

Table S2. Gene Ontology (GO) studies of biological process, molecular function, cellular component, and protein class through functional enrichment analysis of the densely connected regions like cluster 1 with a threshold of $p < 0.05$

Category	Category name	GO term	Genes	p-value
Biological process	DNA damage response, signal transduction by p53 class mediator	GO:0006978	ATM, BAX, BCL2, BRCA1, BRCA2, CCND1, CCNE1, CDK2, CDKN1A, CDKN2A, ERCC1, GADD45A, MLH1, PARP1, PRKDC, PTEN, RAD51, SIRT1, TP53, TWIST1, XRCC3	1.53E-06
	Leukocyte apoptotic process	GO:0071887	AKT1, BAX, BCL2, BCL2L1, CDKN1A, CDKN2A, CXCL12, HIF1A, HSPA1A, ICAM1, IL6, NFE2L2, NOTCH1, PIK3CA, PPARG, PRKCB, PRKCE, PTEN, RAF1, SIRT1, TGFB1, TP53, VEGFA, WT1	1.11E-10
	Regulation of DNA recombination	GO:0000018	CD40, MLH1, RAD51, TGFB1	3.03E-04
	Cell cycle checkpoint	GO:0000075	AKT1, ATM, BAX, BCL2L1, BRCA1, CCND1, CDK2, CDKN1A, GADD45A, MAPK14, PRKDC, TGFB1, TP53, XRCC3	6.59E-12
	DNA damage checkpoint	GO:0000077	ATM, BAX, BRCA1, CCND1, CDK2, CDKN1A, GADD45A, MAPK14, PRKDC, TP53	5.62E-09
	Response to reactive oxygen species	GO:0000302	ABL1, AKT1, BCL2, CASP3, CDK2, IL6, MAPK1, MAPK3, MAPK8, NFE2L2, NOS3, RELA, SIRT1, SOD2	1.01E-11
	Telomere maintenance	GO:0000723	ATM, BRCA2, CCNE1, ERCC1, HSP90AA1, MAPK1, MAPK3, PARP1, PRKDC, PTEN, RAD51, TERT, XRCC3	1.99E-13
	Double-strand break repair via homologous recombination	GO:0000724	ATM, BRCA1, BRCA2, PARP1, RAD51, XRCC3	1.15E-05
	DNA synthesis involved in DNA repair	GO:0000731	ATM, BRCA1, BRCA2, RAD51, SIRT1, XRCC3	2.09E-06
	Regulation of cell growth	GO:0001558	ABL1, AKT1, BCL2, CDKN1A, CDKN2A, CXCL12, ERBB2, GSK3B, HSPA1A, IGF1, MTOR, PIN1, PPARG, SIRT1, TGFB1, TP53, VEGFA, WT1	4.77E-13
	B cell homeostasis	GO:0001782	ABL1, BAX, BCL2, CASP3, HIF1A	3.33E-07
	Lymphocyte activation involved in immune response	GO:0002285	ABL1, CD40, ERCC1, ICAM1, IL6, MLH1, STAT3, TGFB1, TLR4	4.52E-08
	Regulation of DNA repair	GO:0006282	BRCA1, OGG1, RAD51, SIRT1, TWIST1	6.22E-05
	Molecular function	Double-strand break repair	GO:0006302	ATM, BRCA1, BRCA2, ERCC1, MLH1, NHEJ1, OGG1, PARP1, PRKDC, RAD51, TWIST1, XRCC3
Response to oxidative stress		GO:0006979	ABL1, AKT1, BCL2, CASP3, CDK2, ERCC1, HIF1A, HSPA1A, HSPB1, IL6, MAPK1, MAPK3, MAPK8, MCL1, NFE2L2, NOS3, OGG1, PARP1, PTGS2, RELA, SIRT1, SOD2, TP53	4.52E-18
Cell cycle arrest		GO:0007050	ABL1, ATM, BAX, BRCA1, CCND1, CDK2, CDKN1A, CDKN2A, GADD45A, MTOR, TGFB1, TP53	3.37E-09
Response to ionizing radiation		GO:0010212	ATM, BAX, BCL2, BCL2L1, BRCA1, BRCA2, CASP3, CCND1, CCND2, CDKN1A, ERCC1, GADD45A, ICAM1, MAPK14, NHEJ1, PARP1, PRKDC, RAD51, SIRT1, SOD2, TGFB1, TP53, XRCC3	4.80E-28
Telomere capping		GO:0016233	ATM, ERCC1, MAPK1, MAPK3, PRKDC	1.53E-06
Signal transducer, downstream of receptor, with serine/threonine kinase activity		GO:0004702	MAPK1, MAPK14, MAPK3, MAPK8, RAF1	9.26E-05
Cyclin-dependent protein serine/threonine kinase regulator activity		GO:0016538	CASP3, CCND1, CCNE1, CDKN1A, CDKN2A	2.81E-07

	Phosphatase binding	GO:0019902	AKT1, BCL2, ERBB2, MAPK1, MAPK14, MAPK3, PPARG, STAT3, TP53	6.52E-08
	Protein phosphatase binding	GO:0019903	AKT1, BCL2, ERBB2, MAPK14, PPARG, STAT3, TP53	1.38E-06
Cellular process	Cyclin-dependent protein kinase holoenzyme complex	GO:0000307	CCND1, CCND2, CCNE1, CDK2, CDKN1A	8.78E-07
	Chromosome, telomeric region	GO:0000781	ATM, BRCA2, CDK2, ERCC1, PARP1, PRKDC, PTEN, RAD51, TERT, XRCC3	1.71E-09
	Nuclear chromosome, telomeric region	GO:0000784	ATM, BRCA2, ERCC1, PARP1, PRKDC, RAD51, TERT, XRCC3	5.14E-08
Immune response	Lymphocyte activation involved in immune response	GO:0002285	ABL1, CD40, ERCC1, ICAM1, IL6, MLH1, STAT3, TGFB1, TLR4	0.001652943
	Lymphocyte proliferation	GO:0046651	ABL1, ATM, BAX, BCL2, CASP3, CD40, CDKN1A, CDKN2A, ERBB2, IGF1, IL6, TGFB1, TLR4	8.51E-04
	Regulation of lymphocyte proliferation	GO:0050670	ATM, BCL2, CASP3, CD40, CDKN1A, CDKN2A, ERBB2, IGF1, IL6, TGFB1, TLR4	0.001080851
KEGG	Homologous recombination	KEGG:03440	ATM, BRCA1, BRCA2, RAD51, XRCC3	8.71E-05
	Cell cycle	KEGG:04110	ABL1, ATM, CCND1, CCND2, CCNE1, CDK2, CDKN1A, CDKN2A, GADD45A, GSK3B, PRKDC, TGFB1, TP53	8.76E-10
	p53 signaling pathway	KEGG:04115	ATM, BAX, CASP3, CASP8, CCND1, CCND2, CCNE1, CDK2, CDKN1A, CDKN2A, GADD45A, IGF1, PTEN, TP53	1.55E-14
	Apoptosis	KEGG:04210	AKT1, ATM, BAX, BCL2, BCL2L1, CASP3, CASP8, GADD45A, KRAS, MAPK1, MAPK3, MAPK8, MCL1, NFKB1, NFKBIA, PARP1, PIK3CA, RAF1, RELA, TNFSF10, TP53	9.60E-19
	Wnt signaling pathway	KEGG:04310	CCND1, CCND2, GSK3B, MAPK8, PRKCB, RAC1, RHOA, TP53	1.89E-04
	T cell receptor signaling pathway	KEGG:04660	AKT1, GSK3B, KRAS, MAPK1, MAPK14, MAPK3, NFKB1, NFKBIA, PIK3CA, RAF1, RELA, RHOA	1.21E-09
	B cell receptor signaling pathway	KEGG:04662	AKT1, GSK3B, KRAS, MAPK1, MAPK3, NFKB1, NFKBIA, PIK3CA, PRKCB, RAC1, RAF1, RELA	1.35E-11
	Glioma	KEGG:05214	AKT1, CCND1, CDKN1A, CDKN2A, IGF1, IGF1R, KRAS, MAPK1, MAPK3, MTOR, PIK3CA, PRKCB, PTEN, RAF1, TP53	1.58E-16

KEGG, Kyoto Encyclopedia of Genes and Genome.