Table S22 - IPA biological functions of the MII to 8-Celll mega-group

Categories	Functions Annotation	p-value[a]	Z-score[b]	Activation State	Total DEGs
Cell Death and Survival	Cell viability of tumor cell lines	1.29E-05	5.609	Activated	147
Cell Death and Survival	Cell survival	5.32E-08	5.427	Activated	241
Cell Death and Survival	Cell viability	1.20E-06	5.186	Activated	222
Cell Death and Survival	Cell viability of colorectal cancer cell lines	2.51E-04	4.101	Activated	29
Cell Death and Survival	Cell viability of myeloma cell lines	4.81E-06	3.876	Activated	24
Cellular Development, Cellular Growth and Proliferation	Cell proliferation of tumor cell lines	1.92E-10	3.773	Activated	280
Cell Cycle, DNA Replication, Recombination, and Repair	Homologous recombination	1.11E-04	3.579	Activated	21
DNA Replication, Recombination, and Repair	Recombination	9.42E-05	3.554	Activated	27
Cell Cycle, DNA Replication, Recombination, and Repair	DNA recombination	1.24E-04	3.554	Activated	26
Cellular Growth and Proliferation, Embryonic Development	Pluripotency of embryonic cell lines	6.37E-08	3.463	Activated	16
Cellular Growth and Proliferation	Pluripotency of cells	4.24E-07	3.349	Activated	18
Cell Cycle, DNA Replication, Recombination, and Repair	Homologous recombination of cells	9.45E-06	3.3	Activated	18
Cellular Development, Cellular Growth and Proliferation	Cell proliferation of breast cancer cell lines	3.33E-06	3.14	Activated	86
Cellular Growth and Proliferation, Embryonic Development	Pluripotency of embryonic stem cell lines	7.46E-07	2.874	Activated	12
Cell Death and Survival	Cell death	9.58E-15	-2.797	Inhibited	482
Cellular Development, Cellular Growth and Proliferation, Embryonic Development, Organismal Development	Proliferation of embryonic stem cells	1.18E-03	2.728	Activated	11
Cellular Growth and Proliferation	Colony formation of cells	2.93E-03	2.685	Activated	78
Organismal Survival	Organismal death	3.32E-03	-2.641	Inhibited	181
Gene Expression	Repression of RNA	5.58E-06	2.617	Activated	37
Protein Synthesis	Metabolism of protein	1.07E-08	2.61	Activated	87
Cellular Growth and Proliferation	Colony formation	2.82E-03	2.535	Activated	86
Cell Morphology, Connective Tissue Development and Function	Shape change of fibroblast cell lines	4.20E-03	2.53	Activated	16
Cell Cycle	Mitosis of tumor cell lines	1.28E-03	2.377	Activated	25
Cell Death and Survival	Necrosis	9.73E-13	-2.336	Inhibited	413
Gene Expression	Transactivation	1.92E-03	2.308	Activated	84
Cellular Development, Cellular Growth and Proliferation, Connective Tissue Development and Function	Proliferation of fibroblast cell lines	7.58E-05	2.287	Activated	72
RNA Post-Transcriptional Modification	Processing of RNA	8.15E-04	2.242	Activated	15
Cellular Assembly and Organization, Cellular Function and Maintenance	Formation of ribosome	3.20E-03	2.236	Activated	5
RNA Post-Transcriptional Modification	Processing of rRNA	1.08E-04	2.219	Activated	7
Gene Expression	Replication of RNA	2.20E-03	2.144	Activated	5
Cellular Assembly and Organization, Cellular Function and Maintenance, Tissue Development	Formation of microtubules	1.06E-03	-2.137	Inhibited	14
Protein Synthesis	Synthesis of protein	2.76E-10	2.085	Activated	70
Cell Cycle	Cell cycle progression of connective tissue cells	1.11E-03	1.982	Activated	12
Molecular Transport, RNA Trafficking	Export of RNA	1.87E-03	1.982	Activated	7
Cellular Assembly and Organization, Cellular Function and Maintenance	Organization of microtubules	4.51E-03	-1.982	Inhibited	9
Cell Cycle	Mitosis of cervical cancer cell lines	3.54E-03	1.98	Activated	18
Cell Cycle	G1 phase of breast cancer cell lines	3.14E-03	1.98	Activated	11
Gene Expression	Transcription	5.06E-07	1.896		141
Cell Cycle	Cell cycle progression	3.60E-06	1.882		136
Cellular Growth and Proliferation, Connective Tissue Development and Function, Tissue Development	Colony formation of fibroblast cell lines	3.16E-03	1.859		17
Gene Expression	Expression of RNA	1.83E-06	1.806		149

Gene Expression	Transactivation of RNA	2.12E-03	1.804	79
Cell Death and Survival	Cell death of colorectal cancer cell lines	6.83E-04	-1.696	49
Cellular Development	Differentiation of neuroblastoma cell lines	2.70E-03	-1.6	11
Cell Cycle	Interphase	1.73E-07	1.573	114
Cell Death and Survival	Cell death of skin cancer cell lines	3.90E-03	1.501	7
Cell Death and Survival	Apoptosis of skin cancer cell lines	2.53E-03	1.501	6
Cell Morphology, Cellular Function and Maintenance, Embryonic Development	Autophagy of embryonic cell lines	2.78E-03	1.477	12
Protein Synthesis	Production of cytokine	4.81E-03	1.451	8
Cell Death and Survival	Cell death of central nervous system cells	2.32E-03	1.45	46
Cell Death and Survival	Apoptosis	4.66E-09	-1.445	349
Cellular Assembly and Organization, Cellular Function and Maintenance	Nucleation of microtubules	7.95E-04	-1.387	8
Cell Cycle	G2/M phase	2.37E-05	1.362	37
Molecular Transport, Protein Trafficking	Import of protein	4.50E-03	1.342	5
Cell Cycle	Interphase of breast cancer cell lines	4.69E-03	1.331	17
Carbohydrate Metabolism, Molecular Transport, Small Molecule Biochemistry	Transport of 2-deoxyglucose	2.13E-03	1.309	8
Cellular Assembly and Organization	Quantity of lipid droplets	2.39E-03	1.303	14
Cell Death and Survival	Cell death of cervical cancer cell lines	6.12E-09	1.302	77
Cellular Development, Cellular Growth and Proliferation, Embryonic Development	Proliferation of embryonic cell lines	2.83E-03	1.242	43
Cellular Assembly and Organization	Formation of nucleus	4.17E-03	1.226	12
Gene Expression	Transcription of RNA	6.31E-06	1.219	130
Cell Cycle	G1 phase of tumor cell lines	2.86E-05	1.166	44
Cell Death and Survival, Renal and Urological System Development and Function	Cell viability of kidney cell lines	1.57E-04	1.138	18
Cellular Development, Cellular Growth and Proliferation	Cell proliferation of ovarian cancer cell lines	1.31E-04	1.088	27
Cell Death and Survival, Embryonic Development	Cell viability of embryonic cell lines	6.80E-04	1.082	21
Cellular Growth and Proliferation, Tissue Development	Proliferation of airway epithelial cells	3.94E-04	1.076	6
DNA Replication, Recombination, and Repair, Energy Production, Nucleic Acid Metabolism, Small Molecule Biochemistry	Hydrolysis of ATP	3.50E-03	1.066	10
Cardiovascular System Development and Function, Organ Development, Organ Morphology, Skeletal and Muscular System Development and Function	Contraction of cardiac muscle	5.32E-03	-1.066	9
Cell Cycle	Interaction of DNA	6.94E-04	1.065	81
Cell Cycle, Gene Expression	Binding of DNA	9.04E-04	1.033	79
Cell Cycle	Cell division of tumor cell lines	3.85E-04	1	7
Cell Cycle	Interphase of tumor cell lines	4.80E-06	0.993	72
Cell Death and Survival	Cell death of tumor cell lines	7.32E-16	-0.984	290
Cell Death and Survival	Apoptosis of hepatoma cell lines	4.29E-03	-0.976	26
Cell Cycle	G2/M phase of tumor cell lines	1.75E-03	0.97	18
Cell Death and Survival	Cell death of breast cancer cell lines	8.44E-06	0.945	64
DNA Replication, Recombination, and Repair, Nucleic Acid Metabolism, Small Molecule Biochemistry	Hydrolysis of nucleotide	1.69E-03	0.934	21
Cell Death and Survival	Apoptosis of synovial cells	6.71E-04	0.931	11
Cell Cycle, Connective Tissue Development and Function	Mitosis of fibroblast cell lines	4.45E-04	0.915	9
Cell Cycle	G1 phase	2.08E-05	0.913	66
Cellular Assembly and Organization	Nucleation of filaments	2.65E-03	-0.896	9
Cardiovascular System Development and Function, Organ Development, Organ Morphology	Contraction of heart ventricle	2.53E-03	-0.896	6
Cell Death and Survival	Apoptosis of cervical cancer cell lines	2.74E-05	0.891	54
Cell Death and Survival	Cell death of sarcoma cell lines	4.72E-03	-0.878	36
Cellular Development	Differentiation of tumor cell lines	1.25E-04	-0.861	63
Cellular Movement	Invasion of stem cells	1.08E-03	0.849	4
Cell Morphology, Cellular Function and Maintenance	Autophagy of cells	3.09E-03	0.814	40

Protein Synthesis	Translation	1.20E-06	0.8	31
Cell Morphology, Skeletal and Muscular System Development and Function	Contraction of muscle cells	3.14E-03	-0.784	11
Cell-To-Cell Signaling and Interaction	Response of splenocytes	4.42E-03	0.763	6
Cell Death and Survival, Hair and Skin Development and Function	Cell viability of epithelial cell lines	1.47E-03	0.757	19
Cell Cycle	Interphase of carcinoma cell lines	2.59E-03	0.728	15
Cell Cycle	G2 phase	4.57E-05	0.705	45
Cellular Movement	Release of blood cells	1.32E-03	-0.692	6
Cell Death and Survival	Cell death of hepatoma cell lines	1.10E-03	-0.67	31
Cell Cycle	Cleavage of tumor cell lines	2.55E-04	0.64	9
Cellular Assembly and Organization	Density of mitochondria	4.50E-03	0.607	5
Cell Death and Survival	Apoptosis of tumor cell lines	3.07E-10	-0.577	217
Cell Death and Survival	Apoptosis of embryonic cancer cell lines	1.39E-04	0.557	6
Cell Death and Survival	Apoptosis of carcinoma cell lines	3.53E-03	0.517	45
Cellular Development, Cellular Growth and Proliferation	Cell proliferation of carcinoma cell lines	4.19E-03	0.493	64
Cell-mediated Immune Response, Cellular Development, Cellular Function and Maintenance, Cellular Growth and Proliferation, Embryonic Development, Hematological System Development and Function, Hematopoiesis, Lymphoid Tissue Structure and Development, Organ Development, Organismal Development, Tissue Development	Production of natural killer precursor cells	2.02E-03	0.492	4
Cellular Assembly and Organization, Tissue Development	Formation of filaments	5.42E-04	-0.468	50
Protein Synthesis	Expression of protein	3.03E-06	0.457	42
Cellular Assembly and Organization, Tissue Development	Fibrogenesis	6.60E-04	-0.406	54
Protein Synthesis	Translation of protein	1.99E-05	0.328	27
Cell Death and Survival	Apoptosis of synovial fibroblasts	1.06E-03	0.29	7
Cellular Assembly and Organization	Formation of cytoskeleton	6.86E-04	-0.289	47
Cell Cycle	Aneuploidy of embryonic cell lines	2.02E-03	0.254	4
Cellular Assembly and Organization	Development of cytoplasm	1.45E-05	0.218	61
Cellular Movement	Invasion of stomach cancer cell lines	4.42E-03	0.218	6
Cellular Growth and Proliferation, Hematological System Development and Function	Inhibition of dendritic cells	5.34E-03	0.218	4
Cell-To-Cell Signaling and Interaction, Connective Tissue Development and Function	Activation of fibroblasts	2.98E-03	-0.205	10
Cell Cycle	G2 phase of tumor cell lines	3.00E-04	0.196	28
Cellular Movement	Release of cells	3.98E-03	-0.168	8
Cell Death and Survival	Cell death of pheochromocytoma cell lines	1.15E-03	0.16	21
Cell Cycle, Embryonic Development	Mitosis of embryonic cell lines	1.06E-03	0.152	7
Behavior	Limb clasping	3.20E-03	0.152	5
Cell Death and Survival	Cell death of connective tissue cells	2.22E-03	-0.117	86
Cell Death and Survival	Cell death of melanoma cell lines	1.53E-05	0.107	47
Protein Synthesis	Elongation of protein	3.73E-05	0.083	4
Cell Death and Survival	Cell death of bone cancer cell lines	3.51E-03	-0.08	30
Cell Death and Survival	Apoptosis of breast cancer cell lines	6.18E-05	0.079	53
Cell Cycle	Mitosis	4.06E-05	0.036	64
Cellular Development, Cellular Growth and Proliferation	Proliferation of lung cancer cell lines	2.38E-03	-0.023	44
Cell Cycle	Arrest in interphase	2.30E-05		76
Cell Cycle	Arrest in interphase of tumor cell lines	5.10E-04		48
Cell Cycle	Arrest in cell cycle progression	2.32E-03		46
Cell Cycle	Arrest in G1 phase	4.87E-03		41
Cell Morphology	Morphology of tumor cell lines	4.79E-03		39
Cell Cycle	Arrest in G2 phase	1.13E-04		34
Cell Cycle	Arrest in G1 phase of tumor cell lines	3.46E-03		29

Cell Cycle	Arrest in G2/M phase	6.33E-05	21
Cell Cycle	Arrest in G2 phase of tumor cell lines	2.24E-03	21
Cell Cycle	Arrest in G2/M phase of tumor cell lines	3.44E-03	14
Cell Morphology, Hair and Skin Development and Function	Morphology of epithelial cell lines	1.60E-03	13
Cell Cycle, Embryonic Development	Cell cycle progression of embryonic cell lines	1.67E-03	11
Cell Cycle	Cell cycle progression of bone cancer cell lines	2.28E-04	11
Cell Cycle, Cell Morphology, Cellular Assembly and Organization, DNA Replication, Recombination, and Repair	Morphology of chromosomes	1.41E-03	11
Cell Cycle	G1 phase of carcinoma cell lines	2.88E-04	11
Cell Cycle	Delay in mitosis	6.25E-05	11
Cell Cycle, Connective Tissue Development and Function	Cell cycle progression of fibroblasts	3.50E-03	10
Cellular Development, Cellular Growth and Proliferation, Connective Tissue Development and Function	Arrest in proliferation of fibroblast cell lines	2.52E-03	10
Cell Cycle	Delay in cell cycle progression	2.65E-03	9
Cell Cycle	Cell cycle progression of cervical cancer cell lines	3.81E-03	9
Cell Cycle	G1 phase of lung cancer cell lines	3.19E-03	9
Cellular Assembly and Organization	Regulation of mitochondria	7.95E-04	8
Cell Cycle, Connective Tissue Development and Function	G2 phase of fibroblast cell lines	3.98E-03	8
Cell Cycle	Exit from interphase	1.04E-03	8
Cell Cycle	Exit from G1 phase	3.72E-05	7
Cell Cycle	G1 phase of epithelial cells	2.53E-03	6
Cell Cycle	Interphase of lung cell lines	4.42E-03	6
Cell Cycle	G2/M phase of colorectal cancer cell lines	3.20E-03	5
Cell Cycle, Embryonic Development	G2/M phase of embryonic cell lines	4.50E-03	5
Cell Cycle	G1 phase of epidermal cells	5.34E-03	4
Nucleic Acid Metabolism, Small Molecule Biochemistry	Synthesis of nucleoside 5'-phosphate	4.93E-04	4
Cell Cycle	Arrest in cleavage of cells	1.08E-03	4
Cell Cycle, Connective Tissue Development and Function	Delay in cell cycle progression of fibroblast cell lines	4.93E-04	4
Cell Cycle, Skeletal and Muscular System Development and Function	Arrest in cell cycle progression of muscle cells	3.42E-03	4
Cellular Development, Cellular Growth and Proliferation, Tissue Development	Proliferation of bronchial epithelial cells	1.08E-03	4
Lipid Metabolism, Small Molecule Biochemistry, Vitamin and Mineral Metabolism	Catabolism of sterol	2.02E-03	4
Cellular Development	Maturation of oligodendrocyte precursor cells	4.93E-04	4
Lipid Metabolism, Molecular Transport, Small Molecule Biochemistry	Quantity of ursodeoxycholic acid	4.78E-04	3
Organ Morphology, Organismal Development, Reproductive System Development and Function	Size of preantral follicle	4.24E-03	3
Cell Death and Survival, Cellular Function and Maintenance	Clearance of nontypeable Haemophilus influenzae strain 12	1.80E-03	3
Cellular Development, Cellular Growth and Proliferation, Embryonic Development, Hematopoiesis, Lymphoid Tissue Structure and Development, Organ Development, Organismal Development, Tissue Development	Development of type 3 innate lymphoid cells	1.80E-03	3
Cellular Assembly and Organization	Binding of chromosomes	1.80E-03	3
Cellular Assembly and Organization	Quantity of ribosome	4.24E-03	3
Cell Cycle, Gene Expression	Binding of KIF5 binding site	4.78E-04	3
Gene Expression	Synthesis of 47s pre-rRNA	4.78E-04	3
DNA Replication, Recombination, and Repair, RNA Post-Transcriptional Modification	Annealing of hnRNA	4.78E-04	3
Molecular Transport, Protein Trafficking	Import of green fluorescent protein	1.80E-03	3

Nucleic Acid Metabolism, Small Molecule Biochemistry	Synthesis of ribonucleoside monophosphate	1.80E-03	3
Cellular Movement	Migratory capacity of melanoma cell lines	4.78E-04	3
Tissue Morphology	Quantity of Staphylococcus aureus	1.80E-03	3
Tissue Morphology	Quantity of Salmonella enterica serovar Typhimurium C5 strain	1.80E-03	3
Cell Cycle	Arrest in G2/M phase transition of lung cancer cell lines	4.24E-03	3
Cell Cycle	G2/M phase transition of breast cancer cell lines	4.24E-03	3
Cellular Growth and Proliferation, Hematological System Development and Function	Inhibition of bone marrow-derived dendritic cells	4.78E-04	3

a) The p-value: statistical overlap of differentially expressed gene list and gene set
b) Z-score: z>1.96 to be significantly activated or increased, and those with z< −1.96 to be significantly inhibited