

Table S17 - IPA biological functions of the combined EGA1-EGA2 super-groups

Categories	Functions Annotation	p-value <sup>a</sup>	Z-score <sup>b</sup>	Activation State	Total DEGs
Cell Cycle, DNA Replication, Recombination, and Repair	Homologous recombination of cells	1.17E-06	4.123	Activated	17
Gene Expression	Repression of RNA	6.97E-06	4.046	Activated	31
Cell Death and Survival	Cell viability of colorectal cancer cell lines	4.94E-05	4.04	Activated	26
Cellular Growth and Proliferation, Embryonic Development	Pluripotency of embryonic cell lines	1.56E-10	3.97	Activated	17
Cellular Growth and Proliferation	Pluripotency of cells	1.12E-09	3.855	Activated	19
Cellular Growth and Proliferation, Embryonic Development	Pluripotency of embryonic stem cell lines	4.36E-08	3.381	Activated	12
Protein Synthesis	Synthesis of protein	4.69E-13	3.23	Activated	65
Cellular Development, Cellular Growth and Proliferation, Embryonic Development, Organismal Development	Proliferation of embryonic stem cells	5.81E-04	3.138	Activated	10
Cell Morphology, Connective Tissue Development and Function	Shape change of fibroblast cell lines	2.42E-03	3.121	Activated	14
Cellular Development, Embryonic Development, Organismal Development, Tissue Development	Differentiation of embryonic tissue	1.95E-03	2.61	Activated	30
Cell Morphology, Cellular Function and Maintenance	Autophagy of tumor cell lines	1.84E-03	2.543	Activated	23
Cellular Growth and Proliferation	Pluripotency of fibroblast cell lines	1.48E-04	2.406	Activated	6
Cell Cycle	G2/M phase	1.29E-06	2.354	Activated	34
Protein Synthesis	Translation	8.39E-10	2.267	Activated	32
Cellular Assembly and Organization, Cellular Function and Maintenance	Formation of ribosome	9.36E-05	2.236	Activated	6
RNA Post-Transcriptional Modification	Processing of rRNA	2.01E-05	2.219	Activated	7
DNA Replication, Recombination, and Repair, Energy Production, Nucleic Acid Metabolism, Small Molecule Biochemistry	Hydrolysis of ATP	2.03E-03	2.138	Activated	9
Cellular Growth and Proliferation	Accumulation of tumor cell lines	3.59E-03	-2.138	Inhibited	9
Cellular Development, Cellular Growth and Proliferation	Cell proliferation of carcinoma cell lines	2.56E-04	2.118	Activated	57
RNA Post-Transcriptional Modification	Processing of RNA	6.50E-04	2.058	Activated	13
Molecular Transport, RNA Trafficking	Export of RNA	3.97E-04	1.982	Activated	7
Cell Cycle	Cell cycle progression of connective tissue cells	4.43E-04	1.982	Activated	11
Cell Cycle	G1 phase of breast cancer cell lines	1.49E-03	1.98	Activated	10
Cell Death and Survival	Cell death of colorectal cancer cell lines	7.41E-04	-1.93		40
Cell-To-Cell Signaling and Interaction, Hair and Skin Development and Function	Aggregation of epithelial cell lines	3.97E-04	1.929		4
Cell Cycle	Cleavage of tumor cell lines	4.27E-06	1.89		10
Cell Cycle	G1 phase of tumor cell lines	4.94E-05	1.869		36
Cell Death and Survival, Renal and Urological System Development and Function	Cell viability of kidney cell lines	8.50E-04	1.863		14
Protein Synthesis	Translation of protein	1.43E-07	1.7		27
Cell Cycle	G2/M phase of tumor cell lines	7.39E-04	1.698		16
Cell Death and Survival, Cellular Development, Cellular Function and Maintenance, Cellular Growth and Proliferation, Embryonic Development, Organismal Development, Tissue Development	Self-renewal of neural stem cells	3.12E-03	1.673		6
Cellular Development	Differentiation of embryonic cancer cell lines	2.49E-03	1.673		6
Molecular Transport, Protein Trafficking	Internalization of protein	2.74E-03	1.664		8
Cell Death and Survival	Cell death of melanoma cell lines	1.75E-05	-1.497		39

Cell Death and Survival, Embryonic Development	Cell viability of embryonic cell lines	5.05E-04	1.478	18
Cell Death and Survival	Cell viability of gastrointestinal stromal tumor cell lines	3.50E-03	1.432	5
Cell Death and Survival, Hair and Skin Development and Function	Cell viability of epithelial cell lines	1.47E-03	1.401	16
Cell Cycle	Cell division of tumor cell lines	7.09E-06	1.342	8
Cell Death and Survival	Apoptosis of carcinoma cell lines	1.13E-04	-1.204	42
Cellular Assembly and Organization	Fusion of mitochondria	1.00E-03	1.165	5
Cell Morphology, Cellular Function and Maintenance	Mitochondrial membrane potential	3.08E-03	-1.153	4
Cellular Assembly and Organization, DNA Replication, Recombination, and Repair	Stabilization of chromosomes	3.12E-03	1.133	6
Cell-To-Cell Signaling and Interaction	Aggregation of carcinoma cell lines	3.08E-03	1.07	4
Cell Death and Survival, Organismal Survival	Survival of yeast	2.66E-03	1.067	5
Cell Death and Survival	Cell death of megakaryocytes	2.06E-03	0.988	4
Cell Cycle	Initiation of S phase	2.53E-03	0.913	7
Cell Death and Survival	Cell death of central nervous system cells	3.10E-03	0.837	37
Cellular Development, Cellular Growth and Proliferation	Proliferation of lung cancer cell lines	1.43E-06	0.831	46
Cell Cycle	Interphase of fibroblast cell lines	4.65E-05	0.786	22
Gene Expression, RNA Post-Transcriptional Modification	Binding of RNA	3.05E-03	0.728	7
Cell Death and Survival	Cell death of sarcoma cell lines	4.18E-04	-0.63	33
Cell Cycle, Connective Tissue Development and Function	Mitosis of fibroblast cell lines	3.87E-04	0.626	8
Cellular Compromise	Degradation of mitochondria	3.59E-03	0.624	9
Cell Cycle, Connective Tissue Development and Function	Entry into S phase of fibroblast cell lines	3.12E-03	0.555	6
Cell Cycle	G2 phase of tumor cell lines	1.82E-04	0.513	24
Cell Cycle	Interphase of colorectal cancer cell lines	1.63E-03	0.391	14
Cell Cycle, Connective Tissue Development and Function	G1 phase of fibroblast cell lines	4.13E-04	0.378	14
Cell Death and Survival	Cell death of bone cancer cell lines	1.36E-03	0.366	26
Cell Death and Survival	Cell death of stem cells	1.15E-03	-0.332	15
Cell Cycle	Aneuploidy of embryonic cell lines	7.56E-04	0.254	4
Cellular Movement	Invasion of stomach cancer cell lines	1.57E-04	-0.2	7
Cellular Compromise	Dysfunction of mitochondria	8.18E-04	0.154	11
Cellular Assembly and Organization, DNA Replication, Recombination, and Repair	Amplification of centrosome	1.29E-03	0	10
Cell Cycle, Renal and Urological System Development and Function	Initiation of S phase of kidney cell lines	3.63E-03		2
Cell Death and Survival	Cell death of spleen-derived dendritic cells	3.63E-03		2
Cell Cycle	Delay in cell cycle progression	1.96E-03		8
Cellular Growth and Proliferation, Reproductive System Development and Function	Cytostasis of gonadal cell lines	3.63E-03		2
Cellular Assembly and Organization, Cellular Function and Maintenance	Elongation of Nucleus	3.63E-03		2
Amino Acid Metabolism, Small Molecule Biochemistry	Catabolism of glutamine	3.63E-03		2
Cell Cycle	Arrest in G1 phase	3.39E-03		34
Cell Cycle	Arrest in G1 phase of tumor cell lines	1.54E-03		25
Cell Cycle, Connective Tissue Development and Function	Cell cycle progression of fibroblasts	4.89E-04		10
Carbohydrate Metabolism, Molecular Transport	Transport of monocarboxylic acid	4.38E-04		5

Cell Cycle	Arrest in interphase of tumor cell lines	8.39E-05	42
Cell-To-Cell Signaling and Interaction	Aggregation of skin cell lines	8.35E-04	3
Cell Cycle	Cell cycle progression of bone cancer cell lines	2.74E-03	8
Cell Cycle	G2/M phase of colorectal cancer cell lines	1.00E-03	5
Cell-To-Cell Signaling and Interaction, Connective Tissue Development and Function	Reactivation of fibroblasts	3.63E-03	2
Cell Morphology, Hair and Skin Development and Function	Morphology of epithelial cell lines	1.84E-03	11
Cell Cycle	Arrest in G2/M phase transition of tumor cell lines	3.05E-03	7
Cell Cycle	Arrest in cell division of tumor cell lines	3.63E-03	2
Cell Cycle	Arrest in G2 phase	1.02E-05	31
Lipid Metabolism, Small Molecule Biochemistry	Production of C18-ceramide	8.35E-04	3
Cell Cycle	Arrest in G2/M phase of tumor cell lines	2.93E-03	12
Cell Cycle, Connective Tissue Development and Function	Delay in cell cycle progression of fibroblast cell lines	1.79E-04	4
Cell Cycle	Arrest in G2/M phase	6.00E-05	18
Cellular Assembly and Organization	Quantity of ribosome	1.99E-03	3
Cellular Development, Cellular Growth and Proliferation, Connective Tissue Development and Function	Arrest in proliferation of fibroblast cell lines	1.49E-03	9
Cellular Response to Therapeutics	Radioresistance of hepatoma cell lines	3.63E-03	2
Cell Death and Survival	Killing of bone marrow-derived dendritic cells	3.63E-03	2
Protein Synthesis	Elongation of protein	8.35E-04	3
Cell Cycle, Gene Expression	Binding of KIF5 binding site	2.19E-04	3
Cell Cycle, Skeletal and Muscular System Development and Function	Arrest in cell cycle progression of muscle cells	1.30E-03	4
Cellular Assembly and Organization	Binding of ribosome	2.06E-03	4
Cellular Compromise	Disorganization of actin	3.63E-03	2
Cell Cycle	Arrest in interphase	3.77E-06	65
Gene Expression	Synthesis of 47s pre-rRNA	2.19E-04	3
Cellular Compromise	Injury of mitochondrial membrane	3.63E-03	2
DNA Replication, Recombination, and Repair, RNA Post-Transcriptional Modification	Annealing of hnRNA	2.19E-04	3
Cellular Development, Cellular Growth and Proliferation, Connective Tissue Development and Function, Hematological System Development and Function, Hematopoiesis, Organismal Development, Tissue Development	Differentiation of reticulocytes	3.63E-03	2
Cell Cycle	Arrest in G2/M phase transition	2.57E-03	10
Cellular Assembly and Organization, Cellular Function and Maintenance	Formation of monosome	3.63E-03	2
Cell Cycle	Arrest in G2 phase of endothelial cell lines	3.63E-03	2
Cellular Assembly and Organization	Regulation of mitochondria	1.35E-04	8
Cell Cycle	Arrest in G2 phase of tumor cell lines	1.50E-03	18
Cell Cycle	Cell division of cervical cancer cell lines	1.30E-03	4
Cell Morphology	Polarization of bone marrow-derived mast cells	3.63E-03	2
Cellular Response to Therapeutics	Radioresistance of cervical cancer cell lines	3.63E-03	2
Cell Morphology	Size of colorectal cancer cell lines	3.63E-03	2
Carbohydrate Metabolism	Production of glyceraldehyde-3-phosphate	3.63E-03	2
Molecular Transport, Protein Trafficking	Import of green fluorescent protein	8.35E-04	3
Nucleic Acid Metabolism, Small Molecule Biochemistry	Synthesis of ribonucleoside monophosphate	8.35E-04	3
Cell Cycle	Delay in mitosis	2.19E-04	9

Connective Tissue Development and Function, Skeletal and Muscular System Development and Function, Tissue Development	Spacing of trabecular bone	3.63E-03		2
Cell Cycle	Exit from G1 phase	6.71E-06		7
Carbohydrate Metabolism, Small Molecule Biochemistry	Catabolism of D-glucose	3.63E-03		2
Digestive System Development and Function, Organ Morphology, Tissue Morphology	Quantity of M cells	3.63E-03		2
DNA Replication, Recombination, and Repair, Molecular Transport	Depletion of mitochondrial DNA	1.30E-03		4
Carbohydrate Metabolism, Molecular Transport	Transport of dehydroascorbic acid	2.19E-04		3
Cell Cycle, Gene Expression	Binding of AP2 binding site	3.63E-03		2
Embryonic Development, Organ Development, Organismal Development, Respiratory System Development and Function, Tissue Development	Organogenesis of pulmonary alveolus	3.63E-03		2
Quantity of tumor cell lines	Tissue Morphology	1.35E-03	Activated	25
Colony formation of fibroblast cell lines	Cellular Growth and Proliferation, Connective Tissue Development and Function, Tissue Development	5.39E-04	Activated	16
Proliferation of airway epithelial cells	Cellular Growth and Proliferation, Tissue Development	1.00E-03		5
Arrest in G2/M phase transition of lung cancer cell lines	Cell Cycle	1.99E-03		3
G2/M phase of embryonic cell lines	Cell Cycle, Embryonic Development	1.43E-03		5
Cell cycle progression of cervical cancer cell lines	Cell Cycle	2.74E-03		8
Interphase of lung cell lines	Cell Cycle	1.17E-03		6

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