,NGF,EP300,ATF2,FOS,JUN,PTPN11,NTRK3,PIK3C3,SPRY2,SORCS1,PIK3 CB,FRS2,MAP2K5
Small Cell Lung Cancer Signaling	0.001348963	0.028840315	NOS1,PIK3C2B,AKT2,TRAF3,PIK3C2A,PIK3R1,PIK3C2G,CDK6,IKBKE,NFKB1,CDK N2B,CCND1,PTEN,PTK2,MYC,IKBKB,CCNE1,PIK3C3,RARB,TRAF4,CKS1B,BID,PI K3CB,TRAF5,RXRA
Role of NANOG in Mammalian Embryonic Stem Cell Pluripotency	0.002344229	0.047863009	IL6ST,FZD10,BMP4,LIF,T,PIK3R1,BMP2,WNT16,FZD1,SOX2,PIK3C3,GATA6,CTNN B1,PIK3C2B,AKT2,PIK3C2A,GRB2,WNT2B,CDX2,PIK3C2G,BMP5,FZD8,WNT8A,B MPRI1B,FZD4,WNT10A,FZD3,PIK3CB,BMP7,BMP6,WNT11,SALL4,FZD7,WNT5A
Heparan Sulfate Biosynthesis (Late Stages)	0.002818383	0.054954087	CHST7,HS2ST1,EXT1,CHST12,GLCE,NDST4,CHST15,SULT2A1,SULT2B1,HS3ST 3B1,EXT2,HS3ST2,CHST11,HS6ST2,EXTL3,HS3ST1,EXTL2,HS3ST5
Ovarian Cancer Signaling	0.003019952	0.057543994	CDKN2A,FZD10,TCF4,PIK3R1,LHCGR,WNT16,FZD1,CCND1,PDGFC,TCF7,PTEN, ARRB1,EDN1,PROK1,PIK3C3,CTNNA1,PIK3C2B,GJA1,AKT2,PIK3C2A,FGFR3,WNT 2B,PIK3C2G,VEGFC,TCF3,FZD8,WNT8A,FZD4,WNT10A,FZD3,MSH6,EDNRA,LEF 1,PIK3CB,WNT11,TCF7L2,PRKAR1A,FZD7,WNT5A
HGF Signaling	0.003388442	0.0616595	RAP1B,CDKN2A,RAPGEF1,PIK3R1,ETS2,MAP3K5,IL6,CCND1,PTK2,JUN,MAP3K7 ,PIK3C3,HGF,PRKCE,PRKD1,PRKCA,ETS1,PIK3C2B,AKT2,PRKCQ,PIK3C2A,GRB 2,MAP3K1,PIK3C2G,ATF2,MET,FOS,PTPN11,MAP3K8,PIK3CB,PRKCH
Prolactin Signaling	0.004677351	0.081283052	PIK3C2B,FYN,PRKCQ,PIK3C2A,GRB2,PRL,PIK3R1,SOC2,PIK3C2G,NR3C1,TCF7 ,EP300,MYC,FOS,JUN,PTPN11,PIK3C3,IRS1,PRKCE,PIK3CB,NMI,PRKCH,PRKD1, PRKCA
ILK Signaling	0.004786301	0.081283052	MAP2K6,FLNB,FN1,BMP2,DIRAS3,PIK3R1,MYH11,NFKB1,CREB5,PDGFC,CCND1, EP300,PTEN,PTK2,MYC,JUN,RHOB,PROK1,PPAP2B,PIK3C3,RHOU,PPP2R5C,IR S2,CTNNA1,NOS2,DSP,ITGB1,PIK3C2B,PARVA,AKT2,PIK3C2A,TMSB10/TMSB4X, FERMT2,PIK3C2G,VIM,VEGFC,PPP2R5A,ATF2,FOS,LIMS1,IRS1,SNAI2,SH2B2,M YH3,PPP1R12A,RPS6KA5,PIK3CB,LEF1,PPP2R5E,PPP2R1B
Thyroid Cancer Signaling	0.00616595	0.101391139	PPARG,TCF4,KLK3,GDNF,BDNF,NGF,TCF3,CCND1,TCF7,MYC,NTRK3,LEF1,CTN NB1,RXRA,TCF7L2
ERK5 Signaling	0.006606934	0.10543869	IL6ST,LIF,YWHAQ,SGK1,RPS6KA3,CREB5,NGF,ATF2,EP300,MYC,YWHAQ,FOS,R PS6KA6,PTPN11,FOXO3,MEF2C,MAP3K8,RPS6KA5,WNK1,MAP2K5,ELK4
Acute Myeloid Leukemia Signaling Superpathway of Citrulline Metabolism	0.009772372	0.149968484	MAP2K6,RUNX1,PIK3C2B,TCF4,AKT2,PIK3C2A,GRB2,PIK3R1,PIK3C2G,NFKB1,T CF3,CCND1,TCF7,KITLG,MYC,PIM1,PIK3C3,RARA,CEBPA,LEF1,PIK3CB,JUP,MA P2K5,TCF7L2
PI3K Signaling in B Lymphocytes	0.01023293	0.149968484	NOS1,OTC,GLS,ASS1,OAT,ARG2,NOS2 FYN,PIK3R1,ATF6,NFKB1,PTEN,PTPRC,BLK,IKBKB,JUN,PLCE1,CAMK2D,PPP3R 1,FOXO3,PLCB1,IRS2,PLCL1,PPP3CA,AKT2,ATF3,ITPR2,IKBKE,ITPR1,ATF2,PLC Z1,FOS,PLCB4,CD180,BCL10,VAV3,SYK,IRS1,SH2B2,NFATC2,PIK3CB,PIK3AP1
RANK Signaling in Osteoclasts	0.011220185	0.157761127	MAP2K6,PIK3R1,TAB2,MAP3K5,NFKB1,IKBKB,JUN,MAP3K7,PIK3C3,PPP3R1,TRA F5,PPP3CA,PIK3C2B,AKT2,PIK3C2A,MITF,MAP3K1,PIK3C2G,IKBKE,NTFRSF11A, XIAP,FOS,MAPK14,NFATC2,MAP3K8,PIK3CB
Dermatan Sulfate Biosynthesis	0.011481536	0.157761127	CHST7,XYL1,CHSY1,HS2ST1,CHST12,NDST4,CHST15,SULT2A1,DSE,SULT2B1, HS3ST3B1,HS3ST2,CHST11,B3GAT1,HS6ST2,HS3ST1,B3GAT2,HS3ST5
PEDF Signaling	0.013803843	0.18238957	PPARG,ARHGAP22,PIK3C2B,TCF4,AKT2,PIK3C2A,GDNF,BDNF,PIK3R1,PIK3C2G, IKBKE,ZEB1,NGF,NFKB1,TCF7,TCF12,ROCK1,IKBKB,MAPK14,PIK3C3,PIK3CB,C ASP8
Cardiomyocyte Differentiation via BMP Receptors	0.013803843	0.18238957	BMPR1B,BMP4,MAP3K7,BMP2,SMAD6,BMP7,BMP5,ATF2
RAR Activation	0.014125375	0.18238957	RDH10,PIK3R1,SMAD3,BMP2,NR2F2,MAP3K5,NFKB1,SMARCA4,PTEN,EP300,NR 2F1,JUN,ADCY5,RARA,RARB,CSNK2A1,PRKCE,NT5C1B,ZBTB16,CITED2,PRKD1, PRKCA,CCNH,AKT2,PRKCQ,RDH14,MED1,MAP3K1,SMAD7,SMAD6,PARP1,KAT2 B,FOS,MAPK14,CRABP2,ALDH1A2,IGFBP3,NCOA1,TGFB3,PIK3CB,PRKCH,NCO R2,RXRA,PRKAR1A,PPARGC1A
Type II Diabetes Mellitus Signaling	0.014791084	0.183231442	PRKAB2,PIK3R1,SOC2,MAP3K5,NFKB1,IKBKB,MAP3K7,PIK3C3,PRKAA2,ACSL4 ,PRKCE,IRS2,SMPD3,NMAF,PRKD1,PRKCA,PPARG,PIK3C2B,AKT2,PRKCQ,PIK 3C2A,MAP3K1,PIK3C2G,CD36,IKBKE,ACSBG2,SLC2A4,IRS1,SH2B2,PIK3CB,PRK CH,ENPP7
3-phosphoinositide Biosynthesis	0.015135612	0.1840772	PTPN13,PIK3R1,NUDT3,NUDT9,NUDT12,IGBP1,STYXL1,PTEN,PTPRC,PIK3C3,PT PNI1,MTMR2,PPP1R1C,EYA4,NUDT4,RNGTT,PPP3CA,PIK3C2B,PIK3C2A,DUSP27 ,PIK3C2G,PAWR,PPP2R5A,NUDT15,TNS3,PIP5K1A,SYNJ1,PTPN11,PPP1R16B,C D1PT,PPM1H,DUSP23,PPP1R12A,MTMR7,PIK3CB,PPP2R5E,TPTE/TPTE2,PIP4K2

			A
Arginine Biosynthesis IV	0.015488166	0.1840772	OTC,ASS1,OAT,GLUD1
Growth Hormone Signaling	0.016595869	0.187931682	PIK3C2B,PRKCQ,PIK3C2A,PIK3R1,SOCS2,RPS6KA3,PIK3C2G,SLC2A4,FOS,RPS6KA6,IRS1,PIK3C3,IGFBP3,CEBPA,IGF1R,PRKCE,PIK3CB,RPS6KA5,PRKCH,PRK D1,PRKCA
Chondroitin Sulfate Biosynthesis	0.016595869	0.187931682	CHST7,XYL1,CHSY1,HS2ST1,CHST12,NDST4,CHST15,SULT2A1,SULT2B1,HS3ST3B1,HS3ST2,CHST11,B3GAT1,HS6ST2,HS3ST1,B3GAT2,HS3ST5
Glutamate Receptor Signaling	0.016982437	0.187931682	GRIN2B,GRM3,GRM8,GRID2,GLS,GRIA1,SLC1A1,GRIP1,GRIA4,GNNG7,GRIN3A,G NB1,PICK1,GRIK4,GRID1,GRIK2,GRIA3,GRIK1
Gaq Signaling	0.018197009	0.198152703	RGS18,HTR2B,PIK3R1,DIRAS3,GNB2L1,NFKB1,CHRM3,GNNG7,GNB1,IKBKB,HTR 2C,RHOB,PPP3R1,PIK3C3,RHOU,PLCB1,PRKCE,PRKD1,PPP3CA,ADRA1B,GNNG1 2,PRKCA,PIK3C2B,AKT2,PRKCQ,PIK3C2A,ITPR2,RGS7,PIK3C2G,RGS16,IKBKE,I TPR1,PLD1,ROCK1,PLCB4,NFATC2,PIK3CB,PRKCH,AGTR1
D-myo-inositol-5-phosphate Metabolism	0.019054607	0.199067334	PTPN13,NUDT9,NUDT3,NUDT12,IGBP1,STYXL1,PLCH1,PTEN,PTPRC,PLCE1,PT PN1,PLCB1,MTMR2,PPP1R1C,EYA4,NUDT4,RNGTT,PPP3CA,DUSP27,PAWR,PP P2R5A,NUDT15,PLCZ1,PLCB4,TNS3,SYNJ1,PTPN11,PPP1R16B,PPM1H,DUSP23, PPP1R12A,MTMR7,PPP2R5E,TPTE/TPTE2,PIP4K2A
Ephrin Receptor Signaling	0.019498446	0.199067334	RAP1B,FYN,RAPGEF1,PTPN13,GNB2L1,CXCL12,EPHA4,CREB5,PDGFC,GNNG7,E P300,GNB1,PTK2,EFNB2,EPHB1,EPHA8,WASL,ACTR3,SORBS1,PROK1,EFNA5,G NG12,ITGA4,ITGB1,EPHA7,GRIN2B,AKT2,ANGPT1,KALRN,GRB2,GNAI1,PIK3C2G ,EFNA3,VEGFC,EPHA3,EFNA4,FGF1,EFNA1,GRIN3A,ATF2,ROCK1,PTPN11,EPH A5,DOK1,EPHA2
Dermatan Sulfate Biosynthesis (Late Stages)	0.019498446	0.199067334	CHST7,HS2ST1,CHST12,NDST4,SULT2A1,CHST15,SULT2B1,DSE,HS3ST3B1,HS 3ST2,HS6ST2,CHST11,HS3ST1,HS3ST5
Role of Wnt/GSK-3 $\beta$ Signaling in the Pathogenesis of Influenza	0.022387211	0.226464431	SIAH1,FZD10,TCF4,CSNK1G3,WNT2B,CSNK1A1,WNT16,FZD1,TCF3,TCF7,FZD8, WNT8A,FZD4,WNT10A,NCOA1,FZD3,LEF1,CTNNB1,WNT11,TCF7L2,WNT5A,FZD 7
Estrogen-Dependent Breast Cancer Signaling	0.023988329	0.235504928	PIK3C2B,AKT2,HSD17B13,PIK3C2A,PIK3R1,PIK3C2G,NFKB1,CREB5,CCND1,ATF 2,EP300,FOS,JUN,PIK3C3,IGF1R,HSD17B12,PIK3CB,HSD17B4,ESR1
TGF- $\beta$ Signaling	0.024547089	0.239331576	ZFYVE9,MAP2K6,BMP4,GRB2,BMP2,SMAD3,SKI,SMAD6,SMAD7,PITX2,INHBA,EP 300,TGFBF2,ZNF423,FOS,BMPR1B,MAPK14,JUN,MAP3K7,RUNX2,TGFB3,BMP7, ACVR1C,ACVR2A
Epithelial Adherens Junction Signaling	0.02630268	0.247742206	RAP1B,RAPGEF1,TCF4,TGFBF3,PVRL3,MLLT4,MYH11,TCF7,CLIP1,PTEN,TGFB R2,CTNNA2,WASL,ACTR3,SORBS1,HGF,BAIAP2,PVRL1,JUP,CTNNA1,ACVR1C,D LL1,AKT2,LMO7,TCF3,FGF1,MET,CDH2,MAGI1,SNAI2,FER,MYH3,LEF1,CLINT1,P ARD3,MAGI2,ACVR2A,TCF7L2
Superpathway of Inositol Phosphate Compounds	0.028183829	0.252348077	PTPN13,NUDT9,NUDT3,PIK3R1,NUDT12,IGBP1,STYXL1,PLCH1,PTEN,PTPRC,IP MK,PLCE1,ITPKB,PIK3C3,PTPN1,PLCB1,MTMR2,PPP1R1C,EYA4,NUDT4,RNGTT, PPP3CA,PIK3C2B,PIK3C2A,DUSP27,PIK3C2G,PAWR,NUDT15,PPP2R5A,PLCZ1,P LCB4,TNS3,PIP5K1A,SYNJ1,PTPN11,PPP1R16B,CDIPT,PPM1H,DUSP23,PPP1R1 2A,MTMR7,PIK3CB,PPP2R5E,TPTE/TPTE2,PIP4K2A
IL-17A Signaling in Fibroblasts	0.028183829	0.252348077	IKBKB,FOS,JUN,MAPK14,TRAF3IP2,MAP3K7,IKBKE,CXCL5,IL6,NFKBIZ,NFKB1,IL 17A
Thrombopoietin Signaling	0.028840315	0.252348077	PIK3C2B,PRKCQ,PIK3C2A,GRB2,PIK3R1,PIK3C2G,MYC,FOS,JUN,PTPN11,PIK3C 3,PRKCE,PIK3CB,IRS2,PRKCH,PRKD1,PRKCA
Amyotrophic Lateral Sclerosis Signaling	0.028840315	0.252348077	NOS1,GDNF,GRID2,GRIA1,PIK3R1,GRIA4,PDGFC,GRID1,PROK1,PIK3C3,NEFM,B ID,GRIK2,PPP3CA,GRIK1,GRIN2B,PIK3C2B,CACNA1D,PIK3C2A,PIK3C2G,VEGFC ,XIAP,GRIN3A,GRIK4,CAPN2,PIK3CB,GRIA3
IGF-1 Signaling	0.028840315	0.252348077	CTGF,PIK3R1,SOCS2,IGFBP7,YWHAQ,PTK2,JUN,PIK3C3,FOXO3,IGF1R,CSNK2A 1,IRS2,PIK3C2B,AKT2,PIK3C2A,YWHAQ,GRB2,PIK3C2G,IGFBP5,GRB10,FOS,FO XO1,PTPN11,IRS1,IGFBP3,PIK3CB,PRKAR1A
Embryonic Stem Cell Differentiation into Cardiac Lineages	0.029512092	0.252348077	SOX2,HOXB5,ISL1,T,SP4
BMP signaling pathway	0.030902954	0.262421854	BMP4,FST,GRB2,BMP2,SMAD6,SMAD7,NFKB1,PITX2,BMP5,XIAP,NOG,ATF2,ZNF 423,BMPR1B,MAPK14,JUN,MAP3K7,RUNX2,BMP7,BMP6,PRKAR1A
Colorectal Cancer Metastasis Signaling	0.032359366	0.264850014	MMP20,PIK3R1,DIRAS3,SMAD3,GNB2L1,WNT16,IL6,CCND1,TCF7,MYC,TGFBF2, GNB1,RHOB,ADCY5,PROK1,GNNG12,PIK3C2B,AKT2,IL6R,VEGFC,TCF3,TGFB3,FZ D3,LEF1,SIAH1,IL6ST,FZD10,TCF4,PTGER3,FZD1,NFKB1,PDGFC,GNNG7,JUN,AR RB1,PIK3C3,DCC,RHOU,CTNNA1,NOS2,PIK3C2A,GRB2,WNT2B,PIK3C2G,FZD8,F OS,WNT8A,FZD4,WNT10A,TLR5,MSH6,PIK3CB,TCF7L2,WNT11,WNT5A,FZD7,PR KAR1A
TR/RXR Activation	0.032359366	0.264850014	PIK3C2B,AKT2,PIK3C2A,SLC2A1,NXPH2,MED1,PIK3R1,PIK3C2G,PFKP,DIO2,DIO 3,NRNG,EP300,COL6A3,PIK3C3,NCOA1,ACACA,STRBP,PIK3CB,NCOR2,RXRA,T HRB,RCAN2,PPARGC1A
Cyclins and Cell Cycle Regulation	0.034673685	0.267300641	CDKN2A,CCNH,HDAC4,HDAC8,HDAC2,WEE1,CCNB3,CDK6,E2F3,CCND1,CDKN2 B,PPP2R5A,E2F6,CCNE1,CCND2,CCND3,TGFB3,PPP2R5C,BTRC,PPP2R5E,PPP 2R1B,ATR
B Cell Receptor Signaling	0.035481339	0.267300641	MAP2K6,PIK3R1,MAP3K5,CREB5,BCL6,NFKB1,EP300,PTEN,PTPRC,IKBKB,JUN, CAMK2D,MAP3K7,PPP3R1,PIK3C3,PPP3CA,ETS1,PIK3C2B,AKT2,PRKCQ,PIK3C2 A,GRB2,MAP3K1,PIK3C2G,IKBKE,TCF3,ATF2,EBF1,MAPK14,SYNJ1,FOXO1,PTP N11,BCL10,VAV3,PAG1,SYK,NFATC2,PIK3CB,PIK3AP1,MAP3K8
Mechanisms of Viral Exit from Host Cells	0.035481339	0.267300641	CHMP6,PRKCQ,CHMP2B,SH3GL3,CHMP4C,PRKCE,SH3GLB1,PRKCH,PDCC6IP, LMNB1,PRKD1,CHMP3,PRKCA
Chondroitin Sulfate Biosynthesis (Late Stages)	0.035481339	0.267300641	CHST7,CHSY1,HS2ST1,CHST12,NDST4,SULT2A1,CHST15,SULT2B1,HS3ST3B1, HS3ST2,HS6ST2,CHST11,HS3ST1,HS3ST5
LPS-stimulated MAPK Signaling	0.036307805	0.267300641	MAP2K6,PIK3C2B,PRKCQ,PIK3C2A,PIK3R1,PIK3C2G,IKBKE,MAP3K5,NFKB1,ATF 2,FOS,IKBKB,MAPK14,JUN,MAP3K7,PIK3C3,PRKCE,PIK3CB,PRKCH,PRKD1,PRK CA
D-myo-inositol (1,4,5,6)-Tetakisphosphate Biosynthesis	0.037153523	0.267300641	PTPN13,NUDT3,NUDT9,NUDT12,IGBP1,STYXL1,PTEN,PTPRC,IPMK,PTPN1,MTM R2,PPP1R1C,EYA4,NUDT4,RNGTT,PPP3CA,DUSP27,PAWR,PPP2R5A,NUDT15,T NS3,SYNJ1,PTPN11,PPP1R16B,PPM1H,DUSP23,PPP1R12A,MTMR7,PPP2R5E,TP TE/TPTE2
D-myo-inositol (3,4,5,6)-tetakisphosphate Biosynthesis	0.037153523	0.267300641	PTPN13,NUDT3,NUDT9,NUDT12,IGBP1,STYXL1,PTEN,PTPRC,IPMK,PTPN1,MTM R2,PPP1R1C,EYA4,NUDT4,RNGTT,PPP3CA,DUSP27,PAWR,PPP2R5A,NUDT15,T NS3,SYNJ1,PTPN11,PPP1R16B,PPM1H,DUSP23,PPP1R12A,MTMR7,PPP2R5E,TP TE/TPTE2
Neuregulin Signaling	0.037153523	0.267300641	ITGB1,AKT2,PRKCQ,GRB2,PIK3R1,CDK5R1,TMEFF2,AREG/AREGB,PTEN,MYC,E RBB2IP,PICK1,PTPN11,NRG3,ERBB4,GRB7,HSP90AA1,PRKCE,ERRF1,PRKCH,P RKD1,PRKCA,ITGA4,PSEN1
Sulfate Activation for Sulfonation	0.03801894	0.270395836	PAPSS1,PAPSS2

Nitric Oxide Signaling in the Cardiovascular System	0.041686938	0.290402265	PIK3C2B,AKT2,CACNA1D,PIK3C2A,GUCY1A3,ITPR2,PIK3R1,FLT1,RYR2,PIK3C2G,VEGFC,ITPR1,PDGFC,PRKG1,PROK1,PIK3C3,KDR,GUCY1A2,HSP90AA1,PIK3CB,PRKAR1A
Dopamine-DARPP32 Feedback in cAMP Signaling	0.042657952	0.290402265	NOS1,KCNJ2,CSNK1A1,CREB5,EP300,PLCE1,DRD1,ADCY5,PPP3R1,PLCB1,PRKCE,PPP2R5C,PLCL1,PRKD1,PPP3CA,PRKCA,PPP1R14C,GRIN2B,CACNA1D,PRKCO,GUCY1A3,ITPR2,CSNK1G3,GNAI1,KCNJ3,PAWR,ITPR1,PPP2R5A,GRIN3A,ATF2,PLCZ1,PLCB4,PRKG1,CREM,GUCY1A2,PPP1R12A,PRKCH,PPP2R5E,PPP2R1B,PRKAR1A
Notch Signaling	0.043651583	0.290402265	MAML1,MAML2,DLL1,CNTN1,MAML3,RBPJ,PSEN2,HES1,HES7,JAG1,PSEN1,HEY1
P2Y Purigenic Receptor Signaling Pathway	0.043651583	0.290402265	PIK3R1,GNB2L1,NFKB1,CREB5,NGF7,EP300,GNB1,MYC,JUN,PLCE1,ADCY5,PIK3C3,PLCB1,PRKCE,PLCL1,NGG12,PRKD1,PRKCA,PIK3C2B,AKT2,PRKCQ,PIK3C2A,GNAI1,PIK3C2G,ATF2,PLCZ1,FOS,PLCB4,PIK3CB,PRKCH,PRKAR1A
PTEN Signaling	0.043651583	0.290402265	PIK3R1,TGFBF3,NFKB1,CCND1,PTEN,PTK2,TGFBF2,IKKBK,FOXO3,IGF1R,CSNK2A1,ITGA4,ITGB1,AKT2,GRB2,FLT1,PREX2,FGFR2,IKBKE,FOXG1,CNKR3,TNFRSF11A,BMPR1B,MAGI1,FOXO1,SYNJ1,NTRK3,KDR,PIK3CB,MAGI2,BCL2L1
Chronic Myeloid Leukemia Signaling	0.045708819	0.293764965	CDKN2A,PIK3C2B,AKT2,HDAC4,HDAC8,PIK3C2A,HDAC2,GRB2,PIK3R1,SMAD3,PIK3C2G,CDK6,IKBKE,E2F3,NFKB1,CCND1,MECOM,TGFBF2,MYC,IKKBK,E2F6,PTPN11,PIK3C3,TGFB3,PIK3CB
CD40 Signaling	0.045708819	0.293764965	MAP2K6,PIK3C2B,TRAF3,PIK3C2A,PIK3R1,PIK3C2G,TNFAIP3,IKBKE,NFKB1,FOS,IKKBK,MAPK14,JUN,MAP3K7,PIK3C3,PIK3CB,TRAF5,MAP2K5
NRF2-mediated Oxidative Stress Response	0.045708819	0.293764965	MAP2K6,USP14,PIIB,PIK3R1,NQO2,MAF,DNAJC15,MAP3K5,EP300,CUL3,JUN,MAP3K7,PIK3C3,DNAJC1,PRKCE,FMO1,UBE2E3,FKBP5,NFE2L2,PRKD1,PRKCA,GSTA3,PIK3C2B,DNAJB8,PRKCQ,PIK3C2A,GSTA4,MAP3K1,DNAJC19,PIK3C2G,BAH1,FOS,MAPK14,MGST2,DNAJC5B,PIK3CB,PRKCH,CDC34,AOX1,DNAJB6,ABC4,ENC1,MAP2K5,DNAJC7
Calcium-induced T Lymphocyte Apoptosis	0.046773514	0.294442163	CD247,PRKCQ,HDAC2,ITPR2,HLA-DRB1,ITPR1,CABIN1,EP300,PPP3R1,NR4A1,PRKCE,NFATC2,CAPN2,PRKCH,PRKD1,PPP3CA,PRKCA
ErbB4 Signaling	0.046773514	0.294442163	PIK3C2B,PRKCQ,PIK3C2A,GRB2,PIK3R1,PIK3C2G,PSEN2,NRG3,ERBB4,PIK3C3,YAP1,PRKCE,PIK3CB,PRKCH,PRKD1,PSEN1,PRKCA
NGF Signaling	0.050118723	0.303389118	RAP1B,PIK3R1,RPS6KA3,MAP3K5,NFKB1,CREB5,NGF,EP300,IKKBK,MAP3K7,PIK3C3,TRAF4,SMPD3,PIK3C2B,AKT2,PIK3C2A,GRB2,MAP3K1,PIK3C2G,IKBKE,ATF2,ROCK1,TRIO,RPS6KA6,PTPN11,MAP3K8,PIK3CB,RPS6KA5
CREB Signaling in Neurons	0.050118723	0.303389118	GRM3,PIK3R1,GRIA1,GRID2,GNB2L1,CREB5,GRIA4,NGF7,EP300,GNB1,PLCE1,CAMK2D,GRID1,ADCY5,PIK3C3,PLCB1,PRKCE,GRIK2,PLCL1,PRKD1,NGG12,GRIK1,PRKCA,GRIN2B,PIK3C2B,AKT2,PRKCQ,PIK3C2A,GRB2,GRM8,ITPR2,GNAI1,PIK3C2G,ITPR1,ATF2,PLCZ1,PLCB4,GRIK4,PIK3CB,PRKCH,PRKAR1A,GRIA3
cAMP-mediated signaling	0.050118723	0.303389118	CAMK1D,GRM3,PDE3A,LHCGR,CREB5,CAMK2D,MC1R,ADCY5,PPP3R1,HTR7,PKIA,PDE11A,OPRM1,PDE10A,GRM8,PDE4B,CNGA3,ATF2,PDE8A,AKAP13,RAP1GAP,PKIB,CREM,DUSP4,AGTR1,AKAP12,RGS18,PTGER3,DUSP6,PDE4A,RAPGEF4,CHRM3,EP300,DRD1,CAMK1G,CNGB3,PPP3CA,ADRB2,AKAP5,RGS7,GNAI1,AKAP6,PDE4D,OPRD1,AKAP2/PALM2-AKAP2,LPAR1,GLP1R,S1PR1,PDE5A,ADRA2C,AKAP9,PRKAR1A

## Supplementary Table 11: All HEPG2 (in house) TCF7L2 Ingenuity Canonical pathways with at least nominal $P < 0.05$

Ingenuity Canonical Pathways	P-value	B-H Multiple testing correction p-value	Molecules
PPAR $\alpha$ /RXR $\alpha$ Activation	2.40E-06	0.001174898	MAP2K6,NCOA6,TGFBR3,MAP4K4,ABCA1,IL1R2,NR2F1,TGFBR2,JUN,NFKB1A,HSP90AB1,SOS1,PRKAR1B,PLCB1,NCOR1,PLCL1,GOT2,ACVR1C,ITGB5,PRKCA,ADCY9,ADCY2,GNAS,ACAA1,MED1,ADCY3,ACVR1,PLCG1,NR2C2,IL1R1,TGS1,NCOA3,CAND1,PLCB4,MAPK14,IRS1,PLCG2,TGFB3,IL1B,NCOR2,ADIPOR2,ADCY7,ACVR2A,PRKAR1A
Protein Kinase A Signaling	1.70E-05	0.004168694	MYH10,MYL2,NFATC3,MYLK2,GNB5,TCF7,PTCH2,TGFBR2,ROCK2,TH,CAMK2D,PDE7B,PLCB1,CDKN3,PLCL1,EYA2,PRKD1,ADCY9,PTPRD,ADD2,ITPR2,PDE10A,ITPR1,PTPN3,PDE4B,PTPRM,PTP4A1,TTN,CNGA3,PDE8A,EPM2A,PTPRH,MYL12A,PLCG2,ITPR3,TGFB3,LEF1,DUSP4,PTPRA,SIRPA,AKAP12,DUSP6,PTPN14,CDC23,PTPN4,NFKB1A,DUSP10,PTPN1,PRKAR1B,PRKCE,CNGB3,CTNNB1,PRKCA,ADCY2,GNAS,PTPRK,ATF1,MAP3K1,ADCY3,GNAI1,PLCG1,AKAP6,NFATC4,ROCK1,CALM1 (includes others),AKAP2/PALM2-AKAP2,PLCB4,KDELRL3,IHH,NFATC2,PDE5A,CNGB1,ADCY7,PTPRT,PTPN22,TCF7L2,PRKAR1A
Wnt/ $\beta$ -catenin Signaling	5.12861E-05	0.008317638	FRZB,PPP2R2A,SOX10,TGFBR3,SOX12,CSNK1A1,TFLE1,WNT6,KREMEN1,CCND1,TCF7,MYC,TGFBR2,SOX2,SOX9,JUN,DKK2,SOX18,CTNNB1,ACVR1C,SOX4,SRC,AKT2,AXIN2,LRP5,GJA1,WNT9B,ACVR1,SOX11,CDH2,WNT8A,CDH5,GNAO1,TFLE3,TGFB3,LEF1,FZD5,DKK1,ACVR2A,LRP1,TCF7L2
RAR Activation	6.91831E-05	0.008317638	TRIM24,BMP2,NR2F2,SMARCD2,MAP3K5,VEGFA,NR2F1,JUN,ALDH1A1,ALDH1A3,PRKAR1B,PRKCE,NCOR1,SORBS3,NT5C1B,SMAD1,CITED2,PRKD1,PRKCA,ADCY9,SRC,ADCY2,AKT2,GNAS,MED1,MAP3K1,ADCY3,SMAD7,PIK3R3,MAPK14,TAF4,IGFBP3,NCOA1,TGFB3,PIK3CB,NCOR2,NRIP1,ADCY7,SCAND1,PRKAR1A,ADH4
Factors Promoting Cardiogenesis in Vertebrates	0.000104713	0.01023293	NODAL,BMP4,MYL2,BMP2,TGFBR3,TCF7,TGFBR2,PRKCE,CTNNB1,ACVR1C,SMAD1,PRKD1,PRKCA,LRP5,ACVR1,MAPK14,TGFB3,FZD5,LEF1,BMP7,DKK1,BMP6,TCF7L2,ACVR2A,LRP1
Role of NFAT in Cardiac Hypertrophy	0.000177828	0.014454398	MAP2K6,GNB5,CSNK1A1,CABIN1,TGFBR2,CAMK2D,SOS1,PRKAR1B,IGF1R,PLCB1,PRKCE,PLCL1,PRKD1,PRKCA,ADCY9,PIK3C2B,SRC,ADCY2,AKT2,HDAC4,GNAS,ITPR2,ADCY3,MAP3K1,GNAI1,SLC8A3,MEF2A,PLCG1,NFATC4,ITPR1,PIK3R3,CALM1 (includes others),PLCB4,MAPK14,PLCG2,ITPR3,TGFB3,PIK3CB,SLC8A1,ADCY7,PRKAR1A
Corticotropin Releasing Hormone Signaling	0.000346737	0.022908677	GLI2,POMC,PTCH2,VEGFA,JUN,PRKAR1B,PRKCE,NOS2,PRKD1,PRKCA,ADCY9,ADCY2,GNAS,ITPR2,ADCY3,GNAI1,CRH,MEF2A,PLCG1,ITPR1,CALM1 (includes others),MAPK14,PLCG2,GNAO1,ITPR3,NR4A1,ADCY7,PRKAR1A
Neuropathic Pain Signaling In Dorsal Horn Neurons	0.000380189	0.022908677	GRIN2A,GRIA1,TACR1,CAMK2D,PRKAR1B,PRKCE,PLCB1,KCNQ3,PLCL1,PRKD1,PRKCA,SRC,PIK3C2B,GRM8,ITPR2,GRIA2,PLCG1,ITPR1,GRM7,PIK3R3,PLCB4,KCNQ2,PLCG2,ITPR3,PIK3CB,PRKAR1A
Axonal Guidance Signaling	0.000489779	0.026915348	DPYSL2,BMP4,GLI2,ITSN1,MYL2,NFATC3,GNB5,CXCL12,LIMK2,WNT6,PTCH2,NCK2,VEGFA,ROCK2,CFL2,UNC5D,PLCB1,ADAM23,PLXNB2,PLCL1,PRKD1,PIK3C2B,ACTR2,PAPPA,AKT2,KALRN,TUBB2A,MMP2,HHIP,PIK3R3,ADAM18,MYL12A,ADAM12,PLCG2,SEMA6D,GNAO1,RTN4,FZD5,PAK7,ADAM29,EPHA2,MMP2,SLIT1,BMP2,SEMA6A,EPHA4,PDGFC,ABLIM1,ACTR3,EFNA5,SOS1,PRKAR1B,ADAM19,PRKCE,SEMA3B,ROBO2,SEMA3F,PRKCA,TUBB1,GNAS,NRP2,WNT9B,GNA12,C9orf3,GNAI1,PLCG1,NFATC4,EPHA3,ITGA3,EFNA1,ROCK1,WNT8A,PLCB4,WIPF1,NFATC2,PIK3CB,BMP7,BMP6,PRKAR1A,SEMA7A
Superpathway of Citrulline Metabolism	0.001023293	0.050118723	PRODH,GLS,ASS1,ARG2,NOS2,CPS1,ARG1
Renin-Angiotensin Signaling	0.001548817	0.063095734	JUN,SOS1,PRKAR1B,PRKCE,PRKD1,AGT,PRKCA,ADCY9,PIK3C2B,ADCY2,GNAS,ITPR2,ADCY3,MAP3K1,REN,PLCG1,ITPR1,PIK3R3,MAPK14,PLCG2,ITPR3,PAK7,PIK3CB,ADCY7,AGTR1,PRKAR1A
Histidine Degradation III	0.001584893	0.063095734	HAL,MTHFD2,AMDHD1,MTHFD2L,MTHFD1L
Oxidative Ethanol Degradation III	0.001698244	0.063095734	ACSL3,ACSS3,ALDH1A1,ALDH1A3,ALDH3A2,ALDH3A1,ACSL1
EGF Signaling	0.001905461	0.063095734	SRC,PIK3C2B,AKT2,JAK1,ITPR2,MAP3K1,SRF,PLCG1,ITPR1,PIK3R3,JUN,MAPK14,SOS1,ITPR3,PIK3CB,PRKCA
Epithelial Adherens Junction Signaling	0.001995262	0.063095734	MYH10,MYH6,MYL2,TGFBR3,PVRL3,MLL14,TCF7,TGFBR2,CTNNA2,ACTR3,SORBS1,PVRL1,CTNNB1,ACVR1C,SRC,ACTR2,TUBB1,AKT2,FGFR1,TUBB2A,SNAI1,ACVR1,PTPRM,FGF1,CDH2,MAGI1,MYH9,LEF1,PARD3,ACVR2A,TCF7L2,CTNND1
Aryl Hydrocarbon Receptor Signaling	0.002137962	0.063095734	CCND1,ARNT,NR2F1,TGM2,MYC,ALDH1A1,JUN,HSP90AB1,ALDH1A3,ALDH3A2,ALDH3A1,NFE2L2,ALDH5A1,AHR,SRC,NFIC,MED1,GSTA4,NQO1,CDK6,NCOA3,MGST2,NFIA,TGFB3,IL1B,NFIB,NRIP1,NCOR2,DCT,ESR1
Molecular Mechanisms of Cancer	0.002290868	0.063095734	BMP4,JAK1,TAB2,CCND1,PTCH2,MYC,TGFBR2,E2F6,CTNNA2,CAMK2D,ROBO1,PLCB1,SMAD1,PRKD1,CASP10,ADCY9,PIK3C2B,AKT2,ARHGEF4,CDK6,PIK3R3,BCL2L1,MAX,ARHGEF16,IRS1,GNAO1,TGFB3,PAK7,LEF1,FZD5,MAP2K6,BMP2,HIF1A,MAP3K5,NFKB1A,JUN,SOS1,PRKAR1B,PRKCE,BID,CTNNB1,CASP8,PRKCA,SRC,LRP5,ADCY2,GNAS,GNA12,ADCY3,GNAI1,SMAD7,PLCB4,MAPK14,RASGRF1,IHH,BMP7,PIK3CB,BMP6,ADCY7,LRP1,PRKAR1A,PSEN1,CTNND1
G $\alpha$ 12/13 Signaling	0.002454709	0.063095734	MYL2,MAP3K5,F2,CDH11,ROCK2,JUN,NFKB1A,CDH16,CTNNB1,PIK3C2B,SRC,AKT2,CDH4,GNA12,MAP3K1,CDH6,MEF2A,ROCK1,PIK3R3,CDH2,MYL12A,CDH9,CDH5,CDH20,VAV3,CDH8,PIK3CB
Xenobiotic Metabolism Signaling	0.002511886	0.063095734	LIPC,GCLC,CES2,CHST15,ARNT,HS6ST1,ALDH1A1,CAMK2D,NR1I2,SUMO1,ALDH3A2,HS6ST3,ALDH3A1,PRKD1,AHR,PIK3C2B,HDAC4,MED1,UGT1A1,PIK3R3,HS3ST3B1,NCOA1,HS3ST5,MAP2K6,GAL3ST2,PPP2R2A,MAP3K5,CUL3,HSP90AB1,ALDH1A3,PRKCE,SMOX,NOS2,NFE2L2,ALDH5A1,CITE D2,PRKCA,GSTA4,MGMT,NQO1,MAP3K1,SULT2B1,MAPK14,MGST2,HS3ST2,IL1B,PIK3CB,NRIP1,NCOR2,SCAND1,UGT1A9 (includes others)

Growth Hormone Signaling	0.002630268	0.063095734	PIK3C2B,SOCS1,SOCS2,SRF,PLCG1,ONECUT1,PIK3R3,IRS1,PLCG2,IGF1R,IGFBP3,PRKCE,PIK3CB,RPS6KA2,SOCS5,A2M,PRKD1,PRKCA
Role of Macrophages, Fibroblasts and Endothelial Cells in Rheumatoid Arthritis	0.002951209	0.069183097	SOCS1,TRAF3,NFATC3,CXCL12,CSNK1A1,WNT6,CCND1,TCF7,MYC,IL1R2,VEGFA,ROCK2,CAMK2D,TRAF3IP2,DKK2,PLCB1,PLCL1,PRKD1,PIK3C2B,AKT2,SELE,PIK3R3,PLCG2,GNAO1,LEF1,FZD5,MAP2K6,FN1,FRZB,PDGFC,NFKBIA,JUN,PRKCE,CTNNA1,NOS2,PRKCA,SRC,LRP5,WNT9B,DAAM1,PLCG1,CEBPB,NFATC4,IL1R1,ROCK1,CALM1 (includes others),WNT8A,PLCB4,MAPK14,NFATC2,IL1B,PIK3CB,DKK1,TCF7L2,LRP1,MYH10,MYH6,MYL2,SLC4A11,PRKAR1B,PLCB1,KCNQ3,PLCL1,ADCY9,SLC4A5,ADCY2,GNAS,ITPR2,ADCY3,PLCG1,PDE4B,ITPR1,CALM1 (includes others),PLCB4,MYL12A,KCNQ2,PLCG2,ITPR3,MYH9,PDE5A,ADCY7,PRKAR1A,SLC4A10
Cellular Effects of Sildenafil (Viagra)	0.003235937	0.072443596	ACSL3,ACSS3,ALDH1A1,DHRS2,ALDH1A3,ALDH3A2,ALDH3A1,ACSL1,ADH4,DHRS4
Urea Cycle	0.003715352	0.072443596	ASS1,ARG2,CPS1,ARG1
Ethanol Degradation II	0.003890451	0.072443596	MYC,JUN,EDN1,PLB1,SOS1,PLCB1,PRKCE,CASP8,NOS2,PLCL1,PRKD1,CASP10,PRKCA,ADCY9,SRC,PIK3C2B,ADCY2,GNAS,ITPR2,GNA12,ADCY3,GNAI1,PLCG1,PLA2G2E,ITPR1,PIK3R3,PLA2G4A,PLA2G6,PLCB4,MAPK14,PLCG2,GNAO1,ITPR3,PIK3CB,ADCY7
Endothelin-1 Signaling	0.003981072	0.072443596	ACSL3,ACSS3,ALDH1A1,ALDH1A3,ALDH3A2,ALDH3A1,ACSL1
Ethanol Degradation IV	0.004073803	0.072443596	MYL2,CD4,CXCL12,GNB5,ROCK2,JUN,RHOB,PLCB1,PRKCE,PRKD1,PRKCA,ADCY9,PIK3C2B,SRC,ADCY2,AKT2,GNAS,ITPR2,GNA12,ADCY3,GNAI1,ITPR1,PIK3R3,ROCK1,MYL12A,PLCB4,GNAO1,ITPR3,PIK3CB,PAK7,ELMO1,ADCY7
CXCR4 Signaling	0.004365158	0.072443596	GRIN2A,GRIA1,GNB5,CAMK2D,SOS1,PRKAR1B,PRKCE,PLCB1,PLCL1,PRKD1,PRKCA,ADCY9,PIK3C2B,ADCY2,AKT2,GNAS,GRM8,ITPR2,GNA12,ADCY3,GRIA2,GNAI1,PLCG1,ITPR1,GRM7,PIK3R3,CALM1 (includes others),PLCB4,GRIK4,PLCG2,GNAO1,ITPR3,PIK3CB,ADCY7,PRKAR1A
CREB Signaling in Neurons	0.004365158	0.072443596	SOX2,ISL1,TRIM24,CDYL,MYF5,MEIS1,OTX1,HOXB1,HNF4A,FOXC1,ONECUT1,ZFH3X
Transcriptional Regulatory Network in Embryonic Stem Cells	0.004365158	0.072443596	NODAL,BMP4,BMP2,WNT6,PDGFC,TCF7,SOX2,TGFBR2,CTNNA1,SMAD1,PDGFRB,PIK3C2B,AKT2,GNAS,WNT9B,FGFR1,SMAD7,ACVR1C,PIK3R3,WN T8A,TGFB3,S1PR1,BMP7,PIK3CB,LEF1,FZD5,BMP6,TCF7L2,SALL4
Human Embryonic Stem Cell Pluripotency	0.004677351	0.075857758	MAP2K6,GNAI1,PLCG1,MTNR1B,CALM1 (includes others),PLCB4,CAMK2D,RORA,PLCG2,GNAO1,PRKAR1B,PLCB1,PRKCE,PLCL1,PRKD1,PRKAR1A,PRKCA
Melatonin Signaling	0.005370318	0.085113804	MYL2,PIKFYVE,GNB5,LIMK2,CDH11,ROCK2,ACTR3,CFL2,RHOB,ARHGAP12,CDH16,DLG1,PRKCA,ACTR2,SRC,ARHGEF4,GNAS,CDH4,GNA12,CDH6,GNAI1,ITGA3,ROCK1,ARHGAP5,MYL12A,CDH2,CDH9,CDH5,CDH20,ARHG EF16,GNAO1,CDH8,PAK7,ARHGDI,ESR1
RhoGDI Signaling	0.005754399	0.089125094	PDGFC,VEGFA,HSP90AB1,PRKAR1B,CNGB3,CASP8,ADCY9,AQP7,PIK3C2B,AKT2,ADCY2,GNAS,ITPR2,ADCY3,PLCG1,ITPR1,CNGB3,PIK3R3,CALM1 (includes others),PLCG2,ITPR3,CHRNE,CNGB1,PIK3CB,ADCY7,ESR1,PRKAR1A
eNOS Signaling	0.006456542	0.09332543	ADCY9,ADCY2,GNAS,ITPR2,ADCY3,SLC8A3,GNB5,GNAI1,PLCG1,ITPR1,CALM1 (includes others),PLCG2,ITPR3,PRKAR1B,PRKCE,SLC8A1,ADCY7,PRKD1,PRKAR1A,PRKCA
$\alpha$ -Adrenergic Signaling	0.00676083	0.095499259	SRC,AKT2,PLCG1,ITGA3,TMEFF2,MYC,PIK3R3,ERBB2IP,HSP90AB1,NRG3,PLCG2,ERBB4,GRB7,SOS1,TGFA,DLG4,PRKCE,PRKD1,PSEN1,PRKCA
Neuregulin Signaling	0.007585776	0.106414302	CSNK1A1,SP3,SOS1,PRKAR1B,PRKCE,PLCB1,PLCL1,CTNNA1,PRKD1,PRKCA,ADCY9,SRC,PIK3C2B,TUBB1,AKT2,ADCY2,GNAS,ITPR2,ADCY3,TUBB2A,GNAI1,PLCG1,ITPR1,DRD2,PIK3R3,PLCB4,PLCG2,ITPR3,PIK3CB,ADCY7,PRKAR1A
Gap Junction Signaling	0.009549926	0.129717927	MAP2K6,NODAL,BMP4,BMP2,ACVR1,SMAD7,INHBB,TGIF1,TGFBR2,ZNF423,JUN,MAPK14,SOS1,TGFB3,BMP7,HNF4A,SMAD1,ACVR1C,ACVR2A
TGF- $\beta$ Signaling	0.010964782	0.134276496	PIK3C2B,SRC,ITSN1,CLTC,ITGA6,PLCG1,ITGA3,ITGAL,PIK3R3,AP1G2,PLCG2,PRKCE,PIK3CB,ITGA1,ITGB4,ITGB6,CXADR,ITGB5,PRKD1,PRKCA
Virus Entry via Endocytic Pathways	0.011220185	0.134276496	MYH10,MYH6,FN1,MYL2,PDGFC,IL1R2,VEGFA,TGFBR2,EDN1,IGF1R,PDGFRB,AGT,FGFR1,SMAD7,IFNGR1,MMP2,IL1R1,FGF1,CD40,TGFA,IGFBP3,TGFB3,IL1B,MYH9,A2M,AGTR1,CCR7,COL3A1
Hepatic Fibrosis / Hepatic Stellate Cell Activation	0.012022644	0.134276496	NFATC3,MAP3K1,PLCG1,TOB1,NFATC4,TGFBR2,CD28,CALM1 (includes others),NFKBIA,JUN,BCL10,VAV3,PLCG2,SOS1,LAT,TGFB3,NFATC2,CARD11
Regulation of IL-2 Expression in Activated and Anergic T Lymphocytes	0.012022644	0.134276496	PIK3C2B,GNAS,ITPR2,GNAI1,GNB5,LIMK2,PLA2G2E,ITPR1,PIK3R3,ROCK2,ROCK1,CALM1 (includes others),PLA2G6,PLA2G4A,PLCB4,MAPK14,CFL2,ITPR3,PLCB1,PRKCE,PAK7,PIK3CB,PRKD1,PRKCA
CCR3 Signaling in Eosinophils	0.012022644	0.134276496	ADCY9,PIK3C2B,SRC,ADCY2,GNAS,SOX10,ADCY3,PLCG1,POMC,PIK3R3,MC1R,PLCG2,SOS1,PRKAR1B,PIK3CB,DCT,RPS6KA2,ADCY7,PRKAR1A
Melanocyte Development and Pigmentation Signaling	0.012302688	0.134276496	MYL2,GNB5,F2,ROCK2,CAMK2D,RHOB,SOS1,PRKCE,PLCB1,PLCL1,PRKD1,PRKCA,ADCY9,SRC,PIK3C2B,ARHGEF4,ADCY2,AKT2,GNAS,ITPR2,GNA12,ADCY3,GNAI1,PLCG1,ITPR1,ROCK1,PIK3R3,MYL12A,PLCB4,MAPK14,PLCG2,ARHGEF16,GNAO1,ITPR3,PIK3CB,ADCY7
Thrombin Signaling	0.012589254	0.134276496	PIK3C2B,NFATC3,CD4,MAP3K1,PLCG1,NFATC4,CD8A,PIK3R3,CD28,SHB,CALM1 (includes others),PTPRH,JUN,NFKBIA,BCL10,VAV3,SOS1,LAT,NFATC2,PIK3CB,CARD11
T Cell Receptor Signaling	0.012882496	0.134276496	ALDH1A1,ALDH1A3,ALDH3A2,SAT1,SMOX,ALDH3A1
Putrescine Degradation III	0.013182567	0.134276496	SOCS1,PIK3C2B,SOCS2,PLCG1,CEBPB,TCF7,MYC,PIK3R3,JUN,IRS1,PLCG2,SOS1,PRKCE,PIK3CB,SOCS5,PRKD1,PRKCA
Prolactin Signaling	0.013182567	0.134276496	ADCY9,PIK3C2B,ADCY2,AKT2,GNAS,ADCY3,PLCG1,POMC,PIK3R3,PLCB4,PLCG2,PRKAR1B,PLCB1,PIK3CB,PLCL1,ADCY7,PRKAR1A
Leptin Signaling in Obesity	0.013182567	0.134276496	ADCY9,PIK3C2B,ADCY2,AKT2,GNAS,GNA12,ADCY3,GNAI1,PLCG1,PDGFC,PIK3R3,PLCB4,RHOB,PLCG2,S1PR1,PLCB1,PIK3CB,CASP8,PLCL1,ADCY7,SMPD3,PDGFRB,CASP10
Sphingosine-1-phosphate Signaling	0.013182567	0.134276496	PRODH,GLS,ARG2,ARG1
Citrulline Biosynthesis	0.013803843	0.136144468	HNMT,ALDH1A1,ALDH1A3,ALDH3A2,ALDH3A1
Histamine Degradation	0.014454398	0.138675583	PIK3C2B,AKT2,NFATC3,ITPR2,CD4,HLA-DQA1,PLCG1,ITPR1,NFATC4,PLEKHA3,INPP5D,PIK3R3,CALM1 (includes others)
iCOS-iCOSL Signaling in T Helper Cells	0.014791084	0.139958732	

			others),ICOS,CD28,CAMK2D,NFKBIA,CD40,LAT,ITPR3,NFATC2,PIK3CB
Role of Osteoblasts, Osteoclasts and Chondrocytes in Rheumatoid Arthritis	0.016595869	0.151705037	MAP2K6,BMP4,FRZB,NFATC3,BMP2,TAB2,CSNK1A1,WNT6,MAP3K5,TCF7,IL1R2,NFKBIA,JUN,DKK2,CTNNA1,ALPL,SMAD1,SRC,PIK3C2B,LRP5,AKT2,WNT9B,DLX5,NFATC4,IL1R1,ITGA3,PIK3R3,CALM1 (includes others),WNT8A,MAPK14,NFATC2,IL1B,PIK3CB,FZD5,LEF1,BMP7,DKK1,BMP6,LRP1,TCF7L2
PI3K Signaling in B Lymphocytes	0.018197009	0.151705037	BLNK,AKT2,ATF1,NFATC3,ITPR2,PLCG1,ITPR1,NFATC4,PLEKHA3,INPP5D,CALM1 (includes others),PLCB4,JUN,CAMK2D,NFKBIA,CD40,BCL10,IRS1,PLCG2,VAV3,ITPR3,NFATC2,PLCB1,PIK3CB,PLCL1
$\gamma$ -linolenate Biosynthesis II (Animals)	0.018197009	0.151705037	ACSL3,ACSL6,ACSL5,CYB5A,ACSBG2,ACSL1
Tetrahydrofolate Salvage from 5,10-methylenetetrahydrofolate	0.018620871	0.151705037	MTHFD2,MTHFD2L,MTHFD1L
Acetate Conversion to Acetyl-CoA	0.018620871	0.151705037	ACSL3,ACSS3,ACSL1
Role of NFAT in Regulation of the Immune Response	0.019054607	0.151705037	BLNK,NFATC3,CD4,HLA-DQA1,GNB5,CSNK1A1,CABIN1,CD28,JUN,NFKBIA,SOS1,XPO1,PLCB1,PIK3C2B,AKT2,GNAS,ITPR2,GNAI2,GNAI1,MEF2A,PLCG1,ITPR1,NFATC4,PIK3R3,CALM1 (includes others),PLCB4,PLCG2,GNAO1,LAT,ITPR3,NFATC2,PIK3CB
HER-2 Signaling in Breast Cancer	0.019498446	0.151705037	PIK3C2B,AKT2,CDK6,PLCG1,MMP2,MAP3K5,CCND1,PIK3R3,SOS1,PRKCE,PIK3CB,ITGB4,PAR3,ITGB6,ITGB5,PRKD1,PRKCA
Polyamine Regulation in Colon Cancer	0.019498446	0.151705037	MYC,MAX,PSMF1,SAT1,PSME4,PSMB11,CTNNA1
Ephrin A Signaling	0.019952623	0.151705037	ROCK2,ROCK1,PIK3R3,PIK3C2B,CFL2,EFNA5,VAV3,PIK3CB,EPHA4,EPHA3,EPHA2,EFNA1
Glioma Signaling	0.020417379	0.151705037	PIK3C2B,AKT2,RBL2,CDK6,PLCG1,PDGFC,CCND1,IGF1R,PIK3R3,E2F6,CALM1 (includes others),CAMK2D,PLCG2,SOS1,IGF1R,PRKCE,PIK3CB,PRKD1,PRKCA,PDGFRB
Cardiac Hypertrophy Signaling	0.020417379	0.151705037	MAP2K6,EIF2B4,MYL2,GNB5,SRF,MAP3K5,ROCK2,TGFBR2,JUN,RHOB,SOS1,IGF1R,PRKAR1B,PLCB1,PLCL1,ADCY9,PIK3C2B,ADCY2,GNAS,GNAI2,ADCY3,MAP3K1,MEF2A,GNAI1,PLCG1,NFATC4,ROCK1,PIK3R3,CALM1 (includes others),MYL12A,PLCB4,MAPK14,IRS1,PLCG2,GNAO1,TGFB3,ADRA2C,PIK3CB,ADCY7,PRKAR1A
Fatty Acid Activation	0.020892961	0.151705037	ACSL3,ACSL6,ACSL5,ACSBG2,ACSL1
Synaptic Long Term Depression	0.020892961	0.151705037	PPP2R2A,GRIA1,PLB1,IGF1R,PRKCE,PLCB1,NOS2,PLCL1,PRKD1,PRKCA,GNAS,GRM8,ITPR2,GNAI2,GNAI1,CRH,GRIA2,PLCG1,PLA2G2E,ITPR1,GRM7,PLA2G6,PLA2G4A,PLCB4,PLCG2,GNAO1,ITPR3
ILK Signaling	0.021379621	0.151705037	MAP2K6,MYH10,MYH6,FN1,MYL2,PPP2R2A,BMP2,HIF1A,CCND1,PDGFC,NCK2,MYC,VEGFA,JUN,RHOB,CFL2,PPAP2B,ITGB4,CTNNA1,NOS2,DSP,ITGB5,PIK3C2B,AKT2,TMSB10/TMSB4X,FERMT2,SNAI1,PIK3R3,LIMS1,IRS1,MYH9,PIK3CB,LEF1,ITGB6
PDGF Signaling	0.021877616	0.151705037	PIK3C2B,SRC,JAK1,MAP3K1,SRF,PLCG1,PDGFC,INPP5D,MYC,PIK3R3,SYNJ2,JUN,PLCG2,SOS1,PIK3CB,PRKCA,PDGFRB
CD28 Signaling in T Helper Cells	0.022387211	0.151705037	ACTR2,PIK3C2B,AKT2,NFATC3,ITPR2,CD4,MAP3K1,HLA-DQA1,PLCG1,ITPR1,NFATC4,PIK3R3,CALM1 (includes others),CD28,JUN,ACTR3,NFKBIA,BCL10,LAT,ITPR3,NFATC2,PIK3CB,CARD11
Type II Diabetes Mellitus Signaling	0.022387211	0.151705037	PIK3C2B,SOS1,AKT2,ACSL3,SOS2,MAP3K1,ACSL6,MAP3K5,CEBPB,ACSBG2,PIK3R3,NFKBIA,IRS1,ACSL5,PRKCE,PIK3CB,ADIPOR2,SOS5,ENP7,SMPD3,ACSL1,PRKD1,PRKCA
fMLP Signaling in Neutrophils	0.022387211	0.151705037	ACTR2,PIK3C2B,GNAS,NFATC3,NOX3,ITPR2,GNB5,GNAI1,ITPR1,NFATC4,PIK3R3,CALM1 (includes others),PLCB4,ACTR3,NFKBIA,ITPR3,PLCB1,PRKCE,NFATC2,PIK3CB,PRKD1,PRKCA
VEGF Signaling	0.022387211	0.151705037	EIF2S2,PIK3C2B,SRC,AKT2,EIF2B4,EIF1,PLCG1,HIF1A,PDGFC,ARNT,ROCK1,VEGFA,PIK3R3,ROCK2,BCL2L1,PLCG2,SOS1,PIK3CB,PRKCA
Cholecystokinin/Gastrin-mediated Signaling	0.022387211	0.151705037	MAP2K6,SRC,ITPR2,GNAI2,MEF2A,SRF,EPHA4,ITPR1,ROCK2,ROCK1,PLCB4,MAPK14,JUN,RHOB,SOS1,ITPR3,PLCB1,PRKCE,IL1B,PRKD1,PRKCA
Mouse Embryonic Stem Cell Pluripotency	0.022387211	0.151705037	PIK3C2B,ID2,AKT2,JAK1,BMP4,TCF7,MYC,PIK3R3,SOX2,ID1,MAPK14,SOS1,PIK3CB,FZD5,LEF1,CTNNA1,SMAD1,TCF7L2,ID4,ZFP42
Inhibition of Matrix Metalloproteases	0.022908677	0.152405275	MMP21,MMP20,SDC1,HSPG2,ADAM12,THBS2,MMP2,A2M,MMP17,LRP1,MMP20,SPN,NOX3,CTNNA3,CXCL12,MLLT4,RAPGEF4,ROCK2,CTNNA2,ARRHGAP12,PRKCE,CTNNA1,DLG1,PRKD1,MMP17,PRKCA,PIK3C2B,SRC,GNAI1,PLCG1,MMP2,ITGA3,ITGAL,ROCK1,ARRHGAP5,PIK3R3,WIPF1,MAPK14,ITGAM,CDH5,VAV3,PLCG2,PECAM1,PIK3CB,CTNND1
Leukocyte Extravasation Signaling	0.023988329	0.156675107	AKAP12,DUSP6,LHCGR,RAPGEF4,CAMK2D,PDE7B,MC1R,FSHR,PRKAR1B,CNGB3,ADCY9,ADORA3,SRC,ADCY2,GNAS,OPRM1,PDE10A,GRM8,ADCY3,GNAI1,AKAP6,PDE4B,DRD2,MC4R,CNGA3,PDE8A,GRM7,CALM1 (includes others),AKAP2/PALM2-AKAP2,GLP1R,GNAO1,S1PR1,PDE5A,DUSP4,CNGB1,ADRA2C,ADCY7,AGTR1,PRKAR1A
cAMP-mediated signaling	0.024547089	0.156675107	WNT6,CCND1,PDGFC,MYC,E2F6,RHOB,SOS1,IGF1R,PLCB1,CTNNA1,PLCL1,PDGFRB,SRC,PIK3C2B,AKT2,WNT9B,ITPR2,CDK6,PLCG1,ITPR1,PIK3R3,PLCB4,WNT8A,PLCG2,ITPR3,PIK3CB,FZD5,LEF1
Glioblastoma Multiforme Signaling	0.024547089	0.156675107	MAP2K6,MAP3K5,CAMK2D,JUN,SOS1,PRKAR1B,PRKCE,PLCB1,PRKD1,PRKCA,ADCY9,SRC,ADCY2,GNAS,ITPR2,MAP3K1,ADCY3,GNAI1,ITPR1,PLCB4,MAPK14,ITPR3,PAK7,ADCY7,PRKAR1A
GNRH Signaling	0.02630268	0.164058977	PIK3C2B,AKT2,NCOA6,SLC2A1,TRH,MED1,HIF1A,DIO2,DIO3,NCOA3,PIK3R3,KLF9,NCOA1,PIK3CB,SYT2,NCOR1,NCOR2,THRB
TR/RXR Activation	0.027542287	0.170608239	GRIN2A,ITSN1,GNB5,CXCL12,LIMK2,MAP4K4,EPHA4,PDGFC,ROCK2,VEGFA,NCK2,ACTR3,CFL2,SORBS1,EFNA5,SOS1,SRC,ACTR2,AKT2,GNAS,KALRN,GNAI2,GNAI1,EPHA3,ITGA3,FGF1,EFNA1,ROCK1,WIPF1,GNAO1,PAK7,EPHA2
Ephrin Receptor Signaling	0.028183829	0.170608239	GRIN2A,SLC1A4,GRM8,GLS,GRIA1,SLC17A2,SLC1A3,GRIA2,GRM7,CALM1 (includes others),GRIK4,SLC1A2,DLG4
Glutamate Receptor Signaling	0.028840315	0.170608239	GGTLC1,DPEP1,MGST2,GGT1,GGT7
Leukotriene Biosynthesis	0.028840315	0.170608239	GGTLC1,GCLC,GGT1,A2L1,GGT7
$\gamma$ -glutamyl Cycle	0.028840315	0.170608239	GGTLC1,GCLC,GGT1,A2L1,GGT7
Role of Oct4 in Mammalian Embryonic	0.029512092	0.173780083	SOX2,NR2F1,FOXA1,FOXA2,NR2F2,JARID2,TDRD7,MEF2A,SH3GLB1,HOX



Stem Cell Pluripotency			B1,SALL4
Chemokine Signaling	0.030199517	0.174984669	SRC,MYL2,CXCL12,GNAI1,PLCG1,LIMK2,ROCK2,CALM1 (includes others),PLCB4,CAMK2D,JUN,MAPK14,PLCG2,PLCB1,PRKCA
P2Y Purigenic Receptor Signaling Pathway	0.035481339	0.200909281	ADCY9,PIK3C2B,AKT2,ADCY2,GNAS,ADCY3,GNB5,GNAI1,PLCG1,MYC,PIK3R3,PLCB4,JUN,PLCG2,PRKAR1B,PLCB1,PRKCE,PIK3CB,PLCL1,ADCY7,PRKD1,PRKAR1A,PRKCA
Calcium-induced T Lymphocyte Apoptosis	0.037153523	0.207969669	ITPR2,CD4,HLA-DQA1,PLCG1,ITPR1,CABIN1,CALM1 (includes others),ITPR3,NR4A1,PRKCE,NFATC2,PRKD1,PRKCA
ErbB4 Signaling	0.037153523	0.207969669	PIK3C2B,PLCG1,PIK3R3,NRG3,PLCG2,ERBB4,SOS1,YAP1,PRKCE,PIK3CB,PRKD1,PSEN1,PRKCA
Basal Cell Carcinoma Signaling	0.03801894	0.210862815	BMP4,GLI2,WNT9B,BMP2,WNT6,HHIP,TCF7,PTCH2,WNT8A,LEF1,FZD5,BMP7,BMP6,CTNNB1,TCF7L2
CDP-diacylglycerol Biosynthesis I	0.038904514	0.210862815	AGPAT4,GPAM,LCLAT1,MBOAT2,AGPAT3
Aldosterone Signaling in Epithelial Cells	0.039810717	0.212324446	SGK1,PIKFYVE,DNAJC10,HSP90AB1,SOS1,PRKCE,PLCB1,DNAJB1,PLCL1,SCNN1B,PRKD1,PRKCA,AHCY,PIK3C2B,DNAJB12,ITPR2,DNAJB3,PLCG1,ITPR1,PIK3R3,ODF1,NEDD4,PLCB4,SCNN1G,PLCG2,ITPR3,PIK3CB,DNAJB6
Role of Tissue Factor in Cancer	0.039810717	0.213304491	PIK3C2B,SRC,AKT2,GNA12,ITGA6,LIMK2,ITGA3,FRK,F2,PIK3R3,VEGFA,BCL2L1,MAPK14,CFL2,PLCB1,IL1B,FGF,PIK3CB,RPS6KA2,ITGB5,PRKCA
Non-Small Cell Lung Cancer Signaling	0.042657952	0.223872114	PIK3R3,PIK3C2B,AKT2,FHIT,ITPR2,SOS1,ITPR3,TGFA,CDK6,PLCG1,PIK3CB,ITPR1,CCND1,PRKCA
PEDF Signaling	0.042657952	0.223872114	PIK3C2B,AKT2,GDNF,SFRF,ZEB1,TCF7,PIK3R3,ROCK2,ROCK1,BCL2L1,MAPK14,NFKBIA,SOD2,PIK3CB,CASP8
PPAR Signaling	0.046773514	0.237137371	MED1,MAP4K4,IL1R1,PDGFC,IL1R2,NR2F1,NFKBIA,JUN,HSP90AB1,SOS1,NCOA1,IL1B,NCOR1,NRIP1,NCOR2,CITED2,SCAND1,PDGFRB
Colorectal Cancer Metastasis Signaling	0.046773514	0.237137371	MMP20,JAK1,GNB5,WNT6,CCND1,PDGFC,TCF7,VEGFA,TGFBR2,MYC,JUN,RHOB,SOS1,PRKAR1B,CTNNB1,NOS2,MMP17,ADCY9,PIK3C2B,SRC,LRP5,ADCY2,AKT2,GNAS,WNT9B,ADCY3,MMP2,IFNGR1,PIK3R3,BCL2L1,WNT8A,MSH6,TGFB3,PIK3CB,FZD5,LEF1,ADCY7,LRP1,TCF7L2,PRKAR1A
Thyronamine and Iodothyronamine Metabolism	0.047863009	0.237137371	DIO3,DIO2
D-glucuronate Degradation I	0.047863009	0.237137371	CRYL1,DCXR
Thyroid Hormone Metabolism I (via Deiodination)	0.047863009	0.237137371	DIO3,DIO2
Tryptophan Degradation X (Mammalian, via Tryptamine)	0.050118723	0.239883292	ALDH1A1,ALDH1A3,ALDH3A2,SMOX,ALDH3A1
Phosphatidylglycerol Biosynthesis II (Non-plastidic)	0.050118723	0.239883292	AGPAT4,GPAM,LCLAT1,MBOAT2,AGPAT3

**Supplementary Table 12: All HEPG2 (ENCODE) TCF7L2 Ingenuity Conical pathways with at least nominal  $P < 0.05$**

Ingenuity Canonical Pathways	P-value	B-H Multiple testing correction p-value	Molecules
Wnt/ $\beta$ -catenin Signaling	4.2658E-07	0.000128825	FZD10,TGFBR3,TLE1,KREMEN1,FZD1,CCND1,TCF7,SOX2,TGFBR2,MYC,SOX9,JUN,MAP3K7,TGF2,AKT3,DKK2,PPP2R2C,SOX18,CTNBB1,SOX5,SOX4,SRC,AXIN2,LRP5,GJA1,MDM2,CDH2,WNT8A,SOX6,WNT10A,TLE4,TLE3,TGF3,DKK4,FZD5,DKK1,PPP2R1B,ACVR2A,LRP1,TCF7L2
Factors Promoting Cardiogenesis in Vertebrates	5.12861E-07	0.000128825	FZD10,NODAL,BMP4,BMP2,TGFBR3,FZD1,TCF7,TGFBR2,MAP3K7,TGF2,CTNBB1,PRKD1,PRKCA,SMAD2,LRP5,PRKCQ,TGDF1,BMP5,BMPR1B,MAPK14,TGF3,FZD5,DKK1,TCF7L2,LRP1,ACVR2A
Aryl Hydrocarbon Receptor Signaling	1.86209E-06	0.00030903	ALDH4A1,NF1X,CCND1,NR2F1,MYC,ALDH1A1,JUN,ALDH3A2,TGF2,GSTA1,ALDH3A1,NFE2L2,AHR,GSTA2,SRF,NFIC,MED1,NQO1,CDK6,SLC35A2,MDM2,NCOA3,XXRG,MGST2,NF1A,TGF3,IL1B,ALDH18A1,NR1P1,NCOR2,DCT,GSTO2,ESR1
LPS/IL-1 Mediated Inhibition of RXR Function	5.62341E-06	0.000691831	ABCG8,ALDH4A1,ABCG5,LIPC,NR1H4,HS3ST3A1,ABCA1,IL1R2,HS6ST1,JUN,ALDH1A1,SCARB1,UST,MAP3K7,ALDH3A2,ACSL5,CYP7A1,FABP1,ACSL4,GSTA1,IL1RAP,ALDH3A1,SLCO1B3,GSTA2,ACSL3,MGMT,ACSL6,SLC35A2,IL1R1,SULT1E1,SULT2B1,APOC1,HS3ST3B1,FABP2,MGST2,SREBF1,CAT,IL1B,ALDH18A1,GSTO2,HS3ST5,SULT1B1,ACSL1,MAOA
Ethanol Degradation II	2.45471E-05	0.002454709	ALDH4A1,ACSL3,ACSS3,ALDH1A1,RDH14,DHRS2,ALDH3A2,PECR,ALDH3A1,ACSL1,ADH4,DHRS4
LXR/RXR Activation	4.36516E-05	0.003630781	ABCG8,ABCG5,APOA4,APOB,APOH,NR1H4,APOA2,ARG2,ABCA1,IL1R2,LYZ,CYP7A1,SERPINA1,NOS2,IL1RAP,AGT,AHSG,CD36,IL1R1,APOC1,RXR,KNG1,ALB,SREBF1,IL1B,NCOR2,FGA,HMGR
PPAR $\alpha$ /RXR $\alpha$ Activation	7.76247E-05	0.005495409	APOA2,TGFBR3,KRAS,GNA14,GK,ABCA1,IL1R2,NR2F1,TGFBR2,JUN,MAP3K7,TGF2,PRKAA2,PRKAR1B,PLCB1,GOT2,IL1RAP,ITGB5,PRKCA,SMAD2,GRB2,MD1,CD36,IL1R1,NCOA3,MAPK14,IRS1,PRKACG,TGF3,IL1B,NCOR2,ADIPOR2,ACVR2A,PRKAR1A
FXR/RXR Activation	0.000120226	0.00616595	BAAT,PPARG,ABCG8,ABCG5,SDC1,APOB,LIPC,UGT2B4,CYP27A1,FOXA1,NR1H4,CYP8B1,FOXO1,SCARB1,ABCB4,SREBF1,CYP7A1,AKT3,IL1B,HNF4A,SLCO1B3
Role of Osteoblasts, Osteoclasts and Chondrocytes in Rheumatoid Arthritis	0.000123027	0.00616595	FZD10,BMP4,PTK2B,NFATC3,PIK3R1,BMP2,TAB2,FZD1,TCF7,IL1R2,NFAT5,JUN,RUNX2,MAP3K7,DKK2,AKT3,CTNBB1,BIRC3,IL1RAP,PPP3CA,ITGB1,SRF,LRP5,SPP1,ITGA2,IL1R1,GSN,BMP5,IL17A,BMPR1B,WNT8A,MAPK14,FOXO1,WNT10A,DKK4,NFATC2,IL1B,FZD5,DKK1,LRP1,TCF7L2
Bile Acid Biosynthesis, Neutral Pathway	0.000134896	0.00616595	BAAT,AKR1C1/AKR1C2,AKR1D1,CYP27A1,CYP7A1,AKR1C4,CYP8B1
TR/RXR Activation	0.000141254	0.00616595	AKR1C1/AKR1C2,SLC2A1,MED1,PIK3R1,UCP1,MDM2,HIF1A,DIO2,DIO3,NCOA3,F10,XXRG,KLF9,SCARB1,SREBF1,CYP7A1,AKT3,NCOR2,TBL1XR1,THR3,FGA
Ethanol Degradation IV	0.000147911	0.00616595	ALDH4A1,ACSL3,ACSS3,ALDH1A1,ALDH3A2,CAT,ALDH3A1,ACSL1
Molecular Mechanisms of Cancer	0.000162181	0.00616595	BMP4,PIK3R1,TAB2,KRAS,CCND1,MYC,TGFBR2,E2F6,RHOB,PLCB1,BIRC3,PRKD1,RND2,SMAD2,PRKCQ,CASP3,CDK6,RASGRF2,BCL2L1,BMPR1B,MAX,GAB1,IRS1,ARHGAP16,PRKACG,TGF3,FZD5,GNAL,FZD10,BMP2,HIF1A,FZD1,GNA14,JUN,BBC3,MAP3K7,PRKAR1B,TGF2,AKT3,ARHGAP3,CTNBB1,PRKCA,SRF,LRP5,GRB2,GNA12,SMAD7,GNAL1,MDM2,BMP5,MAPK14,FOXO1,RASGRF1,IHH,LRP1,PRKAR1A,PSEN1
TGF- $\beta$ Signaling	0.000295121	0.010471285	SMAD2,NODAL,BMP4,GRB2,BMP2,SMAD7,KRAS,INHBB,TGIF1,INHBA,TGFBR2,BMPR1B,JUN,MAPK14,MAP3K7,RUNX2,TGF3,TGF2,HNF4A,ACVR2A
Oxidative Ethanol Degradation III	0.000416869	0.013803843	ALDH4A1,ACSL3,ACSS3,ALDH1A1,ALDH3A2,ALDH3A1,ACSL1
Serotonin Degradation	0.000457088	0.014454398	ALDH4A1,UGT2B4,RDH14,DHRS2,UGT2B10,UGT1A1,ALDH1A1,ALDH3A2,PECR,ALDH3A1,SULT1B1,MAOA,DHRS4,ADH4
Xenobiotic Metabolism Signaling	0.000562341	0.016595869	ALDH4A1,LIPC,PIK3R1,KRAS,HS3ST3A1,ANKRA2,HS6ST1,ALDH1A1,UST,CES1,MAP3K7,ALDH3A2,GSTA1,PPP2R2C,NOS2,ALDH3A1,NFE2L2,CITED2,PRKD1,AHR,PRKCA,GSTA2,PRKCQ,UGT2B4,MED1,MGMT,NQO1,UGT2B10,SULT1E1,UGT1A1,SULT2B1,HS3ST3B1,MAPK14,MGST2,CAT,IL1B,MAP3K8,ALDH18A1,NCOR2,NR1P1,GSTO2,PPP2R1B,HS3ST5,SULT1B1,MAOA
Axonal Guidance Signaling	0.00060256	0.016595869	BMP4,GLI2,ITSN1,NFATC3,PIK3R1,KRAS,ROCK2,NCK2,SEMA3D,PLCB1,PRKD1,ITGA4,ACTR2,PAPPA,PRKCQ,ADAMTS9,ADAM18,MYL12A,PRKACG,FZD5,EPH A2,GNAL,NRP1,MMP21,FZD10,SLIT1,BMP2,SEMA6A,EPHA4,FZD1,GNA14,PLXN A2,PDGFC,ABLIM1,ROBO1,NFAT5,ACTR3,GLI3,PLXNA1,PRKAR1B,AKT3,PSMD 14,SEMA3B,ROBO2,GNB1L,SEMA3F,PPP3CA,PRKCA,ITGB1,PLXNC1,NRP2,GRB2,GNA12,C9orf3,ITGA2,GNA11,EPHA3,BMP5,SEMA3A,WNT8A,WNT10A,TUBB6,NFATC2,SEMA3C,PRKAR1A,SEMA7A
Human Embryonic Stem Cell Pluripotency	0.000645654	0.016982437	FZD10,NODAL,BMP4,BMP2,PIK3R1,FZD1,PDGFC,TCF7,SOX2,TGFBR2,TGF2,AKT3,CTNBB1,PDGFRB,SMAD2,SMAD7,TGDF1,BMP5,INHBA,WNT8A,BMPR1B,FOXO1,WNT10A,TGF3,S1PR1,FZD5,TCF7L2
RhoGDI Signaling	0.000933254	0.023442288	PIP5K1B,GNA14,CDH11,ROCK2,ACTR3,RHOB,ARHGAP12,ARHGAP3,GNB1L,CDH16,DLG1,ITGA4,PRKCA,RND2,ITGB1,ACTR2,SRF,GNA12,ITGA2,CDH6,GNAL1,RDX,CDH18,WASF1,ARHGAP5,CDH2,MYL12A,ARHGAP16,ARHGAP35,PIP4K2A,ESR1,GNAL
Stearate Biosynthesis I (Animals)	0.001174898	0.02630268	ACSL3,DHCR24,CYP2E1,ACSL6,ACSL5,GNPAT,ELOVL2,ACSL4,HNF4A,ACSL1
Noradrenaline and Adrenaline Degradation	0.001174898	0.02630268	ALDH4A1,ALDH1A1,RDH14,DHRS2,ALDH3A2,PECR,ALDH3A1,ADH4,DHRS4,MAOA
Role of Tissue Factor in Cancer	0.001513561	0.032359366	ITGB1,SRF,CTGF,PTK2B,CASP3,PIK3R1,GNA12,RPS6KA3,ITGA6,KRAS,GNA14,FRK,FGG,BCL2L1,F10,MAPK14,PLCB1,AKT3,IL1B,FGA,ITGB5,PRKCA
Hepatic Cholestasis	0.00162181	0.032359366	ABCG8,ABCG5,NR1H4,CYP8B1,IL1R2,SLCO1C1,JUN,MAP3K7,CYP7A1,PRKAR1B,HNF4A,IL1RAP,PRKD1,SLCO1B3,PRKCA,PRKCQ,TJP2,CYP27A1,IL1R1,ABCB4,SREBF1,PRKACG,IL1B,ESR1,IRAK2,PRKAR1A
Intrinsic Prothrombin Activation Pathway	0.001659587	0.032359366	KNG1,F10,F8,F5,COL10A1,COL18A1,FGA,FGG,COL3A1
RhoA Signaling	0.001737801	0.033884416	ACTR2,PTK2B,NRP2,SEPT9,RTKN,GNA12,RDX,SEPT4,WASF1,PIP5K1B,PLD1,ARHGAP5,ROCK2,MYLK,MYL12A,ACTR3,PLXNA1,ARHGAP12,ARHGAP35,DLG1,SEMA3F,PIP4K2A,CDC42EP4

PXR/RXR Activation	0.001819701	0.033884416	GSTA2,ALDH1A1,FOXO1,ALDH3A2,PRKACG,PRKAR1B,CYP7A1,AKT3,GSTA1,I GFBP1,HNF4A,NR3C1,UGT1A1,SLCO1B3,PRKAR1A
Coagulation System	0.002511886	0.043651583	KNG1,F10,F8,SERPINA5,F5,SERPINA1,TFPI,FGA,A2M,FGG
VDR/RXR Activation	0.002630268	0.044668359	LRP5,CYP24A1,SPP1,PRKCCQ,MED1,NCOA3,RXRG,FOXO1,RUNX2,TGFB2,CEB PA,IGFBP1,SEMA3B,NCOR2,PRKD1,HSD17B2,PRKCA
Caveolar-mediated Endocytosis Signaling	0.002818383	0.046773514	ITGB1,FLNB,COP21,SRC,ITSN1,ITGA2,ITGA6,ALB,CD55,ITGA9,PTPN1,ITGB4,IT GA7,ITGB5,PRKCA,ITGA4
Putrescine Degradation III	0.004168694	0.064565423	ALDH4A1,ALDH1A1,ALDH3A2,SAT1,ALDH3A1,MAOA
Role of Macrophages, Fibroblasts and Endothelial Cells in Rheumatoid Arthritis	0.004265795	0.064565423	IL6ST,FZD10,FN1,NFATC3,PIK3R1,KRAS,FZD1,CCND1,PDGFC,TCF7,ROCK2,M YC,IL1R2,NFAT5,JUN,MAP3K7,CEBPA,DKK2,AKT3,PLCB1,CTNNB1,NOS2,IL1RA P,PPP3CA,PRKD1,PRKCA,TRAF1,SRC,SELE,LRP5,PRKCCQ,DAAM1,IL1R1,IL17A, WNT8A,MAPK14,WNT10A,DKK4,NFATC2,IL1B,FZD5,DKK1,LRP1,TCF7L2,IRAK2
Arginine Degradation I (Arginase Pathway)	0.004265795	0.064565423	ALDH4A1,OAT,ARG2
Acute Phase Response Signaling	0.004570882	0.064565423	IL6ST,FN1,APOH,PIK3R1,APOA2,SOC56,KRAS,CP,SERPINA3,NR3C1,FGG,MBL 2,JUN,F8,ITIH2,MAP3K7,AKT3,SERPINA1,IL1RAP,AGT,GRB2,AHSG,IL1R1,ALB, MAPK14,IL1B,FGA,A2M,SOC55
Actin Nucleation by ARP-WASP Complex	0.004570882	0.064565423	NCK2,ROCK2,ITGB1,RND2,ACTR2,ACTR3,RHOB,GRB2,GNA12,ITGA2,WASF1,K RAS,ITGA4
HER-2 Signaling in Breast Cancer	0.004897788	0.067608298	ITGB1,PRKCCQ,GRB2,PIK3R1,CDK6,MDM2,KRAS,CCND1,AREG/AREGB,FOXO1, AKT3,ITGB4,PARD3,ITGB5,PRKD1,PRKCA
Histamine Degradation	0.005370318	0.072443596	ALDH4A1,HNMT,ALDH1A1,ALDH3A2,ALDH3A1
Inhibition of Angiogenesis by TSP1	0.005623413	0.074131024	TGFBR2,JUN,MAPK14,SDC1,HSPG2,CASP3,THBS1,CD36,AKT3
Netrin Signaling	0.005888437	0.074131024	NCK2,ENAH,NFAT5,NFATC3,PRKACG,PRKAR1B,NFATC2,ABLIM1,PPP3CA,PRK AR1A
$\gamma$ -linolenate Biosynthesis II (Animals)	0.005888437	0.074131024	ACSL3,ACSL6,ACSL5,ACSL4,CYB5A,ACSL1
Type II Diabetes Mellitus Signaling	0.006606934	0.081283052	PPARG,ACSL3,PRKCCQ,PIK3R1,ACSL6,SOC56,CD36,MAP3K7,SLC2A2,IRS1,AC SL5,PRKAA2,AKT3,ACSL4,IRS2,ADIPOR2,SOC55,SMPD3,ACSL1,PRKD1,PRKC A
BMP signaling pathway	0.007079458	0.083176377	BMP4,FST,GRB2,BMP2,SMAD7,KRAS,BMP5,BMPR1B,JUN,MAPK14,MAP3K7,R UNX2,PRKACG,PRKAR1B,PRKAR1A
Neuregulin Signaling	0.007413102	0.085113804	ITGB1,SRC,PRKCCQ,GRB2,PIK3R1,ITGA2,KRAS,TMEFF2,AREG/AREGB,MYC,ER BB4,GRB7,AKT3,PRKD1,PSEN1,PRKCA,ITGA4
Fatty Acid Activation	0.007943282	0.087096359	ACSL3,ACSL6,ACSL5,ACSL4,ACSL1
Epithelial Adherens Junction Signaling	0.007943282	0.087096359	MYH10,TGFBF3,PVRL3,MLLT4,KRAS,TCF7,CLIP1,TGFBF2,ACTR3,SORBS1,TG FB2,AKT3,CTNNB1,SRC,ACTR2,LMO7,WASF1,PTPRM,CDH2,TUBB6,MYH9,PAR D3,MAGI2,TCF7L2,ACVR2A
Valine Degradation I	0.008128305	0.087096359	HIBCH,BCAT1,ABAT,AUH,ACADSB,BCKDHB
Hepatic Fibrosis / Hepatic Stellate Cell Activation	0.008317638	0.087096359	SMAD2,MYH10,CTGF,FN1,IFNGR2,SMAD7,BAMBI,IFNGR1,IL1R1,PDGFC,TGFB R2,IL1R2,EDN1,CYP2E1,TGFB3,TGFB2,MYH9,IL1B,A2M,IL1RAP,AGTR1,COL3A 1,AGT,PDGFRB
Signaling by Rho Family GTPases	0.008317638	0.087096359	SEPT9,PTK2B,NOX3,PIK3R1,GNA14,PIP5K1B,CLIP1,CDH11,ROCK2,MYLK,JUN, ACTR3,RHOB,ARHGEF3,CDH16,GNB1L,ITGA4,ITGB1,RND2,ACTR2,GNA12,ITG A2,GNA11,CDH6,RDX,SEPT4,CDH18,WASF1,PLD1,CDH2,MYL12A,ARHGEF16,P ARD3,PIP4K2A,GNAL,CDC42EP4
Protein Kinase A Signaling	0.009120108	0.09332543	MYH10,NFATC3,PDE3A,TCF7,TGFBF2,ROCK2,MYLK,TH,PHKB,CDKN3,PLCB1, PDE1A,PRKD1,H1F0,PTPRG,PRKCCQ,ITPR2,PTPRM,PTP4A1,EPM2A,MYL12A,I TPR3,PRKACG,TGFB3,AKAP12,FLNB,PTK2B,PPP1R3C,DUSP6,PTPN14,NFAT5, GLI3,DUSP10,PTPN1,PRKAR1B,TGFB2,CTNNB1,GNB1L,PPP3CA,PRKCA,ATF1, GNA11,AKAP6,PDE4D,ADD3,CDC14B,NFATC2,PDE5A,IHH,CNGB1,TCF7L2,PRK AR1A,DUSP16
Mouse Embryonic Stem Cell Pluripotency	0.009332543	0.09332543	IL6ST,FZD10,ID2,BMP4,GRB2,PIK3R1,KRAS,FZD1,TCF7,MYC,SOX2,ID1,MAPK1 4,MAP3K7,AKT3,FZD5,CTNNB1,TCF7L2
Heparan Sulfate Biosynthesis (Late Stages)	0.009549926	0.09332543	HS3ST3B1,AADAC,HS6ST1,UST,EXT1,EXTL3,SULT1E1,HS3ST5,HS3ST3A1,SUL T1B1,SULT2B1
Acetate Conversion to Acetyl-CoA	0.009772372	0.09332543	ACSL3,ACSS3,ACSL1
RAR Activation	0.01	0.09332543	TRIM24,BMP2,PIK3R1,NR2F1,ALDH1A1,JUN,PRKAR1B,TGFB2,AKT3,SORBS3,N T5C1B,PRKD1,CITED2,PRKCA,SMAD2,SRC,PRKCCQ,RDH14,MED1,SMAD7,RXR G,MAPK14,PRKACG,TGFB3,NR1P1,NCOR2,PRKAR1A,ADH4
Colorectal Cancer Metastasis Signaling	0.010964782	0.097723722	IL6ST,FZD10,MMP20,PIK3R1,KRAS,FZD1,CCND1,PDGFC,TCF7,TGFBF2,MYC,J UN,RHOB,TGFB2,PRKAR1B,AKT3,CTNNB1,NOS2,GNB1L,PTGER4,RND2,SMAD 2,SRC,LRP5,CASP3,GRB2,IFNGR1,BCL2L1,WNT8A,WNT10A,PRKACG,TGFB3,F ZD5,LRP1,TCF7L2,PRKAR1A
UDP-D-xylose and UDP-D- glucuronate Biosynthesis Superpathway of Citrulline Metabolism	0.011220185	0.097723722	UXS1,UGDH
Phenylalanine Degradation IV (Mammalian, via Side Chain)	0.011220185	0.097723722	OAT,ARG2,ALDH18A1,NOS2,CPS1
Amyotrophic Lateral Sclerosis Signaling	0.011481536	0.1	HPD,ALDH3A2,GOT1,GOT2,MAOA
ILK Signaling	0.013803843	0.115877736	GRIN2B,GRIN2A,CACNA1D,CASP3,PIK3R1,PDGFC,BCL2L1,GRID1,GRIK4,CAT, SLC1A2,AKT3,GLUL,CAPN2,CAPN7,BIRC3,RNF19A,PPP3CA
Maturity Onset Diabetes of Young (MODY) Signaling	0.014125375	0.116949939	MYH10,FLNB,FN1,BMP2,PIK3R1,HIF1A,CCND1,PDGFC,NCK2,MYC,JUN,RHOB, PPAP2B,AKT3,PPP2R2C,IRS2,ITGB4,CTNNB1,NOS2,ITGB5,DSP,ITGB1,RND2,C ASP3,FERMT2,LIMS1,IRS1,MYH9,PPP2R1B
Glioblastoma Multiforme Signaling	0.016218101	0.132739446	FABP2,CACNA1D,ALDOB,SLC2A2,FABP1,HNF4A
Cholecystokinin/Gastrin-mediated Signaling	0.017378008	0.138356638	RND2,SRC,PRKCCQ,PTK2B,GRB2,ITPR2,GNA12,KRAS,EPHA4,ROCK2,JUN,MAP K14,RHOB,ITPR3,PLCB1,IL1B,PRKD1,PRKCA
Dopamine Degradation	0.018197009	0.142232879	ALDH4A1,ALDH1A1,ALDH3A2,ALDH3A1,SULT1B1,MAOA
Prolactin Signaling	0.018620871	0.143548943	PRKCCQ,GRB2,PIK3R1,SOC56,KRAS,NR3C1,TCF7,MYC,JUN,IRS1,PRLR,SOC55 ,PRKD1,PRKCA
nNOS Signaling in Neurons	0.019054607	0.146217717	GRIN2B,GRIN2A,PRKCCQ,CAPN2,CAPN7,NOS1AP,RASD1,PPP3CA,PRKD1,PRK CA
G Beta Gamma Signaling	0.019952623	0.151008015	SRC,PRKCCQ,GRB2,GNA12,GNA11,KCNJ3,KRAS,GNA14,PRKACG,PRKAR1B,AK T3,GNB1L,GNAL,PRKD1,PRKAR1A,PRKCA

Extrinsic Prothrombin Activation Pathway	0.020417379	0.151008015	F10,F5,TFPI,FGA,FGG
Tryptophan Degradation X (Mammalian, via Tryptamine)	0.020417379	0.151008015	ALDH4A1,ALDH1A1,ALDH3A2,ALDH3A1,MAOA
Methylglyoxal Degradation III	0.021877616	0.15703628	AKR1C1/AKR1C2,CYP2E1,AKR1C4,ADH4
Virus Entry via Endocytic Pathways	0.021877616	0.15703628	ITGB1, SRC, FLNB, PRKCC, ITSN1, PIK3R1, ITGA2, ITGA6, KRAS, CD55, ITGB4, CXAD R, ITGB5, PRKD1, PRKCA, ITGA4
Polyamine Regulation in Colon Cancer	0.022908677	0.158489319	PPARG, MYC, MAX, SAT1, KRAS, CTNNB1
IGF-1 Signaling	0.023442288	0.162929603	CTGF, GRB2, PIK3R1, SOCS6, KRAS, NEDD4, NOV, JUN, FOXO1, IRS1, PRKACG, PR KAR1B, AKT3, IRS2, IGF1R, SOCS5, PRKAR1A
PPAR Signaling	0.024547089	0.165958691	PPARG, GRB2, MED1, KRAS, IL1R1, PDGFC, IL1R2, NR2F1, JUN, MAP3K7, IL1B, NRIP 1, NCOR2, IL1RAP, CITED2, PDGFRB
Sertoli Cell-Sertoli Cell Junction Signaling	0.025118864	0.167109061	SPTBN1, TGFB3, PVRL3, MLLT4, KRAS, JUN, SORBS1, MAP3K7, PPAP2B, PRKAR1 B, AKT3, MTMR2, CTNNB1, NOS2, ITGA4, ITGB1, SRC, TJP2, ITGA2, MAPK14, TUBB6, PRKACG, TGFB3, MAP3K8, MAGI2, A2M, PRKAR1A
Heparan Sulfate Biosynthesis	0.025703958	0.169824365	HS3ST3B1, AADAC, HS6ST1, UST, EXT1, EXTL3, SULT1E1, HS3ST5, HS3ST3A1, SULT 1B1, SULT2B1
Regulation of Cellular Mechanics by Calpain Protease	0.025703958	0.169824365	ITGB1, SRC, GRB2, ITGA2, CDK6, CNGB1, KRAS, CAPN2, CAPN7, CCND1, ITGA4
Mitochondrial L-carnitine Shuttle Pathway	0.026915348	0.170215851	ACSL3, ACSL6, ACSL5, ACSL4, ACSL1
PI3K/AKT Signaling	0.026915348	0.170215851	ITGB1, GRB2, PIK3R1, ITGA2, GDF15, KRAS, MDM2, CCND1, INPP5D, SYNJ2, BCL2L 1, FOXO1, GAB1, LIMS1, AKT3, PPP2R2C, MAP3K8, CTNNB1, PPP2R1B, ITGA4
Retinoate Biosynthesis I	0.027542287	0.170215851	ALDH1A1, RDH14, BMP2, NT5C1B, AKR1C4, ADH4, DHRS4
Fatty Acid $\beta$ -oxidation I	0.027542287	0.170215851	ACSL3, AUH, ACSL6, ACSL5, ACSL4, HSD17B4, ACSL1
Basal Cell Carcinoma Signaling	0.028840315	0.177827941	FZD10, BMP4, GLI2, BMP2, FZD1, BMP5, TCF7, WNT8A, GLI3, WNT10A, FZD5, CTNNB 1, TCF7L2
Thyronamine and Iodothyronamine Metabolism	0.030902954	0.177827941	DIO3, DIO2
Ascorbate Recycling (Cytosolic)	0.030902954	0.177827941	GSTO2, GLRX
Thyroid Hormone Metabolism I (via Deiodination)	0.030902954	0.177827941	DIO3, DIO2
Glutamate Degradation II	0.030902954	0.177827941	GOT1, GOT2
Aspartate Biosynthesis	0.030902954	0.177827941	GOT1, GOT2
Germ Cell-Sertoli Cell Junction Signaling	0.031622777	0.179887092	RND2, ITGB1, SRC, PIK3R1, PVRL3, ITGA2, ITGA6, MLLT4, KRAS, GSN, TGFB2, CDH 2, MAPK14, TUBB6, RHOB, MAP3K7, SORBS1, PPAP2B, TGFB3, TGFB2, MAP3K8, MT MR2, CTNNB1, A2M
IL-12 Signaling and Production in Macrophages	0.032359366	0.18238957	PPARG, APOA4, APOB, PRKCC, PIK3R1, APOA2, IFNGR1, APOC1, ALB, LYZ, MAPK1 4, JUN, TGFB3, TGFB2, AKT3, SERPINA1, MAP3K8, REL, NOS2, PRKD1, PRKCA
Cardiomyocyte Differentiation via BMP Receptors	0.033884416	0.188364909	BMPR1B, BMP4, MAP3K7, BMP2, BMP5
Thyroid Hormone Metabolism II (via Conjugation and/or Degradation)	0.033884416	0.188364909	UGT2B4, UGT2B10, UGT1A1, DIO3, DIO2, SULT1B1
Role of NANOG in Mammalian Embryonic Stem Cell Pluripotency	0.034673685	0.190107828	IL6ST, FZD10, BMP4, GRB2, BMP2, PIK3R1, KRAS, FZD1, BMP5, SOX2, WNT8A, BMP R1B, WNT10A, GAB1, GATA6, AKT3, FZD5, CTNNB1
PTEN Signaling	0.038904514	0.208929613	ITGB1, CASP3, GRB2, TGFB3, PIK3R1, ITGA2, KRAS, FOXG1, CCND1, INPP5D, TGF BR2, SYNJ2, BCL2L1, BMPR1B, FOXO1, AKT3, MAGI2, ITGA4, PDGFRB
NF- $\kappa$ B Activation by Viruses	0.038904514	0.208929613	ITGB1, PRKCC, CD4, PIK3R1, ITGA2, ITGA6, KRAS, AKT3, EIF2AK2, ITGB5, PRKD1, P RKCA, ITGA4
Rac Signaling	0.039810717	0.208929613	ITGB1, ACTR2, PTK2B, NOX3, PIK3R1, ITGA2, WASF1, KRAS, PIP5K1B, PLD1, MCF2L ,JUN, ACTR3, PARD3, PIP4K2A, NCKAP1, ITGA4
Fatty Acid $\alpha$ -oxidation	0.039810717	0.208929613	ALDH4A1, ALDH1A1, ALDH3A2, ALDH3A1
Clathrin-mediated Endocytosis Signaling	0.040738028	0.212813905	SH3BP4, APOA4, APOB, RAB4A, PIK3R1, APOA2, SH3GLB1, PDGFC, LYZ, FGF10, AC TR3, SNX9, FGF12, DAB2, SERPINA1, ITGB4, ITGB5, PPP3CA, ITGB1, FGF16, SRC, A CTR2, GRB2, MDM2, FGF6, APOC1, ALB
Citrulline Biosynthesis	0.043651583	0.221309471	OAT, ARG2, ALDH18A1

**Supplementary Table 13:** Enrichment of GWAS signals for a randomly generated list of 5,000 genes from the 19,015 RefSeq genes used by HOMER

	Random: 5,000 Genes		
	% tot hg19 gene list	% Chip-Seq gene list	P-values: Chi Square
<b>Endocrine</b>	26.3% (5,000/19,015)	23.7% (210.76/888)	0.20
<b>T2D</b>	26.3% (5,000/19,015)	20.1% (16.5/82)	0.37
<b>Cancer</b>	26.3% (5,000/19,015)	24.3% (81.43/335)	0.50
<b>Cardiovascular</b>	26.3% (5,000/19,015)	23.8% (110.31/463)	0.34
<b>Inflammation</b>	26.3% (5,000/19,015)	23.0% (119.82/521)	0.20
<b>Neuropsychiatric</b>	26.3% (5,000/19,015)	23.2% (135.3/584)	0.18
<b>All</b>	26.3% (5,000/19,015)	21.0% (758.81/3607)	2.07x10 <sup>-7</sup>