

Table S3: Pathways identification after ATRA+PDT compared to PDT.

Ingenuity Canonical Pathways	-log(p-value)	Ratio	z-score	Molecules
Aryl Hydrocarbon Receptor Signaling	5.89	0.154	1.155	ALDH1A1,ALDH1A3,ALDH1B1,ALDH1L1,ALDH2,ALDH7A1,CCNA2,CDK6,CYP1A1,FAS,FOS,GSTA4,HSPB1,JUN,NCOA3,NCOA7,NQO2,NR0B2,NR1P1,RARG,TGFB2,TGM2
Tryptophan Degradation X (Mammalian, via Tryptamine)	5.88	0.36	0	AKR1B10,ALDH1A1,ALDH1A3,ALDH1B1,ALDH2,ALDH7A1,DDC,MAOA,MAOB
Putrescine Degradation III	5.5	0.381	0.707	ALDH1A1,ALDH1A3,ALDH1B1,ALDH2,ALDH7A1,MAOA,MAOB,SAT1
Unfolded protein response	4.95	0.214	2.333	CEBPA,CEBPD,DNAJB9,DNAJC3,ERN1,HSPA1A/HSPA1B,HSPA1L,HSPA6,HSPH1,INSIG1,PPARG,PPP1R15A
Oxidative Ethanol Degradation III	4.76	0.368	-0.378	ACSL1,ACSS2,ALDH1A1,ALDH1A3,ALDH1B1,ALDH2,ALDH7A1
Superpathway of Cholesterol Biosynthesis	4.32	0.276	-2.828	ACAT1,HMGCR,HMGCS2,IDI1,LSS,MSMO1,SC5D,SOLE
Ethanol Degradation IV	4.15	0.304	-0.378	ACSL1,ACSS2,ALDH1A1,ALDH1A3,ALDH1B1,ALDH2,ALDH7A1
VDR/RXR Activation	4.09	0.167	-0.378	CEBPA,CYP24A1,GADD45A,IGFBP6,KLF4,KLK6,MXD1,NCOA3,PRKCA,RUNX2,SEMA3B,TGFB2,VDR
Histamine Degradation	4.03	0.353	0	ALDH1A1,ALDH1A3,ALDH1B1,ALDH2,ALDH7A1,AOC1
Tumor Microenvironment Pathway	3.95	0.119	0.218	CD44,CSPG4,CXCL8,CXCR4,FAS,FGF19,FOS,HLA-B,HLA-C,HLA-E,IGF2,JUN,LGALS9,MAP3K14,MMP15,MMP7,PIK3R1,PTGS2,RAP2B,SLC16A1,TGFB2
Senescence Pathway	3.81	0.102	1.512	ACVR1,ATF3,CAPN5,CAPN9,CBX7,CDC25A,CDK6,CDKN2B,CGAS,CXCL8,DMTF1,E2F7,ELF3,ETS1,GADD45A,GADD45B,HIPK2,ITPR2,JUN,PKK4,PIK3R1,PML,PPP2R5B,RAP2B,SMAD3,TGFB2,TGFB2,ZFP36L1
Aldosterone Signaling in Epithelial Cells	3.67	0.12	-0.816	ASIC1,DNAJA1,DNAJB1,DNAJB4,DNAJB9,DNAJC2,DNAJC3,DUSP1,HSPA1A/HSPA1B,HSPA1L,HSPA4L,HSPA6,HSPB1,HSPH1,ITPR2,PIK3R1,PIP5K1A,PRKCA,SGK1
Molecular Mechanisms of Cancer	3.63	0.09	#NUM!	AURKA,BBC3,BIRC3,BMP4,CASP7,CASP9,CDK25A,CDK6,CDKN2B,DVL1,E2F7,FAS,FOS,FYN,GAB1,GAB2,GLI1,GNA14,GNAI1,GNAZ,HIPK2,JUN,PIK3R1,PMAP1,PRKAR2A,PRKCA,RAP2B,RASA1,RHOB,RHOD,RHO,RND3,SMAD3,TGFB2,TGFB2,WNT11
PXR/RXR Activation	3.61	0.169	#NUM!	ABCC2,ALDH1A1,CPT1A,CYP2B6,CYP3A5,HMGCS2,HNF4A,NR0B2,PCK2,PRKAR2A,UGT1A10 (includes others)
Fatty Acid α -oxidation	3.58	0.3	0.816	ALDH1A1,ALDH1A3,ALDH1B1,ALDH2,ALDH7A1,PTGS2
Protein Ubiquitination Pathway	3.5	0.0989	#NUM!	B2M,BIRC3,DNAJA1,DNAJB1,DNAJB4,DNAJB9,DNAJC2,DNAJC3,HLA-B,HLA-C,HLA-E,HSPA1A/HSPA1B,HSPA1L,HSPA4L,HSPA6,HSPB1,HSPH1,NEDD4L,PSMB10,PSMB8,PSME1,PSME2,SMURF1,TAP2,UBC,USP11,USP53
Sumoylation Pathway	3.39	0.136	0	ARHGDI1B,CEBPA,DNMT3A,ETS1,FAS,FOS,JUN,MYB,PML,RHOB,RHOD,RHO,RND3,SP100
Death Receptor Signaling	3.36	0.141	1.941	ARHGDI1B,BIRC3,CASP7,CASP9,FAS,HSPB1,MAP3K14,MAP4K4,PARP10,PARP12,PARP14,PARP8,TIPARP
Dopamine Degradation	3.35	0.233	0.378	ALDH1A1,ALDH1A3,ALDH1B1,ALDH2,ALDH7A1,MAOA,MAOB
Huntington's Disease Signaling	3.27	0.1	-2.324	ATP5MC1,CAPN5,CAPN9,CASP4,CASP7,CASP9,CREB5,DNAJB1,GNA14,HDAC9,HSPA1A/HSPA1B,HSPA1L,HSPA6,JUN,PIK3R1,POLR2L,PRKCA,PSME1,PSME2,RASA1,SGK1,STX1A,TGM2,UBC
LPS/IL-1 Mediated Inhibition of RXR Function	3.27	0.102	0.333	ABCC2,ACSL1,ALDH1A1,ALDH1A3,ALDH1B1,ALDH1L1,ALDH2,ALDH7A1,CHST4,CPT1A,CYP2B6,CYP3A5,GSTA4,HMGCS2,IL1R2,IL1RN,JUN,MAOA,MAOB,NR0B2,NR5A2,SCARB1,SULT2B1
TGF- β Signaling	3.18	0.135	0.905	ACVR1,BMP4,FOS,HNF4A,IRF7,JUN,RAP2B,RUNX2,SMAD3,SMURF1,TGFB2,TGFB2,VDR
Ethanol Degradation II	3.17	0.219	-0.378	ACSL1,ACSS2,ALDH1A1,ALDH1A3,ALDH1B1,ALDH2,ALDH7A1
Caveolar-mediated Endocytosis Signaling	3.16	0.151	#NUM!	B2M,CAV1,CD55,FLNB,FLOT1,FYN,HLA-B,HLA-C,HLA-E,ITGB6,PRKCA
Endothelin-1 Signaling	3.13	0.106	1.606	CASP4,CASP7,CASP9,ECE2,EDN1,FOS,GAB1,GNA14,GNAI1,GNAZ,ITPR2,JUN,PIK3R1,PLAAT3,PLAAT4,PLD1,PLD2,PRKCA,PTGS2,RAP2B
NRF2-mediated Oxidative Stress Response	3.1	0.106	0.632	ABCC1,ABCC2,AKR7A3,DNAJA1,DNAJA4,DNAJB1,DNAJB4,DNAJB9,DNAJC3,FOS,FOSL1,GSTA4,JUN,JUND,MAFF,NQO2,PIK3R1,PRKCA,RAP2B,SCARB1
UVA-Induced MAPK Signaling	3.09	0.133	0	CASP9,FOS,JUN,PARP10,PARP12,PARP14,PARP8,PIK3R1,PRKCA,RAP2B,RPS6KB2,SMPD3,TIPARP
Xenobiotic Metabolism PXR Signaling Pathway	3.02	0.104	0.447	ABCC2,ALDH1A1,ALDH1A3,ALDH1B1,ALDH1L1,ALDH2,ALDH7A1,CHST4,CYP2B6,CYP3A5,GSTA4,MAOA,MAOB,NR1P1,PPP1R10,PRKAR2A,PRKCA,SULT2B1,UGT1A10 (includes others),UGT8
Cytotoxic T Lymphocyte-mediated Apoptosis of Target Cells	3	0.206	#NUM!	B2M,CASP7,CASP9,FAS,HLA-B,HLA-C,HLA-E
Noradrenaline and Adrenaline Degradation	2.92	0.2	0.378	ALDH1A1,ALDH1A3,ALDH1B1,ALDH2,ALDH7A1,MAOA,MAOB
Interferon Signaling	2.85	0.194	2.646	IFI35,IFIT3,IFITM2,IFITM3,IFNGR2,IRF1,PSMB8
Xenobiotic Metabolism CAR Signaling Pathway	2.72	0.101	1.147	ABCC1,ABCC2,ALDH1A1,ALDH1A3,ALDH1B1,ALDH1L1,ALDH2,ALDH7A1,CHST4,CYP1A1,CYP2B6,CYP3A5,GSTA4,NR1P1,PPP2R5B,PRKCA,SULT2B1,UGT1A10 (includes others),UGT8
Stearate Biosynthesis I (Animals)	2.67	0.163	0.378	ACOT11,ACSL1,ELOVL6,GNPAT,HNF4A,MBOAT7,SRD5A3,TBXAS1
Retinoic acid Mediated Apoptosis Signaling	2.67	0.15	2.828	CASP9,CRABP2,IRF1,PARP10,PARP12,PARP14,PARP8,RARG,TIPARP
Antigen Presentation Pathway	2.64	0.179	#NUM!	B2M,HLA-B,HLA-C,HLA-E,PSMB8,TAP2,TAPBP
Xenobiotic Metabolism AHR Signaling Pathway	2.61	0.129	0.905	ALDH1A1,ALDH1A3,ALDH1B1,ALDH1L1,ALDH2,ALDH7A1,CYP1A1,GSTA4,NQO2,NR1P1,UGT1A10 (includes others)
p53 Signaling	2.6	0.122	1.265	BBC3,FAS,GADD45A,GADD45B,HDAC9,HIPK2,JUN,PIK3R1,PMAP1,PML,SERPINE2,TRIM29
Cholesterol Biosynthesis I	2.58	0.308	-2	LSS,MSMO1,SC5D,SOLE
Cholesterol Biosynthesis II (via 24,25-dihydrolanosterol)	2.58	0.308	-2	LSS,MSMO1,SC5D,SOLE
Cholesterol Biosynthesis III (via Desmosterol)	2.58	0.308	-2	LSS,MSMO1,SC5D,SOLE
Hepatic Fibrosis Signaling Pathway	2.57	0.082	0.18	ACVR1,COL18A1,CREB5,CXCL8,DVL1,EDN1,FOS,GLI1,GLI2,GLIS2,GNAI1,IL1R2,IL1RN,IRS2,JUN,KLF9,NOX1,PIK3R1,PPARG,PRKAR2A,PRKCA,RAP2B,RHOB,RHOD,RHO,RND3,RPS6KB2,SMAD3,TGFB2,TGFB2,WNT11
Axonal Guidance Signaling	2.52	0.0769	#NUM!	ABLIM1,ADAM8,ADAM9,ADAMTS6,BMP4,CXCR4,ECE2,EFNA1,EPHA2,EPHB6,ERAP2,FYN,GLI1,GLI2,GLIS2,GNA14,GNAI1,GNAZ,MMP15,MMP7,NR1,NTN4,PIK3R1,PLXNB2,PLXND1,PRKAR2A,PRKCA,RAP2B,RASA1,RHOD,SEMA3A,SEMA3B,SEMA3E,SEMA4B,SEMA7A,TUBA4A,TUBB2A,WNT11
Virus Entry via Endocytic Pathways	2.45	0.118	#NUM!	B2M,CAV1,CD55,FLNB,FYN,HLA-B,HLA-C,HLA-E,ITGB6,PIK3R1,PRKCA,RAP2B
Mevalonate Pathway I	2.44	0.286	-2	ACAT1,HMGCR,HMGCS2,IDI1
IL-8 Signaling	2.44	0.095	1.606	ANGPT1,CXCL1,CXCL8,FOS,GNAI1,HBEGF,JUN,MAP4K4,NOX1,PIK3R1,PLD1,PLD2,PRKCA,PTGS2,RAP2B,RHOB,RHOD,RHO,RND3
Hepatic Cholestasis	2.42	0.0968	#NUM!	ABCC1,ABCC2,CLCF1,CXCL8,CYP3A5,FGF19,HNF4A,IL1R2,IL1RN,JUN,LIF,MAP3K14,NR0B2,NR5A2,PRKAR2A,PRKCA,TGFB2,TJP2
Granulocyte Adhesion and Diapedesis	2.39	0.0983	#NUM!	CC15,CLDN1,CLDN2,CLDN2,CXCL1,CXCL16,CXCL2,CXCL3,CXCL8,CXCR4,GNAI1,HRH1,IL1R2,IL1RN,MMP15,MMP7,SDC4
Polyamine Regulation in Colon Cancer	2.39	0.217	#NUM!	MXD1,PPARG,PSME1,PSME2,SAT1
IGF-1 Signaling	2.38	0.115	-0.333	CASP9,CCN1,FOS,IGFBP2,IGFBP6,IRS2,JUN,PIK3R1,PRKAR2A,RAP2B,RASA1,RPS6KB2
Role of PKR in Interferon Induction and Antiviral Response	2.36	0.11	1.387	ATF3,CASP9,DNAJC3,EIF2AK2,FAS,FOS,HSPA1A/HSPA1B,HSPA1L,HSPA6,IFIH1,IFNGR2,IRF1,JUN
HIF1 α Signaling	2.32	0.0927	-1.147	CNG2,EDN1,EGLN1,HK1,HSPA1A/HSPA1B,HSPA1L,HSPA6,IGF2,JUN,LDHA,MMP15,MMP7,NOX1,PIK3R1,PRKCA,RAP2B,RPS6KB2,SAT1,TGFB2
Glucocorticoid Receptor Signaling	2.27	0.0758	#NUM!	ANXA1,ATP5MC1,CAV1,CEBPA,CXCL3,CXCL8,DUSP1,FOS,HSPA1A/HSPA1B,HSPA1L,HSPA6,IL15RA,IL1R2,IL1RN,JUN,KRT13,KRT20,KRT7,KRT80,MAP3K14,NCOA3,NR1P1,PCK2,PKK4,PIK3R1,POLR2L,PPARG,PTGS2,RAP2B,SGK1,SMAD3,TGFB2,TGFB2,TSC22D3,UQCRCF5
Coagulation System	2.23	0.171	0	F2R,F5,PROS1,SERPINA1,SERPINA5,TFPI
RAR Activation	2.23	0.0928	#NUM!	AKR1B10,AKR1C3,ALDH1A1,ALDH1A3,CRABP2,DHRS3,DUSP1,FOS,JUN,NR1P1,PIK3R1,PML,PRKAR2A,PRKCA,RARG,REL,SMAD3,TGFB2
Xenobiotic Metabolism Signaling	2.21	0.0836	#NUM!	ABCC2,ALDH1A1,ALDH1A3,ALDH1B1,ALDH1L1,ALDH2,ALDH7A1,CHST4,CYP1A1,CYP2B6,CYP3A5,GSTA4,MAOA,MAOB,MAP3K14,NQO2,NR1P1,PIK3R1,PPP2R5B,PRKCA,RAP2B,SULT2B1,UGT1A10 (includes others),UGT8
Anandamide Degradation	2.18	0.667	#NUM!	FAAH,NAAA
Systemic Lupus Erythematosus In B Cell Signaling Pathway	2.15	0.0836	3.545	BCL10,CLCF1,CXCL8,FOS,FYN,GAB1,IFIH1,IFIT3,IFNGR2,INPPL1,IRF7,JUN,LIF,MAP3K14,MAP4K4,MCL1,PAG1,PIK3R1,PLAAT4,PRKCA,RAP2B,TGFB2,TRAF4
Salvage Pathways of Pyrimidine Ribonucleotides	2.14	0.112	0	AK4,APOBEC3B,CDK6,DAPK1,EIF2AK2,GRK5,NME3,NME4,PIM1,PKN1,SGK1
FXR/RXR Activation	2.12	0.103	#NUM!	ABCC2,AMBIP,APOL1,CLU,FGF19,HNF4A,IL1RN,NR0B2,NR5A2,PCK2,PPARG,SCARB1,SERPINA1
Semaphorin Signaling in Neurons	2.12	0.133	#NUM!	FYN,NR1P1,RHOB,RHOD,RHO,RND3,SEMA3A,SEMA7A
MSP-RON Signaling In Macrophages Pathway	2.09	0.106	1.155	CREB5,FOS,GAB2,IFNGR2,JUN,KLK10,KLK6,NFKBIZ,PIK3R1,PTGS2,RAP2B,SBNO2
PDGF Signaling	2.09	0.116	1.897	CAV1,EIF2AK2,FOS,INPPL1,JUN,PIK3R1,PRKCA,RAP2B,RASA1,SPHK2
Germ Cell-Sertoli Cell Junction Signaling	2.08	0.0936	#NUM!	EPN3,FER,GSN,MAP3K14,PIK3R1,RAP2B,RHOB,RHOD,RHO,RND3,TGFB2,TGFB2,TJP1,TUBA4A,TUBB2A,ZYX
Apoptosis Signaling	2.07	0.11	-1.667	BIRC3,CAPN5,CAPN9,CASP7,CASP9,FAS,MAP3K14,MAP4K4,MCL1,PRKCA,RAP2B
Superpathway of Geranylgeranyldiphosphate Biosynthesis I (via Mevalonate)	2.03	0.222	-2	ACAT1,HMGCR,HMGCS2,IDI1
Wnt/ β -catenin Signaling	2.03	0.0925	-1.291	ACVR1,AXIN2,CD44,DKK1,DVL1,JUN,MMP7,NR5A2,PPP2R5B,RARG,SOX12,SOX4,TGFB2,TGFB2,UBC,WNT11
Regulation Of The Epithelial Mesenchymal Transition By Growth Factors Pathway	2.03	0.0904	2	EGR1,ETS1,FGF19,FGFR2,FOS,GAB1,HMGA2,ID2,JUN,LATS2,PAR6B,PIK3R1,RAP2B,SMAD3,SMURF1,TGFB2,TGFB2
Osteoarthritis Pathway	2	0.0864	0.775	CASP4,CASP7,CASP9,CREB5,CXCL8,DDIT4,DKK1,ELF3,GLI1,GLI2,GLIS2,IL1R2,PPARG,PTGS2,RUNX2,SDC4,SLC39A8,SMAD3,TGFB2
Prostanoid Biosynthesis	1.99	0.3	#NUM!	CYP2S1,PTGS2,TBXAS1
GDNF Family Ligand-Receptor Interactions	1.98	0.118	1.633	FOS,GAB1,IRS2,ITPR2,JUN,PDLIM7,PIK3R1,RAP2B,RASA1
PPAR α /RXR α Activation	1.97	0.089	-1.5	ACAA1,ACVR1,BCL3,GNA14,GPD1,IL1R2,JUN,MAP3K14,MAP4K4,NCOA3,NR0B2,PRKAR2A,PRKCA,RAP2B,SMAD3,TGFB2,TGFB2
Regulation of the Epithelial-Mesenchymal Transition Pathway	1.95	0.0885	#NUM!	DVL1,EGR1,ETS1,FGF19,FGFR2,GAB1,HMGA2,ID2,JAG2,PAR6B,PIK3R1,RAP2B,SMAD3,SMURF1,TGFB2,TGFB2,WNT11
PPAR Signaling	1.92	0.105	-1.508	FOS,IL1R2,IL1RN,JUN,MAP3K14,MAP4K4,NR0B2,NR1P1,PPARG,PTGS2,RAP2B
Melatonin Degradation II	1.89	0.5	#NUM!	MAOA,MAOB
Acetate Conversion to Acetyl-CoA	1.89	0.5	#NUM!	ACSL1,ACSS2
Integrin Signaling	1.84	0.0845	-0.277	CAPN5,CAPN9,CAV1,FYN,GRB7,GSN,ITGB6,NEDD9,PIK3R1,RAP2B,RHOB,RHOD,RHO,RND3,TNK2,TSPAN4,TSPAN6,ZYX
Serotonin Degradation	1.84	0.119	0.707	ALDH1A1,ALDH1A3,ALDH1B1,ALDH2,ALDH7A1,MAOA,MAOB,UGT1A10 (includes others)
Estrogen Biosynthesis	1.84	0.143	1.342	AKR1C1/AKR1C2/AKR1C3,CYP1A1,CYP2B6,CYP2S1,CYP3A5
CXCR4 Signaling	1.83	0.0898	0	CXCR4,EGR1,FOS,GNA14,GNAI1,GNAZ,ITPR2,JUN,PIK3R1,PRKCA,RAP2B,RHOB,RHOD,RHO,RND3
Pancreatic Adenocarcinoma Signaling	1.81	0.101	0	CASP9,CDKN2B,E2F7,HBEGF,PIK3R1,PLD1,PLD2,PTGS2,SMAD3,TGFB2,TGFB2
Endoplasmic Reticulum Stress Pathway	1.79	0.19	2	CASP7,CASP9,DNAJC3,ERN1
Retinol Biosynthesis	1.75	0.136	0.447	AADAC,AKR1B10,AKR1C3,DHRS3,LIPG,PNPLA2
B Cell Receptor Signaling	1.75	0.086	1.5	BCL10,BCL6,CARD10,CREB5,DAPP1,EGR1,ETS1,GAB1,GAB2,INPPL1,JUN,MAP3K14,PAG1,PIK3R1,RAP2B,RPS6KB2
Protein Kinase A Signaling	1.74	0.0725	-1.177	AKAP12,CDC14B,CDC25A,CNCA1,CREB5,DUSP1,DUSP16,DUSP2,DUSP5,FLNB,GNAI1,H1-0,H1-10,ITPR2,PDE12,PDE8A,PPP1R10,PPP1R1B,PRKAR2A,PRKCA,PTGS2,PTPN21,PTPN9,PTPRB,PTPRH,PYGB,SMAD3,TGFB2,TGFB2
TR/RXR Activation	1.72	0.107	#NUM!	AKR1C1/AKR1C2/AKR1C3,BCL3,KLF9,ME1,NCOA3,PIK3R1,SCARB1,SLC16A3
Production of Nitric Oxide and Reactive Oxygen Species in Macrophages	1.7	0.0847	1	APOL1,CLU,FOS,IFNGR2,IRF1,JUN,MAP3K14,PIK3R1,PPP1R10,PPP2R5B,PRKCA,RHOB,RHOD,RHO,RND3,SERPINA1
HIPPO signaling	1.69	0.106	-1.134	AJUBA,CD44,LATS2,PPP1R10,PPP2R5B,RASSF6,SMAD3,TEAD2,TJP2
Protein Citrullination	1.68	0.4	#NUM!	PADI1,PADI2
Creatine-phosphate Biosynthesis	1.68	0.4	#NUM!	CKB,MAP4K4
Retinoate Biosynthesis I	1.66	0.147	-0.447	AKR1B10,AKR1C3,ALDH1A1,ALDH1A3,DHRS3
PFKFB4 Signaling Pathway	1.66	0.13	0	CREB5,HK1,NCOA3,PFKM,PRKAR2A,TGFB2
ERK5 Signaling	1.66	0.111	1.414	CREB5,FOS,FOSL1,GAB1,LIF,RAP2B,RPS6KB2,SGK1

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Ingenuity Canonical Pathways	-log(p-value)	Ratio	z-score	Molecules
Gloma Invasiveness Signaling	1.63	0.11	0	CD44,F2R,PIK3R1,RAP2B,RHOB,RHOD,RHO,RND3
Role of Tissue Factor in Cancer	1.63	0.0948	#NUM!	CCN1,CXCL1,CXCL8,EGR1,F2RL1,FYN,GNA14,HBEGF,PIK3R1,PRKCA,RAP2B
Agranulocyte Adhesion and Diapedesis	1.62	0.0829	#NUM!	CCL15,CLDN1,CLDN12,CLDN2,CXCL1,CXCL16,CXCL2,CXCL3,CXCL8,CXCR4,GNA11,HRH1,IL1RN,MMP15,MMP7,SDC4
TWEAK Signaling	1.61	0.143	1.342	BIRC3,CASP7,CASP9,MAP3K14,TNFRSF12A
Sphingosine-1-phosphate Signaling	1.6	0.094	-1.265	ACER2,CASP4,CASP7,CASP9,GNA11,PIK3R1,RHOB,RHOD,RHO,RND3,SMPD3
HER-2 Signaling in Breast Cancer	1.6	0.0825	1.291	CASP7,CASP9,ELF3,ETS1,FOS,FYN,HBEGF,ITGB6,JUN,PAR6B,PIK3R1,PRKCA,PTGS2,RAP2B,RPS6KB2,SMAD3
Estrogen Receptor Signaling	1.57	0.0732	-1.043	ATP5MC1,CAV1,CREB5,FBXO32,FOS,GNA14,GNA11,GNAZ,IGF2,JUN,MDK,MED15,MMP15,MMP7,NCOA3,NR0B2,NR1P1,PIK3R1,PRKAR2A,PRKCA,RAP2B,RPS6KB2,RUNX2,UQCRFS1
Role of IL-17A in Psoriasis	1.57	0.214	#NUM!	CXCL1,CXCL3,CXCL8
Acyl-CoA Hydrolysis	1.57	0.214	#NUM!	ACOT11,GNPAT,HNF4A
Phenylalanine Degradation IV (Mammalian, via Side Chain)	1.57	0.214	#NUM!	ALDH2,MAOA,MAOB
IL-17A Signaling in Fibroblasts	1.56	0.139	#NUM!	CEBPD,FOS,JUN,LCN2,NFKBIZ
Cholecystokinin/Gastrin-mediated Signaling	1.55	0.0924	1.508	FOS,IL1RN,ITPR2,JUN,PRKCA,PTGS2,RAP2B,RHOB,RHOD,RHO,RND3
Toll-like Receptor Signaling	1.54	0.105	1.633	EIF2AK2,FOS,IL1RN,JUN,MAP3K14,MAP4K4,TRAF4,UBC
Regulation of IL-2 Expression in Activated and Anergic T Lymphocytes	1.54	0.1	#NUM!	BCL10,FOS,FYN,JUN,RAP2B,SMAD3,TGFB2,TGFB2,TOB1
Bupropion Degradation	1.53	0.16	2	CYP1A1,CYP2B6,CYP2S1,CYP3A5
PD-1, PD-L1 cancer immunotherapy pathway	1.51	0.0943	0	B2M,CBLB,HLA-B,HLA-C,HLA-E,IFNGR2,LATS2,PIK3R1,SMAD3,TGFB2
Thrombopoietin Signaling	1.51	0.111	1.89	FOS,GAB2,IRS2,JUN,PIK3R1,PRKCA,RAP2B
T Cell Receptor Signaling	1.51	0.0943	#NUM!	BCL10,FOS,FYN,JUN,PAG1,PIK3R1,PTPRH,RAP2B,RASA1,TKX
Myc Mediated Apoptosis Signaling	1.5	0.12	0	BBC3,CASP9,FAS,MCL1,PMIAP1,PRKAR2A
TNFR1 Signaling	1.5	0.12	1.633	BIRC3,CASP7,CASP9,FOS,JUN,MAP3K14
Tight Junction Signaling	1.5	0.0833	#NUM!	CEBPA,CLDN1,CLDN12,CLDN2,FOS,JUN,PPP2R5B,PRKAR2A,SMURF1,TGFB2,TGFB2,TJP1,TJP2,TJP3
Neuroinflammation Signaling Pathway	1.49	0.0733	1.789	ACVR1,B2M,BACE2,BIRC3,CALB2,CREB5,CXCL8,FAS,FOS,GABRP,GRIN2D,HLA-B,HLA-C,HLA-E,IFNGR2,IRF7,JUN,NOX1,PIK3R1,PTGS2,TGFB2,TGFB2
Choline Biosynthesis III	1.49	0.2	#NUM!	CHPT1,PLD1,PLD2
PI3K Signaling in B Lymphocytes	1.47	0.087	1.265	ATF3,BCL10,CARD10,DAPP1,FOS,FYN,IRS2,ITPR2,JUN,PIK3R1,PLEKHA2,RAP2B
IL-17A Signaling in Gastric Cells	1.47	0.154	2	CXCL1,CXCL8,FOS,JUN
Superpathway of Melatonin Degradation	1.45	0.108	1.89	CYP1A1,CYP2B6,CYP2S1,CYP3A5,MAOA,MAOB,UGT1A10 (includes others)
Antiproliferative Role of TOB in T Cell Signaling	1.42	0.128	0.447	CCNA2,SMAD3,TGFB2,TGFB2,TOB1
Pyridoxal 5'-phosphate Salvage Pathway	1.42	0.106	0.816	CDK6,DAPK1,EIF2AK2,GRK5,PIM1,PKN1,SGK1
Ephrin Receptor Signaling	1.41	0.0794	-0.707	ANGPT1,CREB5,CXCR4,EFNA1,EPHA2,EPHB6,FYN,GNA14,GNA11,GNAZ,GRIN2D,MAP3K14,MAP4K4,RAP2B,RASA1
Extrinsic Prothrombin Activation Pathway	1.41	0.188	#NUM!	F5,PROS1,TFPI
IL-6 Signaling	1.4	0.0873	2.111	CXCL8,FOS,HSPB1,IL1R2,IL1RN,JUN,MAP3K14,MAP4K4,MCL1,PIK3R1,RAP2B
Cyclins and Cell Cycle Regulation	1.39	0.0988	-1.134	CCNA2,CDC25A,CDK6,CDKN2B,E2F7,HDAC9,PPP2R5B,TGFB2
Cell Cycle: G1/S Checkpoint Regulation	1.39	0.104	0	CDC25A,CDK6,CDKN2B,E2F7,HDAC9,SMAD3,TGFB2
Prolactin Signaling	1.39	0.0988	1.134	FOS,FYN,IRF1,JUN,NMI,PIK3R1,PRKCA,RAP2B
eNOS Signaling	1.37	0.0818	-0.707	AQP5,CASP9,CAV1,CCNA2,CNGA1,HSPA1A/HSPA1B,HSPA1L,HSPA6,ITPR2,NOSTRIN,PIK3R1,PRKAR2A,PRKCA
Regulation Of The Epithelial Mesenchymal Transition In Development Pathway	1.32	0.0952	-2.121	AXIN2,DVL1,GLI1,GLI2,GLIS2,JAG2,S100A4,WNT11
EGF Signaling	1.32	0.109	0	FOS,ITPR2,JUN,PIK3R1,PRKCA,RASA1
Sonic Hedgehog Signaling	1.32	0.138	0	GLI1,GLI2,GLIS2,PRKAR2A
Sorbitol Degradation I	1.32	1	#NUM!	SORD
Lanosterol Biosynthesis	1.32	1	#NUM!	LSS
Intrinsic Prothrombin Activation Pathway	1.31	0.119	0.447	COL18A1,F5,KLK10,KLK6,PROS1
AMPK Signaling	1.29	0.0751	-0.277	AK2,AK4,CCNA2,CFTR,CPT1A,CREB5,HMGR,HNF4A,IRS2,PCK2,PFKM,PHLPP1,PIK3R1,PPP2R5B,PRKAR2A,TBC1D1
Neuroprotective Role of THOP1 in Alzheimer's Disease	1.28	0.0862	0.447	DPP4,ECE2,HLA-B,HLA-C,HLA-E,KLK10,KLK6,NFYA,PRKAR2A,SERPINA3
FAT10 Signaling Pathway	1.28	0.167	#NUM!	MAP1LC3B,PSME1,PSME2
Systemic Lupus Erythematosus In T Cell Signaling Pathway	1.27	0.0689	-1.043	B2M,BCL6,CASP4,CASP7,CASP9,CD44,CREB5,FAS,FOS,GADD45A,GNA11,HLA-B,HLA-C,HLA-E,JUN,PIK3R1,PPP2R5B,RAP2B,RHOB,RHOD,RHO,RND3,RPS6KB2
BAG2 Signaling Pathway	1.27	0.116	0.447	HSPA1A/HSPA1B,HSPA1L,HSPA6,PSME1,PSME2
TNFR2 Signaling	1.27	0.133	1	BIRC3,FOS,JUN,MAP3K14
Salvage Pathways of Pyrimidine Deoxyribonucleotides	1.27	0.25	#NUM!	APOBEC3B,TK2
HMGB1 Signaling	1.26	0.0788	1.732	CLCF1,CXCL8,FOS,IFNGR2,JUN,LIF,PIK3R1,RAP2B,RHOB,RHOD,RHO,RND3,TGFB2
IL-12 Signaling and Production in Macrophages	1.26	0.0827	#NUM!	APOL1,CLU,FOS,IRF1,JUN,PIK3R1,PPARG,PRKCA,REL,SERPINA1,TGFB2
Triacylglycerol Biosynthesis	1.23	0.114	-0.447	DGAT2,ELOVL6,LPCAT1,MBOAT7,PLPP3
Acetone Degradation I (to Methylglyoxal)	1.23	0.129	2	CYP1A1,CYP2B6,CYP2S1,CYP3A5
Chronic Myeloid Leukemia Signaling	1.23	0.0874	#NUM!	CDK6,E2F7,GAB2,HDAC9,PIK3R1,RAP2B,SMAD3,TGFB2,TGFB2
Ceramide Signaling	1.22	0.0909	2.449	CNKSR1,FOS,JUN,PIK3R1,PPP2R5B,RAP2B,SMPD3,SPHK2
Methylglyoxal Degradation III	1.22	0.158	#NUM!	AKR1B10,AKR1C1,AKR1C2,AKR1C3
Coronavirus Replication Pathway	1.2	0.111	-1.342	BAG3,IFITM2,IFITM3,TUBA4A,TUBB2A
Colorectal Cancer Metastasis Signaling	1.2	0.0711	-0.258	CASP9,DVL1,FOS,JUN,MMP15,MMP7,PIK3R1,PRKAR2A,PTGS2,RAP2B,RHOB,RHOD,RHO,RND3,SMAD3,TGFB2,TGFB2,WNT11
ERK/MAPK Signaling	1.2	0.0743	0	CREB5,DUSP1,DUSP2,ELF3,ETS1,FOS,FYN,HSPB1,PIK3R1,PPARG,PPP1R10,PPP2R5B,PRKAR2A,PRKCA,RAP2B
HGF Signaling	1.2	0.0833	1.89	ELF3,ETS1,FOS,GAB1,JUN,MAP3K14,PIK3R1,PRKCA,PTGS2,RAP2B
Hepatic Fibrosis / Hepatic Stellate Cell Activation	1.19	0.0753	#NUM!	COL17A1,COL18A1,CXCL3,CXCL8,EDN1,FAS,FGFR2,IFNGR2,IGF2,IL1R2,KLF6,SMAD3,TGFB2,TGFB2
IL-15 Production	1.18	0.0826	2.53	CLK1,CLK4,EPHA2,FER,FGFR2,FYN,IRF1,ROR1,TNK2,TKX
SPINK1 Pancreatic Cancer Pathway	1.17	0.1	-0.816	F2RL1,KLK10,KLK6,SMAD3,SPINK1,TGFB2
PCP pathway	1.17	0.1	-0.447	CELSR1,DVL1,JUN,JUND,LGR4,WNT11
FAT10 Cancer Signaling Pathway	1.17	0.109	0.447	ACVR1,CXCR4,SMAD3,TGFB2,TGFB2
Sirtuin Signaling Pathway	1.16	0.0687	1.069	ACSS2,ATP5MC1,CPT1A,CXCL8,GADD45A,GADD45B,H1-0,H1-10,HMGCS2,JUN,LDHA,MAP1LC3B,PCK2,PFKM,PPARG,PPIF,TUBA4A,UQCRFS1,VDAC1,XPA
The Visual Cycle	1.16	0.15	#NUM!	AKR1B10,AKR1C3,DHRS3
Insulin Receptor Signaling	1.15	0.0791	-0.302	ASIC1,FYN,GAB1,INPL1,IRS2,PIK3R1,PPP1R10,PRKAR2A,RAP2B,RPS6KB2,SGK1
Induction of Apoptosis by HIV1	1.15	0.0984	0	BBC3,BIRC3,CASP9,CXCR4,FAS,MAP3K14
Tec Kinase Signaling	1.13	0.0751	0	FAS,FOS,FYN,GNA14,GNA11,GNAZ,PIK3R1,PRKCA,RHOB,RHOD,RHO,RND3,TKX
ILK Signaling	1.13	0.0737	0.832	CREB5,FLNB,FOS,IRS2,ITGB6,JUN,LIMS2,PIK3R1,PPP2R5B,PTGS2,RHOB,RHOD,RHO,RND3
nNOS Signaling in Neurons	1.13	0.106	#NUM!	CAPN5,CAPN9,GRIN2D,PFKM,PRKCA
Gαq Signaling	1.12	0.0764	-0.577	GNA14,HRH1,ITPR2,PIK3R1,PLD1,PLD2,PRKCA,RGS2,RHOB,RHOD,RHO,RND3
Dopamine Receptor Signaling	1.12	0.0909	#NUM!	DDC,MAOA,MAOB,PPP1R10,PPP1R1B,PPP2R5B,PRKAR2A
Inhibition of Angiogenesis by TSP1	1.11	0.118	#NUM!	FYN,HSPG2,JUN,TGFB2
T Cell Exhaustion Signaling Pathway	1.1	0.0743	0.707	ACVR1,BCL6,FOS,HLA-B,HLA-C,HLA-E,JUN,LGALS9,PIK3R1,PPP2R5B,RAP2B,SMAD3,TGFB2
Graft-versus-Host Disease Signaling	1.1	0.104	#NUM!	FAS,HLA-B,HLA-C,HLA-E,IL1RN
Calcium Transport I	1.1	0.2	#NUM!	ATP2A3,ATP2B1
Ferroptosis Signaling Pathway	1.09	0.0794	0	CHAC1,DPP4,EMP1,HMGR,HSPB1,NOX1,RAP2B,SAT1,SLC39A8,STEAP3
Leukocyte Extravasation Signaling	1.09	0.0725	0	CD44,CLDN1,CLDN12,CLDN2,CXCR4,FER,GNA11,MMP15,MMP7,NOX1,PIK3R1,PRKCA,RAP1GAP,TKX
Fcγ Receptor-mediated Phagocytosis in Macrophages and Monocytes	1.09	0.0851	0	FYN,GAB2,PIK3R1,PIP5K1A,PLD1,PLD2,PRKCA,RPS6KB2
Cardiac Hypertrophy Signaling (Enhanced)	1.08	0.0624	0.73	ACVR1,ATP2A3,CLCF1,CXCL8,DVL1,EDN1,FGF19,FGFR2,GNA14,GNA11,HDAC9,HSPB1,IL15RA,IL1R2,ITPR2,JUN,LIF,MAP3K14,PDE12,PDE9A,PIK3R1,PKN1,PRKAR2A,PRKCA,PTGS2,RAP2B,RCAN1,RPS6KB2,TGFB2,TGFB2,WNT11
Thyroid Cancer Signaling	1.07	0.0886	1.134	CXCL8,CXCR4,FOS,IRS2,JUN,PIK3R1,RAP2B
Sertoli Cell-Sertoli Cell Junction Signaling	1.07	0.0722	#NUM!	CLDN1,CLDN12,CLDN2,EPN3,JUN,MAP3K14,MPP6,PRKAR2A,RAP2B,TJP1,TJP2,TJP3,TUBA4A,TUBB2A
Atherosclerosis Signaling	1.07	0.0787	#NUM!	APOL1,CLU,COL18A1,CXCL8,CXCR4,IL1RN,PLAAT3,PLAAT4,SERPINA1,TNFRSF12A
Pyrimidine Deoxyribonucleotides De Novo Biosynthesis I	1.06	0.136	#NUM!	AK4,NME3,NME4
Corticotropin Releasing Hormone Signaling	1.05	0.0759	0	CREB5,FOS,GLI1,GLI2,GNA11,ITPR2,JUN,JUND,PRKAR2A,PRKCA,PTGS2
Chemokine Signaling	1.05	0.0875	0.378	CXCR4,FOS,GNA11,JUN,NOX1,PRKCA,RAP2B
Renal Cell Carcinoma Signaling	1.05	0.0875	1.633	ETS1,FOS,GAB1,JUN,PIK3R1,RAP2B,UBC
Triacylglycerol Degradation	1.04	0.1	0.447	AADAC,ABHD6,FAAH,LIPG,PNPLA2
Amyotrophic Lateral Sclerosis Signaling	1.03	0.0825	0	BIRC3,CAPN5,CAPN9,CASP7,CASP9,GRIN2D,PIK3R1,RNF19A
Epoxysqualene Biosynthesis	1.03	0.5	#NUM!	SQLE
Spermine Biosynthesis	1.03	0.5	#NUM!	AMD1

Table S3: Pathways identification after ATRA+PDT compared to PDT.

Ingenuity Canonical Pathways	-log(p-value)	Ratio	z-score	Molecules
Choline Degradation I	1.03	0.5	#NUM!	ALDH7A1
Spermidine Biosynthesis I	1.03	0.5	#NUM!	AMD1
Sulfate Activation for Sulfonation	1.03	0.5	#NUM!	PAPSS1
GDP-L-fucose Biosynthesis I (from GDP-D-mannose)	1.03	0.5	#NUM!	TSTA3
Ketogenesis	1.02	0.182	#NUM!	ACAT1,HMGCS2
GDP-glucose Biosynthesis	1.02	0.182	#NUM!	HK1,PGM1
Eicosanoid Signaling	1.02	0.0909	#NUM!	AKR1C3,DPEP1,PLAAT3,PLAAT4,PTGS2,TBXAS1
Superpathway of Inositol Phosphate Compounds	1.01	0.0704	1.604	CDC25A,DUSP1,DUSP16,DUSP2,DUSP5,INPPL1,ITPKA,PIK3R1,PIP5K1A,PPFIBP2,PPP1R1B,PPP2R5B,PTPRH,RASA1
UVC-Induced MAPK Signaling	1.01	0.098	2.236	FOS,JUN,PRKCA,RAP2B,SMPD3
Apelin Endothelial Signaling Pathway	0.996	0.0783	1	ANGPT1,FOS,GNAI1,JUN,PIK3R1,PRKCA,RAP2B,RPS6KB2,SMAD3
Signaling by Rho Family GTPases	0.987	0.0672	0.535	CDC42EP1,CDC42EP2,FOS,GNA14,GNAI1,GNAZ,JUN,NOX1,PIK3R1,PIP5K1A,PKN1,PLD1,RHOB,RHOD,RHOA,RND3,STMN1
3-phosphoinositide Biosynthesis	0.987	0.0723	1.155	CDC25A,DUSP1,DUSP16,DUSP2,DUSP5,PIK3R1,PIP5K1A,PPFIBP2,PPP1R1B,PPP2R5B,PTPRH,RASA1
Role of Osteoblasts, Osteoclasts and Chondrocytes in Rheumatoid Arthritis	0.987	0.0688	#NUM!	BIRC3,BMP4,CASP9,DKK1,DVL1,FOS,GSN,IL1R2,IL1RN,JUN,MAP3K14,PIK3R1,RUNX2,SMURF1,WNT11
Tumoricidal Function of Hepatic Natural Killer Cells	0.975	0.125	#NUM!	CASP7,CASP9,FAS
Coronavirus Pathogenesis Pathway	0.971	0.0733	0.905	CASP9,CXCL8,E2F7,EEF1A2,FOS,IRF7,JUN,PTGS2,SMAD3,TGFBR2,TRIM25
Lymphotoxin β Receptor Signaling	0.963	0.0943	1.342	CASP9,CXCL1,MAP3K14,PIK3R1,TRAF4
Glucose and Glucose-1-phosphate Degradation	0.959	0.167	#NUM!	HK1,PGM1
Glycogen Degradation II	0.959	0.167	#NUM!	PGM1,PYGB
SPINK1 General Cancer Pathway	0.947	0.087	-0.816	MT1E,MT1X,MT2A,PIK3R1,RAP2B,SPINK1
p38 MAPK Signaling	0.943	0.0763	0	CREB5,DUSP1,FAS,HSPB1,IL1R2,IL1RN,RPS6KB2,TGFBR2,TGFBR2
Renin-Angiotensin Signaling	0.943	0.0763	0.333	FOS,ITPR2,JUN,NOX1,PIK3R1,PRKAR2A,PRKCA,RAP2B,REN
BMP signaling pathway	0.943	0.0824	0.378	BMP4,JUN,PRKAR2A,RAP2B,RUNX2,SMURF1,SOSTDC1
Airway Pathology in Chronic Obstructive Pulmonary Disease	0.943	0.0763	#NUM!	AMBP,CLCF1,CXCL1,CXCL3,CXCL8,FGF19,LCN2,LIF,TGFBR2
IL-17 Signaling	0.936	0.0695	3.051	CLCF1,CXCL1,CXCL3,CXCL8,FOS,JUN,LCN2,LIF,MAP3K14,PIK3R1,PTGS2,RAP2B,TGFBR2
Sperm Motility	0.924	0.0673	0.816	CLK1,CLK4,CNGA1,EPHA2,FER,FGFR2,FYN,ITPR2,PLAAT3,PLAAT4,PRKAR2A,PRKCA,ROR1,TNK2,TXK
Role of Hypercytokinemia/hyperchemokine in the Pathogenesis of Influenza	0.924	0.0814	2.646	CXCL3,CXCL8,EIF2AK2,IFIT3,IL1RN,IRF7,OAS3
IL-10 Signaling	0.924	0.0857	#NUM!	FOS,IL1R2,IL1RN,JUN,MAP3K14,MAP4K4
Role of IL-17A in Arthritis	0.91	0.0909	#NUM!	CXCL1,CXCL3,CXCL8,PIK3R1,PTGS2
Growth Hormone Signaling	0.903	0.0845	-0.447	CEBPA,FOS,IGF2,PIK3R1,PRKCA,RPS6KB2
Small Cell Lung Cancer Signaling	0.903	0.0845	0	CASP9,CDK6,CDKN2B,PIK3R1,PTGS2,TRAF4
Estrogen-mediated S-phase Entry	0.896	0.115	#NUM!	CCNA2,CDC25A,E2F7
Bile Acid Biosynthesis, Neutral Pathway	0.896	0.154	#NUM!	AKR1C1,AKR1C2,AKR1C3
Apelin Liver Signaling Pathway	0.896	0.115	#NUM!	COL18A1,EDN1,FAS
Thrombin Signaling	0.893	0.0673	0.577	F2R,GATA2,GATA6,GNA14,GNAI1,GNAZ,ITPR2,PIK3R1,PRKCA,RAP2B,RHOB,RHOD,RHOA,RND3
Insulin Secretion Signaling Pathway	0.889	0.0656	-2	AGO4,CREB5,EIF4A2,FYN,GNA14,ITPR2,PIK3R1,PRKAR2A,PRKCA,RPS6KB2,SEC11C,SEC61A1,SEC61B,SEC61G,SPCS3,SSR1
Erythropoietin Signaling Pathway	0.889	0.0694	0	BIRC3,CLCF1,CXCL8,FOS,IRS2,ITPR2,JUN,LIF,PIK3R1,PRKCA,RAP2B,TGFBR2
GNRH Signaling	0.889	0.0694	1.155	CREB5,EGR1,FOS,GNA14,GNAI1,HBEGF,ITPR2,JUN,MAP3K14,PRKAR2A,PRKCA,RAP2B
Basal Cell Carcinoma Signaling	0.883	0.0833	-1	BMP4,DVL1,GLI1,GLI2,GLIS2,WNT11
3-phosphoinositide Degradation	0.883	0.0705	1.508	CDC25A,DUSP1,DUSP16,DUSP2,DUSP5,INPPL1,PPFIBP2,PPP1R1B,PPP2R5B,PTPRH,RASA1
G Beta Gamma Signaling	0.879	0.0738	-1	CAV1,CAV2,GNA14,GNAI1,GNAZ,HBEGF,PRKAR2A,PRKCA,RAP2B
Ovarian Cancer Signaling	0.879	0.0719	0	CD44,DVL1,EDN1,MMP7,PIK3R1,PRKAR2A,PTGS2,RAP2B,RPS6KB2,WNT11
Neuregulin Signaling	0.879	0.0762	0.707	EREG,ERRF1,GRB7,HBEGF,PIK3R1,PRKCA,RAP2B,RPS6KB2
Acute Myeloid Leukemia Signaling	0.87	0.0787	-0.816	CEBPA,KITLG,PIK3R1,PIM1,PML,RAP2B,RPS6KB2
CTLA4 Signaling in Cytotoxic T Lymphocytes	0.87	0.0787	#NUM!	B2M,FYN,HLA-B,HLA-C,HLA-E,PIK3R1,PPP2R5B
Nicotine Degradation III	0.863	0.0877	2.236	CYP1A1,CYP2B6,CYP2S1,CYP3A5,UGT1A10 (includes others)
Methylglyoxal Degradation I	0.863	0.333	#NUM!	HAGHL
Proline Degradation	0.863	0.333	#NUM!	LOC102724788/PRODH
Thiosulfate Disproportionation III (Rhodanese)	0.863	0.333	#NUM!	TST
Glycerol-3-phosphate Shuttle	0.863	0.333	#NUM!	GPD1
Adenine and Adenosine Salvage I	0.863	0.333	#NUM!	APRT
S-adenosyl-L-methionine Biosynthesis	0.863	0.333	#NUM!	MAT2A
Non-Small Cell Lung Cancer Signaling	0.86	0.0822	-0.447	CASP9,CDK6,ITPR2,PIK3R1,PRKCA,RAP2B
Cdc42 Signaling	0.851	0.0682	1.633	B2M,CDC42EP2,EXOC8,FGD3,FOS,HLA-B,HLA-C,HLA-E,IQGAP2,JUN,RASA1,TNK2
Glycogen Degradation III	0.845	0.143	#NUM!	PGM1,PYGB
Urate Biosynthesis/Inosine 5'-phosphate Degradation	0.845	0.143	#NUM!	IMPDH1,NT5E
Regulation of Cellular Mechanics by Calpain Protease	0.842	0.0811	0	CAPN5,CAPN9,CCNA2,CDK6,CNGA1,RAP2B
D-myo-inositol (1,4,5,6)-Tetrakisphosphate Biosynthesis	0.839	0.0704	1.265	CDC25A,DUSP1,DUSP16,DUSP2,DUSP5,PPFIBP2,PPP1R1B,PPP2R5B,PTPRH,RASA1
D-myo-inositol (3,4,5,6)-tetrakisphosphate Biosynthesis	0.839	0.0704	1.265	CDC25A,DUSP1,DUSP16,DUSP2,DUSP5,PPFIBP2,PPP1R1B,PPP2R5B,PTPRH,RASA1
Cancer Drug Resistance By Drug Efflux	0.839	0.0862	#NUM!	ABCC1,ABCC2,PIK3R1,PTGS2,RAP2B
CDK5 Signaling	0.83	0.0741	0.707	EGR1,FOSB,LAMA5,PPP1R10,PPP1R1B,PPP2R5B,PRKAR2A,RAP2B
Serotonin Receptor Signaling	0.824	0.093	#NUM!	DDC,HTR1D,MAOA,MAOB
Angiotensin Signaling	0.821	0.08	1	ANGPT1,CASP9,GRB7,PIK3R1,RAP2B,RASA1
Estrogen-Dependent Breast Cancer Signaling	0.821	0.08	1.342	AKR1C1,AKR1C2,CREB5,FOS,JUN,PIK3R1,RAP2B
Role of MAPK Signaling in Inhibiting the Pathogenesis of Influenza	0.821	0.08	2.449	CXCL8,EIF2AK2,JUN,PLAAT3,PLAAT4,PTGS2
IL-1 Signaling	0.815	0.0761	1	FOS,GNA14,GNAI1,GNAZ,JUN,MAP3K14,PRKAR2A
NF- κ B Signaling	0.815	0.067	1.155	BCL10,BMP4,CARD10,EIF2AK2,FGFR2,IL1R2,IL1RN,MAP3K14,MAP4K4,PIK3R1,RAP2B,TGFBR2
Neurotrophin/TRK Signaling	0.804	0.0789	1.633	CREB5,FOS,GAB1,JUN,PIK3R1,RAP2B
Melatonin Degradation I	0.796	0.0833	2.236	CYP1A1,CYP2B6,CYP2S1,CYP3A5,UGT1A10 (includes others)
Superpathway of Citrulline Metabolism	0.796	0.133	#NUM!	ASS1,LOC102724788/PRODH
Dopamine-DARPP32 Feedback in cAMP Signaling	0.793	0.0675	0.632	ATP2A3,CAMKK1,CREB5,GNAI1,GRIN2D,ITPR2,PPP1R10,PPP1R1B,PPP2R5B,PRKAR2A,PRKCA
Role of NFAT in Regulation of the Immune Response	0.79	0.0663	-0.905	FOS,FYN,GNA14,GNAI1,GNAZ,HLA-B,ITPR2,JUN,PIK3R1,RAP2B,RCAN1,RCAN3
Type I Diabetes Mellitus Signaling	0.785	0.0721	1.342	CASP9,FAS,HLA-B,HLA-C,HLA-E,IFNGR2,IRF1,MAP3K14
ErbB Signaling	0.783	0.0745	1.89	EREG,FOS,HBEGF,JUN,PIK3R1,PRKCA,RAP2B
iNOS Signaling	0.775	0.0889	#NUM!	FOS,IFNGR2,IRF1,JUN
Glioblastoma Multiforme Signaling	0.77	0.0667	-1	CDK6,E2F7,IGF2,ITPR2,PIK3R1,RAP2B,RHOB,RHOD,RHOA,RND3,WNT11
IL-7 Signaling Pathway	0.767	0.0769	-1	BCL6,CDC25A,FYN,JUN,MCL1,PIK3R1
PI3K/AKT Signaling	0.757	0.0652	0	GAB1,GAB2,GDF15,IL15RA,IL1R2,INPPL1,MCL1,PIK3R1,PPP2R5B,PTGS2,RAP2B,RPS6KB2
IL-3 Signaling	0.75	0.0759	1.633	FOS,GAB2,JUN,PIK3R1,PRKCA,RAP2B
Communication between Innate and Adaptive Immune Cells	0.75	0.0729	#NUM!	B2M,CCL15,CXCL8,HLA-B,HLA-C,HLA-E,IL1RN
Glutaryl-CoA Degradation	0.75	0.125	#NUM!	ACAT1,CYP2S1
Androgen Biosynthesis	0.75	0.125	#NUM!	AKR1C3,SRD5A3
Spermine and Spermidine Degradation I	0.747	0.25	#NUM!	SAT1
Catecholamine Biosynthesis	0.747	0.25	#NUM!	DDC
Phenylethylamine Degradation I	0.747	0.25	#NUM!	ALDH2
Cardiac Hypertrophy Signaling	0.745	0.0625	0.535	GNA14,GNAI1,GNAZ,HSPB1,JUN,MAP3K14,PIK3R1,PRKAR2A,RAP2B,RHOB,RHOD,RHOA,RND3,TGFBR2,TGFBR2
NGF Signaling	0.74	0.0702	1.134	CREB5,GAB1,MAP3K14,PIK3R1,RAP2B,RPS6KB2,SMPD3,TRAF4
Ephrin A Signaling	0.726	0.0851	#NUM!	EFNA1,EPHA2,FYN,PIK3R1
Phagosome Maturation	0.721	0.0662	#NUM!	ATP6V1B1,B2M,CTSE,CTSS,HLA-B,HLA-C,HLA-E,NOX1,TUBA4A,TUBB2A
MSP-RON Signaling In Cancer Cells Pathway	0.71	0.0672	2.333	CREB5,ELF3,ETS1,FOS,JUN,KLK10,KLK6,PIK3R1,RAP2B
Mitochondrial L-carnitine Shuttle Pathway	0.71	0.118	#NUM!	ACSL1,CPT1A
Epithelial Adherens Junction Signaling	0.71	0.0658	#NUM!	ACVR1,EPN3,FER,LMO7,RAP2B,TGFBR2,TGFBR2,TUBA4A,TUBB2A,ZYX
Adipogenesis pathway	0.71	0.0672	#NUM!	BMP4,CEBPA,CEBPD,FGFR2,HDAC9,NR1D2,PPARG,SMAD3,TXNIP

Table S3: Pathways identification after ATRA+PDT compared to PDT.

Ingenuity Canonical Pathways	-log(p-value)	Ratio	z-score	Molecules
Airway Inflammation in Asthma	0.706	0.0938	#NUM!	CXCL8,IFNGR2,TGFB2
PDF Signaling	0.699	0.0732	0.816	CASP7,FAS,PIK3R1,PNPLA2,PPARG,RAP2B
Mitochondrial Dysfunction	0.699	0.0643	#NUM!	ACO1,ATP5MC1,ATP5MC3,BACE2,CASP9,CPT1A,DHODH,MAOA,MAOB,UQCERS1,VDAC1
CD40 Signaling	0.697	0.0769	1	FOS,JUN,MAP3K14,PIK3R1,PTGS2
Phospholipases	0.697	0.0769	1.342	LIPG,PLAAT3,PLAAT4,PLD1,PLD2
Nicotine Degradation II	0.697	0.0769	2.236	CYP1A1,CYP2B6,CYP2S1,CYP3A5,UGT1A10 (includes others)
Human Embryonic Stem Cell Pluripotency	0.697	0.0667	#NUM!	ACVR1,BMP4,DVL1,FGFR2,PIK3R1,SMAD3,TGFB2,TGFBR2,WNT11
Role of Pattern Recognition Receptors in Recognition of Bacteria and Viruses	0.686	0.0649	1.342	CLCF1,CXCL8,EIF2AK2,IFIH1,IRF7,LIF,OAS3,PIK3R1,PRKCA,TGFB2
Androgen Signaling	0.684	0.0662	0	DNAJB1,GNA14,GNAI1,GNAZ,JUN,POLR2L,PRKAR2A,PRKCA,SMAD3
LPS-stimulated MAPK Signaling	0.682	0.0723	1.633	FOS,JUN,MAP3K14,PIK3R1,PRKCA,RAP2B
Autoimmune Thyroid Disease Signaling	0.682	0.0816	#NUM!	FAS,HLA-B,HLA-C,HLA-E
mTOR Signaling	0.678	0.0619	-0.302	DDIT4,EIF4A2,PIK3R1,PLD1,PLD2,PPP2R5B,PRKCA,RAP2B,RHOB,RHOD,RHOU,RND3,RPS6KB2
Circadian Rhythm Signaling	0.678	0.0909	#NUM!	CREB5,GRIN2D,NR1D1
IL-9 Signaling	0.678	0.0909	#NUM!	BCL3,IRS2,PIK3R1
Pyrimidine Ribonucleotides Interconversion	0.678	0.0909	#NUM!	AK4,NME3,NME4
Role of NANOG in Mammalian Embryonic Stem Cell Pluripotency	0.672	0.0672	1	BMP4,DVL1,GAB1,GATA6,LIF,PIK3R1,RAP2B,WNT11
1D-myo-inositol Hexakisphosphate Biosynthesis II (Mammalian)	0.672	0.111	#NUM!	INPPL1,ITPKA
D-myo-inositol (1,3,4)-trisphosphate Biosynthesis	0.672	0.111	#NUM!	INPPL1,ITPKA
Iron homeostasis signaling pathway	0.672	0.0657	#NUM!	ABCB10,ACO1,ATP6V1B1,BMP4,CIAO3,GDF15,HEPH,SMAD3,STEAP3
FGF Signaling	0.666	0.0714	1.633	CREB5,FGF19,FGFR2,GAB1,PIK3R1,PRKCA
Serine Biosynthesis	0.662	0.2	#NUM!	PSPH
CMP-N-acetylneuraminate Biosynthesis I (Eukaryotes)	0.662	0.2	#NUM!	GNE
Lysine Degradation II	0.662	0.2	#NUM!	ALDH7A1
Lysine Degradation V	0.662	0.2	#NUM!	ALDH7A1
Trans, trans-farnesyl Diphosphate Biosynthesis	0.662	0.2	#NUM!	IDI1
Citrulline-Nitric Oxide Cycle	0.662	0.2	#NUM!	ASS1
Galactose Degradation I (Leloir Pathway)	0.662	0.2	#NUM!	GALM
Tyrosine Degradation I	0.662	0.2	#NUM!	HGD
Amyloid Processing	0.662	0.08	#NUM!	BACE2,CAPN5,CAPN9,PRKAR2A
D-myo-inositol-5-phosphate Metabolism	0.652	0.0637	1.265	CDC25A,DUSP1,DUSP16,DUSP2,DUSP5,PPFIBP2,PPP1R1B,PPP2R5B,PTPRH,RASA1
Semaphorin Neuronal Repulsive Signaling Pathway	0.65	0.0647	-0.333	CD44,CSPG4,FYN,NRP1,PIK3R1,PLXND1,PRKAR2A,SEMA3A,SEMA3E
Rac Signaling	0.648	0.0661	-0.707	CD44,IQGAP2,JUN,NOX1,PIK3R1,PIP5K1A,PLD1,RAP2B
LXR/RXR Activation	0.648	0.0661	-0.378	AMBP,APOL1,CLU,HMGCR,IL1R2,IL1RN,PTGS2,SERPINA1
Hereditary Breast Cancer Signaling	0.636	0.0643	#NUM!	CDK6,FANCF,GADD45A,GADD45B,HDAC9,PIK3R1,POLR2L,RAP2B,UBC
Granzyme A Signaling	0.636	0.105	#NUM!	H1-0,H1-10
GADD45 Signaling	0.636	0.105	#NUM!	GADD45A,GADD45B
Purine Nucleotides Degradation II (Aerobic)	0.636	0.105	#NUM!	IMPDH1,NT5E
Inhibition of ARE-Mediated mRNA Degradation Pathway	0.635	0.0656	-1.414	AGO4,PPP2R5B,PRKAR2A,PSME1,PSME2,TIA1,ZFP36,ZFP36L1
Pyrimidine Ribonucleotides De Novo Biosynthesis	0.629	0.0857	#NUM!	AK4,NME3,NME4
Natural Killer Cell Signaling	0.623	0.0609	0	B2M,COL18A1,FYN,HLA-B,HLA-C,HLA-E,HSPA1A/HSPA1B,HSPA1L,HSPA6,MAP3K14,PIK3R1,RAP2B
RhoA Signaling	0.622	0.065	0.378	CDC42EP1,CDC42EP2,PIP5K1A,PKN1,PLD1,PLEKHG5,RND3,RTKN
UVB-Induced MAPK Signaling	0.622	0.0769	1	FOS,JUN,PIK3R1,PRKCA
Gap Junction Signaling	0.613	0.0606	#NUM!	CAV1,GJB2,GNAI1,ITPR2,PIK3R1,PRKAR2A,PRKCA,RAP2B,TJP1,TJP2,TUBA4A,TUBB2A
G-Protein Coupled Receptor Signaling	0.611	0.0584	#NUM!	CREB5,DUSP1,FYN,GNA14,GNAI1,HRH1,HTR1D,PDE12,PDE9A,PIK3R1,PRKAR2A,PRKCA,RAP1GAP,RAP2B,RASA1,RGS2
Xenobiotic Metabolism General Signaling Pathway	0.604	0.0629	-0.333	ABCA2,GSTA4,MAP3K14,NQO2,PIK3R1,PRKCA,RAP2B,UGT1A10 (includes others),UGT8
Endocannabinoid Cancer Inhibition Pathway	0.604	0.0629	1.667	ATF3,CASP4,CASP7,CASP9,CREB5,GNAI1,PIK3R1,PRKAR2A,SMPD3
CD27 Signaling in Lymphocytes	0.604	0.0755	#NUM!	CASP9,FOS,JUN,MAP3K14
GP6 Signaling Pathway	0.599	0.064	-0.707	COL17A1,COL18A1,FYN,LAMA5,LAMC2,NOX1,PIK3R1,PRKCA
RANK Signaling in Osteoclasts	0.593	0.0674	0.816	BIRC3,FOS,GSN,JUN,MAP3K14,PIK3R1
Arginine Biosynthesis IV	0.592	0.167	#NUM!	ASS1
Pyruvate Fermentation to Lactate	0.592	0.167	#NUM!	LDHA
Urea Cycle	0.592	0.167	#NUM!	ASS1
Chondroitin and Dermatan Biosynthesis	0.592	0.167	#NUM!	CHPF
Ceramide Biosynthesis	0.592	0.167	#NUM!	DEGS2
Serotonin and Melatonin Biosynthesis	0.592	0.167	#NUM!	DDC
Glycerol Degradation I	0.592	0.167	#NUM!	GPD1
Ceramide Degradation	0.592	0.167	#NUM!	ACER2
Zymosterol Biosynthesis	0.592	0.167	#NUM!	MSMO1
Glycogen Biosynthesis II (from UDP-D-Glucose)	0.592	0.167	#NUM!	GYG1
Cell Cycle Regulation by BTG Family Proteins	0.583	0.0811	#NUM!	BTG1,E2F7,PPP2R5B
Ephrin B Signaling	0.58	0.0694	-2.236	CXCR4,EPHB6,GNA14,GNAI1,GNAZ
P2Y Purigenic Receptor Signaling Pathway	0.575	0.063	1.414	CREB5,FOS,GNAI1,JUN,PIK3R1,PRKAR2A,PRKCA,RAP2B
Docosahexaenoic Acid (DHA) Signaling	0.562	0.0789	#NUM!	CASP9,PIK3R1,PNPLA2
Glioma Signaling	0.558	0.0636	0	CDK6,CDKN2B,E2F7,IGF2,PIK3R1,PRKCA,RAP2B
Role of MAPK Signaling in Promoting the Pathogenesis of Influenza	0.558	0.0636	1.89	ATP6V1B1,JUN,PLAAT3,PLAAT4,PRKCA,PTGS2,RAP2B
Synaptic Long Term Potentiation	0.554	0.062	0	CREB5,GNA14,GRIN2D,ITPR2,PPP1R10,PRKAR2A,PRKCA,RAP2B
p70S6K Signaling	0.554	0.062	0	F2R,F2RL1,GNAI1,PIK3R1,PLD1,PPP2R5B,PRKCA,RAP2B
CDP-diaclyglycerol Biosynthesis I	0.545	0.0909	#NUM!	LPCAT1,MBOAT7
Inhibition of Matrix Metalloproteases	0.541	0.0769	#NUM!	HSPG2,MMP15,MMP7
IL-15 Signaling	0.536	0.0667	0.447	CXCL8,IL15RA,PIK3R1,RAP2B,RPS6KB2
Trehalose Degradation II (Trehalase)	0.536	0.143	#NUM!	HK1
Superpathway of Serine and Glycine Biosynthesis I	0.536	0.143	#NUM!	PSPH
Phosphatidylcholine Biosynthesis I	0.536	0.143	#NUM!	CHPT1
Factors Promoting Cardiogenesis in Vertebrates	0.532	0.06	-0.333	ACVR1,BMP4,CREB5,DKK1,DVL1,PRKCA,TGFB2,TGFBR2,WNT11
Melanocyte Development and Pigmentation Signaling	0.527	0.0638	-0.816	CREB5,KITLG,PIK3R1,PRKAR2A,RAP2B,RPS6KB2
RhoGDI Signaling	0.524	0.0582	0	ARHGDI1B,CD44,GNA14,GNAI1,GNAZ,PIP5K1A,PRKCA,RHOB,RHOD,RHOU,RND3
Opioid Signaling Pathway	0.524	0.0567	0.277	CREB5,FOS,FOSB,FYN,GNAI1,GRIN2D,GRK5,ITPR2,PLD2,PRKAR2A,PRKCA,RAP2B,RPS6KB2,SIGMAR1
Relaxin Signaling	0.521	0.0596	0	FOS,GNA14,GNAI1,GNAZ,JUN,PDE12,PDE9A,PIK3R1,PRKAR2A
NF-κB Activation by Viruses	0.521	0.0658	1.342	EIF2AK2,MAP3K14,PIK3R1,PRKCA,RAP2B
April Mediated Signaling	0.521	0.075	#NUM!	FOS,JUN,MAP3K14
Differential Regulation of Cytokine Production in Intestinal Epithelial Cells by IL-17A	0.519	0.087	#NUM!	CXCL1,LCN2
Superpathway of D-myo-inositol (1,4,5)-trisphosphate Metabolism	0.519	0.087	#NUM!	INPPL1,ITPKA
Tryptophan Degradation III (Eukaryotic)	0.519	0.087	#NUM!	ACAT1,CYP2S1
α-Adrenergic Signaling	0.516	0.0632	-0.447	GNAI1,ITPR2,PRKAR2A,PRKCA,PYGB,RAP2B
Th1 and Th2 Activation Pathway	0.514	0.0585	#NUM!	ACVR1,CXCR4,HLA-B,IFNGR2,IRF1,JAG2,JUN,LGALS9,PIK3R1,TGFBR2
B Cell Activating Factor Signaling	0.503	0.0732	#NUM!	FOS,JUN,MAP3K14
Phosphatidylglycerol Biosynthesis II (Non-plastidic)	0.493	0.0833	#NUM!	LPCAT1,MBOAT7
TCA Cycle II (Eukaryotic)	0.493	0.0833	#NUM!	ACO1,SUCLA2
ATM Signaling	0.492	0.0619	0	CDC25A,CREB5,GADD45A,GADD45B,JUN,PPP2R5B
STAT3 Pathway	0.492	0.0593	0.447	CDC25A,FGFR2,IL15RA,IL1R2,PIM1,RAP2B,TGFB2,TGFBR2
Bladder Cancer Signaling	0.492	0.0619	#NUM!	CXCL8,DAPK1,FGF19,MMP15,MMP7,RAP2B
Maturity Onset Diabetes of Young (MODY) Signaling	0.488	0.0667	#NUM!	APOL1,APOL2,APOL6,HNF4A

Table S3: Pathways identification after ATRA+PDT compared to PDT.

Ingenuity Canonical Pathways	-log(p-value)	Ratio	z-score	Molecules
Sphingosine and Sphingosine-1-phosphate Metabolism	0.488	0.125	#NUM!	ACER2
Sphingomyelin Metabolism	0.488	0.125	#NUM!	SMPD3
Breast Cancer Regulation by Stathmin1	0.485	0.0525	3.772	ADGRF1,ADGRG5,AURKA,CDK6,CELSR1,CREB5,E2F7,F2R,F2RL1,GPR158,GPR160,GPR35,GPR87,GPRC5A,HCAR1,HRH1,HTR1D,JUN,LGR4,NMUR2,PIK3R1,PPP1R10,PPP2R5B,PRKAR2A,PRKCA,RAP2B,SPDEF,STMN1,TGFB2,TUBA4A,TUBB2A
MIF Regulation of Innate Immunity	0.484	0.0714	#NUM!	FOS,JUN,PTGS2
BEX2 Signaling Pathway	0.483	0.0633	-0.447	BBC3,ITGB6,JUN,PPP2R5B,SWAP70
Role of NFAT in Cardiac Hypertrophy	0.479	0.0561	-0.302	GNAI1,HDAC9,ITPR2,LIF,PIK3R1,PRKAR2A,PRKCA,RAP2B,RCAN1,RCAN3,TGFB2,TGFB2R2
IL-2 Signaling	0.474	0.0656	#NUM!	FOS,JUN,PIK3R1,RAP2B
Nitric Oxide Signaling in the Cardiovascular System	0.47	0.0606	0	ATP2A3,CAV1,ITPR2,PIK3R1,PRKAR2A,PRKCA
Role of MAPK Signaling in the Pathogenesis of Influenza	0.47	0.0625	#NUM!	PLAAT3,PLAAT4,PRKCA,PTGS2,RAP2B
Role of Macrophages, Fibroblasts and Endothelial Cells in Rheumatoid Arthritis	0.469	0.0541	#NUM!	CEBPA,CEBPD,CREB5,CXCL8,DKK1,DVL1,F2RL1,FOS,IL1R2,IL1RN,JUN,MAP3K14,PIK3R1,PRKCA,RAP2B,TRAF4,WNT11
Necroptosis Signaling Pathway	0.467	0.0573	-0.333	BIRC3,CAPN5,CAPN9,DAPK1,EIF2AK2,FAS,PP1F,UBC,VDAC1
Role of IL-17F in Allergic Inflammatory Airway Diseases	0.467	0.0698	#NUM!	CREB5,CXCL1,CXCL8
Wnt/Ca+ pathway	0.46	0.0645	1	CREB5,DVL1,PRKCA,ROR1
Actin Nucleation by ARP-WASP Complex	0.458	0.0617	0.447	RAP2B,RHOB,RHOD,RHO, RND3
Role of RIG1-like Receptors in Antiviral Innate Immunity	0.451	0.0682	#NUM!	IFIH1,IRF7,TRIM25
Apelin Pancreas Signaling Pathway	0.451	0.0682	#NUM!	ERN1,PIK3R1,PRKAR2A
Neuropathic Pain Signaling In Dorsal Horn Neurons	0.449	0.0594	0	FOS,GRIN2D,ITPR2,PIK3R1,PRKAR2A,PRKCA
Sucrose Degradation V (Mammalian)	0.446	0.111	#NUM!	GALM
Citrulline Biosynthesis	0.446	0.111	#NUM!	LOC102724788/PRODH
CD28 Signaling in T Helper Cells	0.441	0.0579	0	BCL10,FOS,FYN,HLA-B,ITPR2,JUN,PIK3R1
Acute Phase Response Signaling	0.439	0.0556	2.333	AMBIP,CRABP2,FOS,IL1RN,JUN,MAP3K14,PIK3R1,RAP2B,SERPINA1,SERPINA3
SAPK/JNK Signaling	0.438	0.0588	0.816	GAB1,GADD45A,JUN,MAP4K4,PIK3R1,RAP2B
Role of PI3K/AKT Signaling in the Pathogenesis of Influenza	0.433	0.0625	#NUM!	CASP9,GNAI1,PIK3R1,PLAC8
Cardiac β -adrenergic Signaling	0.428	0.0563	-1.134	AKAP12,ATP2A3,PDE12,PDE9A,PKIB,PPP1R10,PPP2R5B,PRKAR2A
Mouse Embryonic Stem Cell Pluripotency	0.427	0.0583	-0.816	BMP4,DVL1,ID2,LIF,PIK3R1,RAP2B
Regulation of Actin-based Motility by Rho	0.427	0.0583	0.447	GSN,PIPSK1A,RHOB,RHOD,RHO, RND3
VEGF Family Ligand-Receptor Interactions	0.424	0.0595	1	FOS,NRP1,PIK3R1,PRKCA,RAP2B
IL-4 Signaling	0.412	0.0588	#NUM!	HLA-B,INPPL1,PIK3R1,RAP2B,RPS6KB2
Ketolysis	0.41	0.1	#NUM!	ACAT1
Dendritic Cell Maturation	0.409	0.0543	1	B2M,CD58,CD18A1,CREB5,HLA-B,HLA-C,HLA-E,IL1RN,MAP3K14,PIK3R1
Calcium-induced T Lymphocyte Apoptosis	0.408	0.0606	0	ATP2A3,HLA-B,ITPR2,PRKCA
Allograft Rejection Signaling	0.401	0.0581	#NUM!	B2M,FAS,HLA-B,HLA-C,HLA-E
Calcium Signaling	0.396	0.0534	-0.707	ATP2A3,ATP2B1,CAMKK1,CREB5,GRIN2D,HDAC9,ITPR2,PRKAR2A,RAP2B,RCAN1,RCAN3
Chondroitin Sulfate Biosynthesis (Late Stages)	0.39	0.0625	#NUM!	CHPF,CHST4,SULT2B1
Telomerase Signaling	0.389	0.0561	0.447	ELF3,ETS1,HDAC9,PIK3R1,PPP2R5B,RAP2B
14-3-3-mediated Signaling	0.388	0.0551	1.342	FOS,JUN,PIK3R1,PRKCA,RAP2B,TUBA4A,TUBB2A
Remodeling of Epithelial Adherens Junctions	0.384	0.0588	#NUM!	MAPRE3,TUBA4A,TUBB2A,ZYX
Endocannabinoid Neuronal Synapse Pathway	0.38	0.0547	0.447	ABHD6,FAAH,GNA14,GNAI1,GRIN2D,PRKAR2A,PTGS2
Purine Nucleotides De Novo Biosynthesis II	0.379	0.0909	#NUM!	IMPDH1
cAMP-mediated signaling	0.378	0.0524	-0.302	AKAP12,CNGA1,CREB5,DUSP1,GNAI1,HTR1D,PDE12,PDE9A,PKIB,PRKAR2A,RAP1GAP, RGS2
Hematopoiesis from Pluripotent Stem Cells	0.377	0.0612	#NUM!	CXCL8,KITLG,LIF
Cell Cycle: G2/M DNA Damage Checkpoint Regulation	0.377	0.0612	#NUM!	AURKA,GADD45A,HIPK2
Role of JAK1 and JAK3 in γ Cytokine Signaling	0.373	0.058	#NUM!	IL15RA,IRS2,PIK3R1,RAP2B
White Adipose Tissue Browning Pathway	0.372	0.0543	0.816	CREB5,FGFR2,LDHA,PPARG,PRKAR2A,RARG,SLC16A1
Crosstalk between Dendritic Cells and Natural Killer Cells	0.372	0.0562	#NUM!	FAS,HLA-B,HLA-C,HLA-E,IL15RA
OX40 Signaling Pathway	0.362	0.0556	#NUM!	B2M,HLA-B,HLA-C,HLA-E,JUN
GM-CSF Signaling	0.362	0.0571	#NUM!	ETS1,PIK3R1,PIM1,RAP2B
Assembly of RNA Polymerase I Complex	0.351	0.0833	#NUM!	TAF1A
Hematopoiesis from Multipotent Stem Cells	0.351	0.0833	#NUM!	KITLG
4-1BB Signaling in T Lymphocytes	0.338	0.0625	#NUM!	JUN,MAP3K14
GPCR-Mediated Integration of Enteroendocrine Signaling Exemplified by an L Cell	0.331	0.0548	0	GNA14,GNAI1,ITPR2,PRKAR2A
T Helper Cell Differentiation	0.331	0.0548	#NUM!	BCL6,HLA-B,IFNGR2,TGFB2R2
PKC θ Signaling in T Lymphocytes	0.33	0.0516	1.414	BCL10,FOS,FYN,HLA-B,JUN,MAP3K14,PIK3R1,RAP2B
Fatty Acid Activation	0.326	0.0769	#NUM!	ACSL1
Guanosine Nucleotides Degradation III	0.326	0.0769	#NUM!	NT5E
UDP-N-acetyl-D-galactosamine Biosynthesis II	0.326	0.0769	#NUM!	HK1
CCR5 Signaling in Macrophages	0.325	0.0532	1	FAS,FOS,GNAI1,JUN,PRKCA
Fatty Acid β -oxidation I	0.323	0.0606	#NUM!	ACAA1,ACSL1
Endocannabinoid Developing Neuron Pathway	0.321	0.0522	0.447	CREB5,GNAI1,PIK3R1,PRKAR2A,RAP1GAP,RAP2B
Hypoxia Signaling in the Cardiovascular System	0.321	0.0541	#NUM!	CREB5,EDN1,JUN,LDHA
Th2 Pathway	0.319	0.0515	-1.342	ACVR1,CXCR4,HLA-B,JAG2,JUN,PIK3R1,TGFB2R2
PTEN Signaling	0.319	0.0515	0.816	CASP9,FGFR2,INPPL1,PIK3R1,RAP2B,RPS6KB2,TGFB2R2
Transcriptional Regulatory Network in Embryonic Stem Cells	0.316	0.0556	#NUM!	GATA6,HNF4A,ZFX3
fMLP Signaling in Neutrophils	0.314	0.0517	-0.816	GNAI1,ITPR2,NOX1,PIK3R1,PRKCA,RAP2B
Role of JAK2 in Hormone-like Cytokine Signaling	0.31	0.0588	#NUM!	IRS2,SH2B3
Fc Epsilon RI Signaling	0.307	0.0513	0	FYN,GAB1,INPPL1,PIK3R1,PRKCA,RAP2B
CREB Signaling in Neurons	0.304	0.0487	1.961	ADGRF1,ADGRG5,CELSR1,CREB5,F2R,F2RL1,FGFR2,GNA14,GNAI1,GNAZ,GPR158,GPR160,GPR35,GPR87,GPRC5A,GRIN2D,HCAR1,HRH1,HTR1D,ITPR2,LGR4,NMUR2,PIK3R1,POLR2L,PRKAR2A,PRKCA,RAP2B,TGFB2,TGFB2R2
Leukotriene Biosynthesis	0.303	0.0714	#NUM!	DPEP1
Colanic Acid Building Blocks Biosynthesis	0.303	0.0714	#NUM!	TSTA3
Macropinocytosis Signaling	0.303	0.0526	#NUM!	ITGB6,PIK3R1,PRKCA,RAP2B
Nucleotide Excision Repair Pathway	0.296	0.0571	#NUM!	POLR2L,XPA
Chondroitin Sulfate Biosynthesis	0.294	0.0536	#NUM!	CHPF,CHST4,SULT2B1
Phospholipase C Signaling	0.29	0.0489	0.632	CREB5,FYN,HDAC9,ITPR2,PLD1,PLD2,PRKCA,RAP2B,RHOB,RHOD,RHO, RND3,TGM2
CNTF Signaling	0.284	0.0526	#NUM!	PIK3R1,RAP2B,RPS6KB2
Role of CHK Proteins in Cell Cycle Checkpoint Control	0.284	0.0526	#NUM!	CDC25A,E2F7,PPP2R5B
Type II Diabetes Mellitus Signaling	0.279	0.0493	-0.447	ACSL1,IRS2,MAP3K14,PIK3R1,PPARG,PRKCA,SMPD3
MSP-RON Signaling Pathway	0.275	0.0517	#NUM!	KLK10,KLK6,PIK3R1
FLT3 Signaling in Hematopoietic Progenitor Cells	0.268	0.05	1	CREB5,GAB2,PIK3R1,RAP2B
JAK/Stat Signaling	0.268	0.05	1	FOS,JUN,PIK3R1,RAP2B
Dermatan Sulfate Biosynthesis	0.265	0.0508	#NUM!	CHPF,CHST4,SULT2B1
Granzyme B Signaling	0.264	0.0625	#NUM!	CASP9
Chondroitin Sulfate Degradation (Metazoa)	0.264	0.0625	#NUM!	CEMIP
Adenosine Nucleotides Degradation II	0.264	0.0625	#NUM!	NT5E
Parkinson's Signaling	0.264	0.0625	#NUM!	CASP9
Endometrial Cancer Signaling	0.256	0.05	#NUM!	CASP9,PIK3R1,RAP2B
Gai Signaling	0.253	0.048	0.447	CAV1,GNAI1,HTR1D,PRKAR2A,RAP1GAP,RAP2B
FAK Signaling	0.249	0.0481	#NUM!	CAPN5,CAPN9,FYN,PIK3R1,RAP2B
Autophagy	0.247	0.0492	#NUM!	CTSE,CTSS,MAP1LC3B
Isoleucine Degradation I	0.246	0.0588	#NUM!	ACAT1
γ -linolenate Biosynthesis II (Animals)	0.246	0.0588	#NUM!	ACSL1
Dermatan Sulfate Degradation (Metazoa)	0.246	0.0588	#NUM!	CEMIP
D-myo-inositol (1,4,5)-trisphosphate Degradation	0.246	0.0588	#NUM!	INPPL1

Table S3: Pathways identification after ATRA+PDT compared to PDT.

Ingenuity Canonical Pathways	-log(p-value)	Ratio	z-score	Molecules
Differential Regulation of Cytokine Production in Macrophages and T Helper Cells by	0.231	0.0556	#NUM!	CXCL1
Cardiomyocyte Differentiation via BMP Receptors	0.203	0.05	#NUM!	BMP4
HOTAIR Regulatory Pathway	0	0.0437	-1.89	AGO4,CD44,IRF1,MMP15,MMP7,PIK3R1,WNT11
Synaptogenesis Signaling Pathway	0	0.0449	-1.069	CREB5,EFNA1,EPHA2,EPHB6,FYN,GRIN2D,LRP8,PIK3R1,PRKAR2A,RAP2B,RPS6KB2,SNCG,STX1A,SYT7
Antioxidant Action of Vitamin C	0	0.0459	-1	PLAAT3,PLAAT4,PLD1,PLD2,SLC23A3
Apelin Cardiomyocyte Signaling Pathway	0	0.0404	-1	ATP2A3,GNAI1,PIK3R1,PRKCA
Reelin Signaling in Neurons	0	0.041	-0.447	FYN,GRIN2D,LRP8,PDK4,PIK3R1
GPCR-Mediated Nutrient Sensing in Enteroendocrine Cells	0	0.0446	-0.447	GNA14,GNAI1,ITPR2,PRKAR2A,PRKCA
Synaptic Long Term Depression	0	0.0476	-0.333	GNA14,GNAI1,GNAZ,ITPR2,PLAAT3,PLAAT4,PPP2R5B,PRKCA,RAP2B
EIF2 Signaling	0	0.0357	0	AGO4,ATF3,EIF2AK2,EIF4A2,PIK3R1,PPP1R15A,RAP2B,WARS1
Th1 Pathway	0	0.0413	0	HLA-B,IFNGR2,IRF1,LGALS9,PIK3R1
Adrenomedullin signaling pathway	0	0.0406	0	FOS,GNA14,IL1RN,ITPR2,PIK3R1,PPARG,PRKAR2A,RAP2B
Gα12/13 Signaling	0	0.0458	0.816	F2R,F2RL1,JUN,PIK3R1,RAP2B,RASA1
Actin Cytoskeleton Signaling	0	0.0352	1.89	F2R,FGD3,FGF19,GSN,IQGAP2,PIK3R1,PIP5K1A,RAP2B
Role of BRCA1 in DNA Damage Response	0	0.0375	#NUM!	E2F7,FANCF,GADD45A
Activation of IRF by Cytosolic Pattern Recognition Receptors	0	0.0476	#NUM!	IFIH1,IRF7,JUN
Claudin-mediated Endocytosis Signaling	0	0.0466	#NUM!	AAK1,APOL1,CLU,F2R,FGF19,ITGB6,PIK3R1,SERPINA1,UBC
TREM1 Signaling	0	0.04	#NUM!	CXCL3,CXCL8,LAT2
FcγRIIB Signaling in B Lymphocytes	0	0.0267	#NUM!	PIK3R1,RAP2B
CCR3 Signaling in Eosinophils	0	0.0403	#NUM!	GNAI1,ITPR2,PIK3R1,PRKCA,RAP2B
Oncostatin M Signaling	0	0.0465	#NUM!	MT2A,RAP2B
Role of Cytokines in Mediating Communication between Immune Cells	0	0.037	#NUM!	CXCL8,IL1RN
Mechanisms of Viral Exit from Host Cells	0	0.0244	#NUM!	PRKCA
Melatonin Signaling	0	0.0417	#NUM!	GNAI1,PRKAR2A,PRKCA
Cellular Effects of Sildenafil (Viagra)	0	0.0153	#NUM!	ITPR2,PRKAR2A
Agrin Interactions at Neuromuscular Junction	0	0.0429	#NUM!	DVL1,JUN,RAP2B
ICOS-COSL Signaling in T Helper Cells	0	0.045	#NUM!	GAB2,HLA-B,ITPR2,PIK3R1,PLEKHA2
Lipid Antigen Presentation by CD1	0	0.0385	#NUM!	B2M
Mitotic Roles of Polo-Like Kinase	0	0.0455	#NUM!	CDC25A,PLK3,PPP2R5B
DNA Methylation and Transcriptional Repression Signaling	0	0.0286	#NUM!	DNMT3A
Antiproliferative Role of Somatostatin Receptor 2	0	0.026	#NUM!	PIK3R1,RAP2B
Role of Oct4 in Mammalian Embryonic Stem Cell Pluripotency	0	0.0435	#NUM!	CCNF,NR5A2
Melanoma Signaling	0	0.04	#NUM!	PIK3R1,RAP2B
Prostate Cancer Signaling	0	0.044	#NUM!	CASP9,CREB5,PIK3R1,RAP2B
Primary Immunodeficiency Signaling	0	0.02	#NUM!	TAP2
Systemic Lupus Erythematosus Signaling	0	0.0349	#NUM!	FOS,HLA-B,HLA-C,HLA-E,IL1RN,JUN,PIK3R1,RAP2B
PAK Signaling	0	0.0189	#NUM!	PIK3R1,RAP2B
Altered T Cell and B Cell Signaling in Rheumatoid Arthritis	0	0.0444	#NUM!	FAS,HLA-B,IL1RN,MAP3K14
Regulation of eIF4 and p70S6K Signaling	0	0.0301	#NUM!	AGO4,EIF4A2,PIK3R1,PPP2R5B,RAP2B
Leptin Signaling in Obesity	0	0.027	#NUM!	PIK3R1,PRKAR2A
B Cell Development	0	0.0278	#NUM!	HLA-B
Role of Wnt/GSK-3β Signaling in the Pathogenesis of Influenza	0	0.0385	#NUM!	DVL1,NCOA3,WNT11
Nur77 Signaling in T Lymphocytes	0	0.0441	#NUM!	CASP9,HDAC9,PRKCA
MIF-mediated Glucocorticoid Regulation	0	0.0294	#NUM!	PTGS2
Cell Cycle Control of Chromosomal Replication	0	0.0179	#NUM!	CDK6
Assembly of RNA Polymerase II Complex	0	0.02	#NUM!	POLR2L
IL-17A Signaling in Airway Cells	0	0.0462	#NUM!	CXCL1,CXCL3,PIK3R1
Role of JAK1, JAK2 and TYK2 in Interferon Signaling	0	0.0417	#NUM!	IFNGR2
Paxillin Signaling	0	0.0278	#NUM!	ITGB6,PIK3R1,RAP2B
nNOS Signaling in Skeletal Muscle Cells	0	0.0244	#NUM!	SNTB1
ErbB2-ErbB3 Signaling	0	0.0462	#NUM!	JUN,PIK3R1,RAP2B
ErbB4 Signaling	0	0.0448	#NUM!	PIK3R1,PRKCA,RAP2B
Netrin Signaling	0	0.0308	#NUM!	ABLIM1,PRKAR2A
Heparan Sulfate Biosynthesis	0	0.038	#NUM!	AADAC,CHST4,SULT2B1
Thyroid Hormone Metabolism II (via Conjugation and/or Degradation)	0	0.0263	#NUM!	UGT1A10 (includes others)
Heparan Sulfate Biosynthesis (Late Stages)	0	0.0417	#NUM!	AADAC,CHST4,SULT2B1
tRNA Splicing	0	0.0455	#NUM!	PDE12,PDE9A
NAD Salvage Pathway II	0	0.0385	#NUM!	NT5E
D-myo-inositol (1,4,5)-Trisphosphate Biosynthesis	0	0.04	#NUM!	PIP5K1A
Glutathione-mediated Detoxification	0	0.0312	#NUM!	GSTA4
tRNA Charging	0	0.0256	#NUM!	WARS1
Dermatan Sulfate Biosynthesis (Late Stages)	0	0.0435	#NUM!	CHST4,SULT2B1
Glycolysis I	0	0.0385	#NUM!	PFKM
Gluconeogenesis I	0	0.0385	#NUM!	ME1
Methionine Degradation I (to Homocysteine)	0	0.0455	#NUM!	MAT2A
Superpathway of Methionine Degradation	0	0.027	#NUM!	MAT2A
Gas Signaling	0	0.0374	#NUM!	CNGA1,CREB5,PRKAR2A,RGS2
Cysteine Biosynthesis III (mammalia)	0	0.0417	#NUM!	MAT2A
Role of p14/p19ARF in Tumor Suppression	0	0.0345	#NUM!	PIK3R1
Vitamin-C Transport	0	0.0417	#NUM!	GJB2
Oxidative Phosphorylation	0	0.0275	#NUM!	ATP5MC1,ATP5MC3,UQCRCF1
GABA Receptor Signaling	0	0.0211	#NUM!	GABRP,UBC
Phototransduction Pathway	0	0.0385	#NUM!	CNGA1,PRKAR2A
Glutamate Receptor Signaling	0	0.0175	#NUM!	GRIN2D
Notch Signaling	0	0.027	#NUM!	JAG2
VEGF Signaling	0	0.0303	#NUM!	PIK3R1,PRKCA,RAP2B
Gustation Pathway	0	0.0323	#NUM!	ASIC1,ITPR2,PDE12,PDE9A,PRKAR2A
Phagosome Formation	0	0.0451	#NUM!	PIK3R1,PRKCA,RHOB,RHOD,RHOU,RND3
NER Pathway	0	0.0194	#NUM!	POLR2L,XPA
Apelin Cardiac Fibroblast Signaling Pathway	0	0.0435	#NUM!	TGFB2
Apelin Adipocyte Signaling Pathway	0	0.0366	#NUM!	GNAI1,NOX1,PRKAR2A
IL-23 Signaling Pathway	0	0.0227	#NUM!	PIK3R1
Kinetochore Metaphase Signaling Pathway	0	0.0297	#NUM!	INCENP,PPP1R10,PPP2R5B
Complement System	0	0.027	#NUM!	CD55