

Supplementary data:

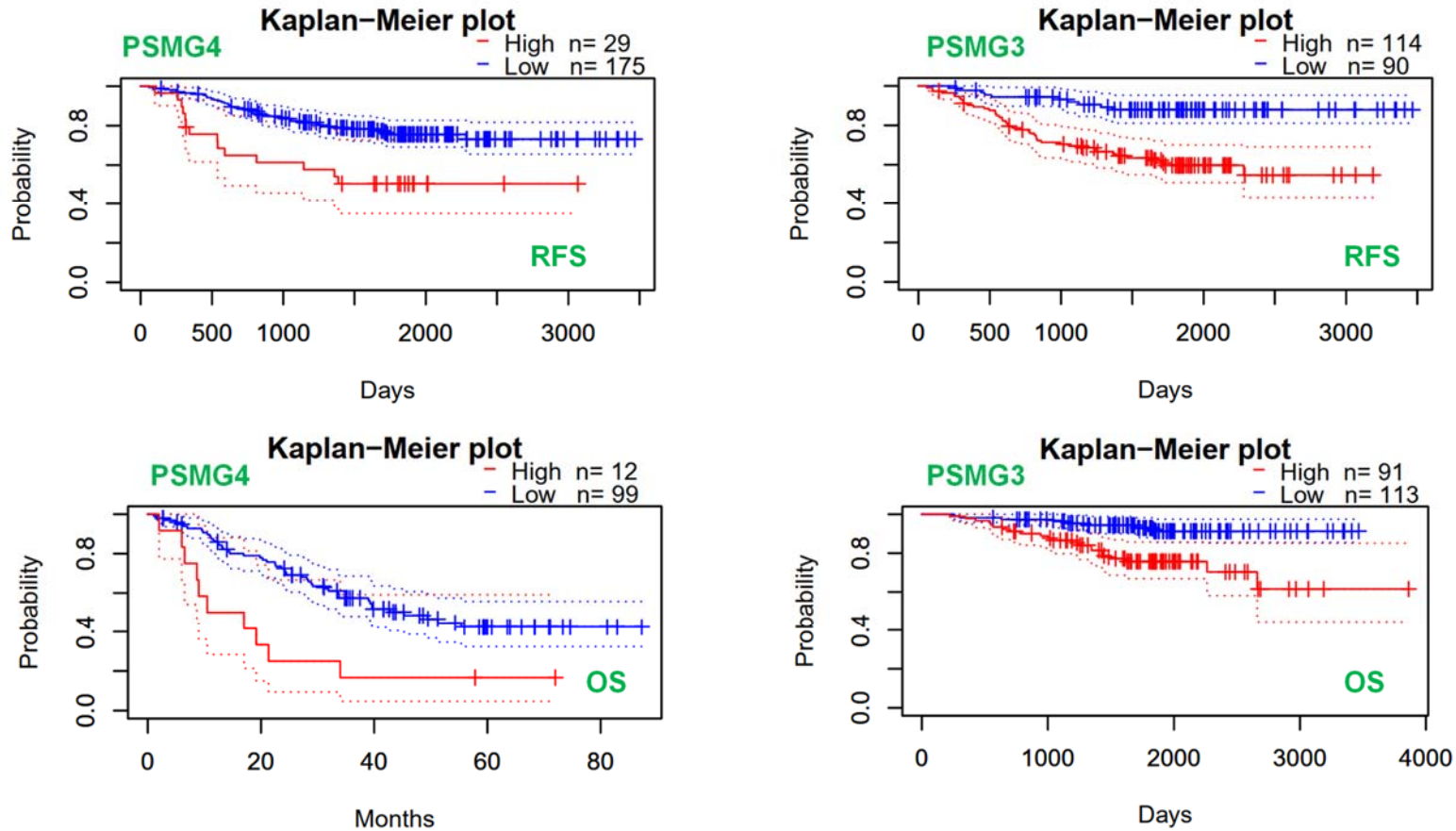


Figure S1: Predicted survival analyses according to expression level of PSMG3 and PSMG4 in LUAD patient via prognoscan database.

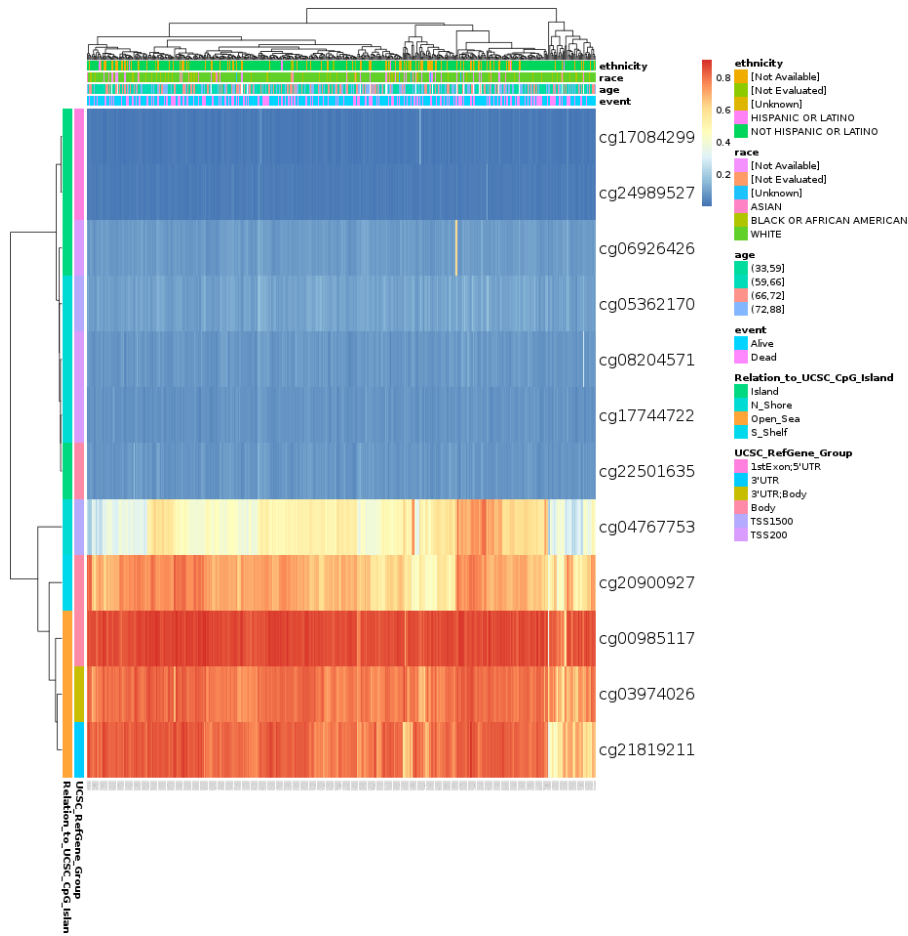


Figure S2: Heatmap of DNA methylation expression levels of the PSMG4 in lung cancer by MethSurv platform.

**Table S1: Pathway analysis of genes co-expressed with PSMG1 from public LUAD databases using the MetaCore database (with  $p < 0.01$  set as the cutoff value)**

#	Maps	pValue	Network Objects from Active Data
1	Cell cycle_Role of APC in cell cycle regulation	2.16E-21	Nek2A, BUB1, MAD2b, BUB3, Tome-1, Geminin, Emi1, Cyclin A, Aurora-A, TCP1, Aurora-B, Kid, CDC20, Cyclin B, MAD2a, Securin, CDK1 (p34), CKS1
2	Cell cycle_The metaphase checkpoint	1.52E-18	Nek2A, BUB1, MAD2b, SPBC25, CENP-A, BUB3, DSN1, Aurora-A, Aurora-B, HP1 gamma, HEC, CDCA1, CDC20, HZwint-1, MAD2a, Survivin, CENP-H
3	Ubiquinone metabolism	2.03E-18	NDUFS5, NDUFAB1, NDUFA1, NDUFB9, NDUFB4, NDUFA8, NDUFA9, NDUFB6, NDUFB3, COQ3, NDUFB2, NDUFS8, NDUFB1, NDUFS6, coenzyme Q2 homolog, prenyltransferase (yeast), NDUFV1, NDUFS3, NDUFB10, NDUFC2, NDUFC1, DAP13, NDUFV3
4	Cell cycle_Spindle assembly and chromosome separation	1.14E-14	Nek2A, CSE1L, RCC1, Aurora-A, Aurora-B, HEC, Kid, CDC20, Tubulin alpha, Cyclin B, MAD2a, Securin, Ran, CDK1 (p34)
5	Cell cycle_Role of Nek in cell cycle regulation	5.54E-12	Nek2A, Tubulin gamma, Cyclin B1, RCC1, Aurora-A, HEC, Tubulin alpha, MAD2a, Ran, Histone H3, Histone H1, CDK1 (p34)
6	DNA damage_ATM/ATR regulation of G2/M checkpoint: cytoplasmic signaling	1.85E-10	CDC25C, UBE2C, Cyclin B1, JAB1, Chk2, Chk1, Aurora-A, PP1-cat, Aurora-B, PP2A catalytic, Histone H3, CDK1 (p34), 14-3-3
7	Cell cycle_Chromosome condensation in prometaphase	6.46E-10	CAP-G, Cyclin A, CAP-G/G2, Aurora-A, Aurora-B, Cyclin B, Histone H3, Histone H1, CDK1 (p34)
8	Abnormalities in cell cycle in SCLC	8.98E-10	CDK4, PCNA, Cyclin B1, Cyclin A, Cyclin E, Aurora-B, Histone H3, CDK1 (p34), Cyclin E2, CKS1
9	Cell cycle_Start of DNA replication in early S phase	2.71E-09	RPA3, Geminin, Cyclin E, ORC6L, ORC5L, ASK (Dbf4), PP2A catalytic, CDC7, Histone H1, CDC45L
10	GTP-XTP metabolism	3.57E-08	POLR2J, NDPK A, POLR2I, RRP41, RPB6, RRP46, HPRT, RPB7.0, POLR3K, POLR3F, RPB8, POLR2G, RPA16, RPA39
11	ATP/ITP metabolism	5.12E-08	POLR2J, NDPK A, POLR2I, RRP41, RPB6, RRP46, HPRT, RPB7.0, POLR3K, APRT, ADSL, POLR3F, RPB8, POLR2G, RPA16, RPA39
12	DNA damage_ATM/ATR regulation of G2/M checkpoint: nuclear signaling	1.01E-07	CDC25C, Cyclin B1, Histone H2AX, Chk2, Cyclin A, Chk1, Cyclin B, Cyclin B2, TTK, CDK1 (p34)
13	DNA damage_Double-strand break repair via homologous recombination	1.18E-07	MAD2b, DSS1, Histone H2AX, PPP4C, Rad51, RAD54B, SWI5, PIR51, Histone H2A, E2N(UBC13), AUNIP, RAD51C, CDK1 (p34)
14	Role of XBP1 protein in multiple myeloma	2.93E-07	SERP1, PSMA5, DNAJB11, PSMA6, PSMA7, Proteasome (20S core), ERP5
15	CTP/UTP metabolism	3.3E-07	POLR2J, CTP synthase, NDPK A, POLR2I, RRP41, RPB6, RRP46, RPB7.0, POLR3K, POLR3F, RPB8, POLR2G, RPA16, RPA39

16	Cell cycle_Cell cycle (generic schema)	4.3E-07	CDC25C, CDK4, Cyclin A, Cyclin E, Cyclin B, E2F6, CDK1 (p34)
17	Immune response_Antigen presentation by MHC class I, classical pathway	6.23E-07	PSMB1, PSMB5, PSME2, BCAP31, TCP1, PA28 (11S regulator), Impas 1, PSMB2, PSME1, Proteasome (20S core)
18	Cell cycle_Sister chromatid cohesion	8.69E-07	PCNA, Cyclin B, DCC1, Securin, Histone H3, Histone H1, CDK1 (p34)
19	Putative pathways of activation of monoclonal protein secretion in multiple myeloma	1.63E-06	SSR-delta, SERP1, DAD-1, DNAJB11, Cyclophilin B, ARMET, ERP5
20	DNA damage_Intra S-phase checkpoint	2.23E-06	PCNA, Histone H2AX, Chk2, Cyclin A, Chk1, PP1-cat, PP1-cat alpha, ASK (Dbf4), CDC7, Histone H3, CDC45L
21	Cell cycle_Role of SCF complex in cell cycle regulation	4.87E-06	CDK4, Emi1, Cyclin E, Chk1, NEDD8, CDK1 (p34), CKS1
22	DNA damage_ATM/ATR regulation of G1/S checkpoint	9.78E-06	CDK4, PCNA, Histone H2AX, Chk2, Cyclin A, Cyclin E, Chk1, PP2A catalytic
23	Cell cycle_Nucleocytoplasmic transport of CDK/Cyclins	1.43E-05	CDK4, Cyclin B1, Cyclin A, Cyclin E, CDK1 (p34)
24	CREB1-dependent transcription deregulation in Huntington's Disease	3.14E-05	Cytochrome c, COX VIIc, TFAM, NDUFS3, COX VIa-1, SOD1
25	Cell cycle_Initiation of mitosis	3.14E-05	CDC25C, Cyclin B1, Cyclin B2, Histone H3, Histone H1, CDK1 (p34)

**Table S2: Pathway analysis of genes co-expressed with PSMG2 from public LUAD databases using the MetaCore database (with  $p < 0.01$  set as the cutoff value)**

#	Maps	pValue	Network Objects from Active Data
1	GTP-XTP metabolism	1.72E-09	RRP4, PM/SCL-75, NDPK A, NDPK complex, RRP43, RPB7.0, RRP40, NDPK B, RPB8, CSL4, POLR2G, PNPB, RPA16, RPA39
2	ATP/ITP metabolism	1.40E-08	RRP4, PM/SCL-75, NDPK A, NDPK complex, RRP43, RPB7.0, RRP40, ADSL, NDPK B, RPB8, CSL4, POLR2G, PNPB, RPA16, RPA39
3	Ubiquinone metabolism	1.58E-08	NDUFAB1, NDUFA1, NDUFB4, NDUFA8, NDUFA9, NDUFB6, NDUFB3, NDUFB5, NDUFV2, NDUFA5, NDUFS3, DAP13
4	Cell cycle_Role of APC in cell cycle regulation	1.22E-07	BUB3, Geminin, Cyclin A, Cyclin B, MAD2a, Securin, CDK1 (p34), CKS1
5	CTP/UTP metabolism	1.38E-07	RRP4, PM/SCL-75, NDPK A, NDPK complex, RRP43, RPB7.0, RRP40, NDPK B, RPB8, CSL4, POLR2G, RPA16, RPA39

6	Cell cycle_Spindle assembly and chromosome separation	1.59E-07	Ubiquitin, HEC, Tubulin alpha, Cyclin B, MAD2a, Securin, Ran, CDK1 (p34)
7	DNA damage_ATM/ATR regulation of G2/M checkpoint: nuclear signaling	2.02E-06	CDC25C, RBBP8 (CtIP), Cyclin B1, Ku70, Cyclin A, Cyclin B, Cyclin B2, CDK1 (p34)
8	Cell cycle_The metaphase checkpoint	4.78E-06	BUB3, HP1 gamma, HEC, CDCA1, MAD2a, Survivin, CENP-H
9	Apoptosis and survival_Granzyme A signaling	1.19E-05	NDPK A, HSP70, HMGB2, hnRNP C, Ku70, APEX, NDUFS3
10	LRRK2 in neuronal apoptosis in Parkinson's disease	1.32E-05	Cytochrome c, PRDX3, Thioredoxin, ANT, Caspase-3
11	Cell cycle_Role of Nek in cell cycle regulation	2.91E-05	Cyclin B1, HEC, Tubulin alpha, MAD2a, Ran, CDK1 (p34)
12	DNA damage_Double-strand break repair via homologous recombination	3.38E-05	NARF, RBBP8 (CtIP), DSS1, Rad51, SWI5, Histone H2A, E2N(UBC13), SFR1, CDK1 (p34)
13	DNA damage_ATM/ATR regulation of G2/M checkpoint: cytoplasmic signaling	5.18E-05	CDC25C, MLCP (cat), Cyclin B1, PP1-cat, PP2A catalytic, CDK1 (p34), IPP-2
14	Proteolysis_Putative ubiquitin pathway	6.55E-05	Ubiquitin, HSP70, UBCH6, E2N(UBC13), UBCH7
15	Cell cycle_Sister chromatid cohesion	6.55E-05	PCNA, Cyclin B, RFC3, Securin, CDK1 (p34)
16	IL-6 signaling in colorectal cancer	6.89E-05	Cyclin B1, HSP70, Ku70, Cyclin B, Survivin, CDK1 (p34)
17	Immune response_Antigen presentation by MHC class I, classical pathway	7.54E-05	PSMB1, PSMB5, PSME2, HSP70, PA28 (11S regulator), PSME1, PSMB8(LMP7)
18	Transcription_Role of heterochromatin protein 1 (HP1) family in transcriptional silencing	1.08E-04	SUMO-1, Cyclin A2, HP1 gamma, MBD2, HP1, CDK1 (p34)
19	Cell cycle_Initiation of mitosis	1.22E-04	CDC25C, Cyclin B1, Cyclin B2, CDK1 (p34), CDK7
20	Translation_(L)-selenoaminoacids incorporation in proteins during translation	1.25E-04	SEP15, Selenoprotein K, RPL30, SelT, SEPHS1, SELS
21	Inhibition of remyelination in multiple sclerosis: regulation of cytoskeleton proteins	1.87E-04	MLCP (cat), CDK5, Tubulin alpha, MRLC, Stathmin, Cofilin

22	Abnormalities in cell cycle in SCLC	2.10E-04	PCNA, Cyclin B1, Cyclin A, CDK1 (p34), CKS1
23	dGTP metabolism	2.25E-04	NDPK A, POLE3 (YBL1), NDPK complex, DGUOK, NDPK B, PNPB, POLE4
24	Immune response_BAFF-induced non-canonical NF-kB signaling	2.48E-04	Ubiquitin, SUMO-1, UBE1C, E2N(UBC13), NEDD8
25	dATP/dITP metabolism	4.62E-04	NDPK A, POLE3 (YBL1), NDPK complex, DGUOK, ADSL, NDPK B, PNPB, POLE4

**Table S3: Pathway analysis of genes co-expressed with PSMG3 from public LUAD databases using the MetaCore database (with  $p < 0.01$  set as the cutoff value)**

#	Maps	pValue	Network Objects from Active Data
1	Cell cycle_Role of Nek in cell cycle regulation	8.06E-13	Tubulin beta, Tubulin gamma, Cyclin B1, RCC1, MAD1 (mitotic checkpoint), Tubulin alpha, MAD2a, Ran, Histone H1, Histone H3, CDK1 (p34), Tubulin (in microtubules)
2	Cell cycle_Spindle assembly and chromosome separation	1.24E-12	RCC1, MAD1 (mitotic checkpoint), Aurora-B, Kid, CDC20, Tubulin alpha, Cyclin B, MAD2a, Securin, Ran, CDK1 (p34), Tubulin (in microtubules)
3	Cell cycle_Role of APC in cell cycle regulation	2.27E-11	MAD2b, Tome-1, Geminin, Aurora-B, Kid, CDC20, Cyclin B, MAD2a, Securin, CDK1 (p34), CKS1
4	Cell cycle_The metaphase checkpoint	9.8E-11	MAD2b, SPBC25, CENP-A, MAD1 (mitotic checkpoint), Aurora-B, HP1 gamma, CDCA1, CDC20, MAD2a, Survivin, CENP-H
5	Cell cycle_Sister chromatid cohesion	1.19E-08	PCNA, CHTF18, Cyclin B, DCC1, Securin, Histone H1, Histone H3, CDK1 (p34)
6	Abnormalities in cell cycle in SCLC	9.33E-08	CDK4, PCNA, Cyclin B1, Cyclin E, Aurora-B, Histone H3, CDK1 (p34), CKS1
7	DNA damage_Double-strand break repair via homologous recombination	1.54E-07	MAD2b, RecQL4, WDR79, DSS1, Histone H2AX, PPP4C, Rad51, SWI5, Histone H2A, AUNIP, Histone H4, CDK1 (p34)
8	Cell cycle_Start of DNA replication in early S phase	2.16E-07	RPA3, Geminin, Cyclin E, ORC6L, ORC5L, ASK (Dbf4), Histone H1, CDC45L
9	DNA damage_ATM activation by DNA damage	2.19E-07	HSP90, OBFC2B, RecQL4, HMG14, Histone H2AX, PP2A regulatory, CDK5, Suv39H1, Histone H4, BRAT1, Histone H3
10	Cell cycle_Initiation of mitosis	7.34E-07	CDC25C, Cyclin B1, Cyclin B2, Kinase MYT1, Histone H1, Histone H3, CDK1 (p34)
11	DNA damage_ATM/ATR regulation of G2/M checkpoint: cytoplasmic signaling	9.08E-07	CDC25C, UBE2C, Cyclin B1, JAB1, PP2A regulatory, PP1-cat, Aurora-B, Histone H3, CDK1 (p34)
12	Cell cycle_Cell cycle (generic schema)	3.21E-06	CDC25C, CDK4, Cyclin E, Cyclin B, E2F4, CDK1 (p34)

13	Cytoskeleton remodeling_Keratin filaments	7.79E-06	Tubulin beta, Tubulin gamma 1, Keratin 18, Actin cytoskeletal, Tubulin alpha, CDK1 (p34), Tubulin (in microtubules)
14	CTP/UTP metabolism	1.37E-05	POLR2J, NDPK A, POLR2I, RRP41, RPB6, RPB7.0, RPB8, UDP, RPA16, RPA39, NDPK D (mitochondrial)
15	Transcription_Role of heterochromatin protein 1 (HP1) family in transcriptional silencing	1.62E-05	Cyclin E, HP1 gamma, HP1, Suv39H1, Histone H4, Histone H3, CDK1 (p34)
16	GTP-XTP metabolism	1.71E-05	POLR2J, NDPK A, POLR2I, RRP41, RPB6, RPB7.0, RPB8, RPA16, RPA39, NDPK D (mitochondrial)
17	Ubiquinone metabolism	2.17E-05	NDUFAB1, NDUFA1, NDUFA4, COQ3, NDUFS8, NDUFS6, coenzyme Q2 homolog, prenyltransferase (yeast), NDUFV1, DAP13
18	Cell cycle_Role of SCF complex in cell cycle regulation	2.44E-05	CDK4, Cyclin E, NEDD8, CDK1 (p34), CDC34, CKS1
19	Cytoskeleton remodeling_Regulation of actin cytoskeleton organization by the kinase effectors of Rho GTPases	2.47E-05	ARPC1B, Actin cytoskeletal, Rac3, Cofilin, non-muscle, F-Actin cytoskeleton, Cofilin, Rac1-related, Rac1
20	Inhibition of remyelination in multiple sclerosis: regulation of cytoskeleton proteins	3.1E-05	Tubulin beta, Actin cytoskeletal, CDK5, Tubulin alpha, Cofilin, Rac1, Tubulin (in microtubules)
21	Neurophysiological process_Receptor-mediated axon growth repulsion	4.18E-05	Ephrin-A, Actin cytoskeletal, CDK5, F-Actin cytoskeleton, Cofilin, Rac1, Tubulin (in microtubules)
22	ATP/ITP metabolism	5.08E-05	POLR2J, NDPK A, POLR2I, RRP41, RPB6, RPB7.0, ADSL, RPB8, RPA16, RPA39, NDPK D (mitochondrial)
23	Cell cycle_Chromosome condensation in prometaphase	5.83E-05	Aurora-B, Cyclin B, Histone H1, Histone H3, CDK1 (p34)
24	Apoptosis and survival_Regulation of apoptosis by mitochondrial proteins	7.1E-05	Cytochrome c, GC1QBP, MTCH2, HtrA2, TIMM8A, Metaxin 1, Smac/Diablo, PP1-cat alpha, PP2C, Cofilin
25	Cell adhesion_Gap junctions	7.42E-05	Tubulin beta, Actin cytoskeletal, Actin, Tubulin alpha, Tubulin (in microtubules)

**Table S4: Pathway analysis of genes co-expressed with PSMG4 from public LUAD databases using the MetaCore database (with  $p < 0.01$  set as the cutoff value)**

#	Maps	pValue	Network Objects from Active Data
1	Statin action on the PI3K/ Akt pathway in COPD	4.67E-04	HSP90, p70 S6 kinase2, p70 S6 kinases

2	DNA damage_Classical NHEJ mechanism of DSBs repair	6.38E-04	PNKP, DNA polymerase lambda, PAXX
3	Folic acid metabolism	2.50E-03	FOLC1, FOLC2, SLC19A1
4	Possible regulation of HSF-1/ chaperone pathway in Huntington's disease	3.52E-03	HSP90, HSF1
5	Development_Negative regulation of WNT/Beta-catenin signaling in the nucleus	6.34E-03	Nitrilase 1, KDM2, RUVBL2
6	Histone deacetylases in Prostate Cancer	6.66E-03	HSP90, Sirtuin5
7	Role of osteoblasts in bone lesions formation in multiple myeloma	9.61E-03	Osteocalcin, TAZ
8	Oxidative stress_NOX and DUOX families of NADPH oxidases	9.61E-03	PDIP38, NOXA1
9	G-protein signaling_Rac2 regulation pathway	1.01E-02	NOXA1, PREX1
10	The role of UV radiation in melanoma development	1.24E-02	XRCC3, USF1
11	Development_Notch Signaling Pathway	1.49E-02	Radical fringe, GCN5
12	Development_TNF-alpha, IL-1 alpha and WNT5A-dependent regulation of osteogenesis and adipogenesis in mesenchymal stem cells	1.69E-02	Osteocalcin, TAZ
13	Development_Fetal brown fat cell differentiation	2.27E-02	p70 S6 kinase2, USF1
14	Development_YAP/TAZ-mediated co-regulation of transcription	2.35E-02	Osteocalcin, TAZ
15	Regulation of metabolism_Insulin regulation of glycogen metabolism	2.43E-02	PHK gamma, PHK gamma (liver)
16	Signal transduction_mTORC1 downstream signaling	2.67E-02	p70 S6 kinase2, p70 S6 kinases
17	Apoptosis and survival_TNF-alpha-induced ROS-dependent Caspase-3 signaling	2.67E-02	NOXA1, FLAD1
18	DNA damage_ATM-dependent double-strand break foci	3.19E-02	KDM2A, GCN5
19	Immune response_IL-11 signaling pathway via MEK/ERK and PI3K/AKT cascades	3.28E-02	Osteocalcin, p70 S6 kinases
20	Transcription_Negative regulation of HIF1A function	3.46E-02	HSP90, RUVBL2
21	Mechanisms of drug resistance in SCLC	3.55E-02	p70 S6 kinase2, HSF1
22	DNA damage_ATM activation by DNA damage	3.64E-02	HSP90, MRNIP
23	Immune response_IL-2 signaling via ERK, PI3K, and PLC-gamma	3.83E-02	p70 S6 kinase2, p70 S6 kinases
24	DNA damage_Intra S-phase checkpoint	4.12E-02	MUS81, GCN5
25	Development_Negative regulation of WNT/Beta-catenin signaling in the cytoplasm	4.73E-02	YAP1/TAZ, TAZ