**SUPPLEMENTARY INFORMATION**

*Mlh1 deficiency in normal mucosa associates with microsatellite stable colon cancer*

Marjaana Pussila¹, Petri Törönen², Elisabet Einarsdottir³,⁴, Shintaro Katayama⁵, Kaarel Krjutškov⁵,⁶, Liisa Holm¹,², Juha Kere³,⁴,⁶, Päivi Peltomäki⁷, Markus J. Mäkinen⁸,⁹, Jere Linden¹⁰, Minna Nyström¹*¹

**Supplementary figure 1.** Number of colon tumors and carcinomas in different age and diet groups. Aging and Western-style diet increased the total number of (A) colon tumors and (B) carcinomas. AIN (AIN-93G control diet), WD (Western-style diet).

**Supplementary figure 2.** Histopathology of serrated adenocarcinoma E347
Supplementary figure 3. MSI analysis of four dinucleotide and two mononucleotide markers in carcinomas

N = normal, C = carcinoma
### Supplementary Table 1: Diet nutritional content

|                            | AIN93-G | WD          |
|---------------------------|---------|-------------|
| **Total energy content (kcal/g)** | 3.8     | 4.6         |
| Kcal from carbohydrates (%) | 63.9    | 42.3        |
| Kcal from protein (%)      | 18.8    | 18.5        |
| Kcal from fat (%)          | 17.2    | 39.2        |
| **Carbohydrate source (g/kg)** |         |             |
| Starch                    | 397     | 306         |
| Maltodextrin              | 132     | 95          |
| Sucrose                   | 100     | 116         |
| **Protein source (g/kg)** | 200     | 232         |
| (casein)                  |         | (casein, vitamin free) |
| **Fat source (g/kg)**     |         |             |
| Soybean oil               | 70      | -           |
| Anhydrous milkfat         | -       | 133         |
| Canola oil                | -       | 55          |
| Sunflower oil             | -       | 12          |
| **Vitamin D (IU/kg)**     | 1000    | 100         |
| **Folic acid (mg/kg)**    | 2       | 0.2         |
| **Calcium (g/kg)**        | 5       | 0.5         |
| **Fiber (cellulose) (g/kg)** | 50  | 20          |
Supplementary Table 2: histopathology grading criteria

**Hyperplasia**

Epithelial hyperplasia was characterized by localized increase in mucosal thickness, long uniform crypts with increased cell proliferation, and no atypia.

**Adenoma**

Adenomas were classified either tubular or tubulovillous/papillary adenomas, and the degree of dysplasia was graded in low- and high-grade dysplasia.

In adenomas with low-grade dysplasia, distorted and irregularly distributed crypt structures were composed of proliferating epithelium showing nuclear crowding and pseudostratification. The nuclear features of low-grade dysplasia consisted of mild to moderate increase in nuclear size, granular chromatin and discernible nucleoli.

In adenomas with high-grade dysplasia, the crypt structures were disorganized and often packed, with cribriform areas. The cells showed increased atypia, irregular nuclei with coarse chromatin and enlarged, conspicuous nucleoli.

**Carcinoma**

In carcinomas, there were signs of invasion. Some of the cases were early cancers, with limited submucosal invasion. Invasion was characterized by displacement of malignant glands between the muscularis mucosa, submucosal vascular structures or by pushing border –type invasion with tumor extending to submucosal level or beyond.

|                      | Architectural disorganization | Nuclear pseudo-stratification | Nuclear atypia | Chromatin | Nucleoli |
|----------------------|------------------------------|------------------------------|----------------|-----------|---------|
| Normal               | none                         | no                           | no             | even      | inconspicuous |
| Hyperplasia          | none                         | crypt basis                  | no             | even      | inconspicuous |
| Low-grade dysplasia  | mild                         | mild to moderate             | mild           | granular  | present  |
| High-grade dysplasia | moderate to marked           | moderate to marked           | marked         | coarse    | conspicuous |
| Adenocarcinoma       | marked to severe             | variable                     | marked         | coarse    | conspicuous |
Evaluation of the RNA-seq preprocessing steps

Data was found to be difficult for preprocessing as it contained surprisingly many zero values (~57%) and many low counts (68% below 4 counts). First evaluation is done by visualizing the percentiles from each library. Data is shown with shifted log \( (x_{\text{log}} = \log(x + 1)) \). The aim of this visualization is to ensure that counts are comparable across the libraries. First we evaluated the raw count data:

![Different percentiles for unprocessed data](image)

**Figure 1**: Stability of the raw counts before normalizations. Data is processed with shifted log for visualization. The percentiles shown are 0, 25, 50, 75, 95, and 100. Four first percentiles are mostly on top of each other.

Figure 1 shows that raw data has significant instabilities in percentiles. This is a well-known artefact of RNA-seq data. However, by using DeSeq style normalization\(^1\), shown in figure 2, we can improve data stability significantly. Third normalization step in our pipeline was ComBat normalization\(^2\). It altered the behavior of percentiles only little (See figure 3)
Figure 2: Stability of the data after DeSeq normalization. Notice the improved stability of the percentiles. See figure 1 for more information on visualization.

Figure 3: Stability of the data after ComBat normalization. Stability is similar to figure 2. See figure 1 for more information on the visualization.

Another important check on any biological dataset is the similarity of the biological replicates vs. similarity of different sample groups. Here the aim is to see if we can see separation between different sample groups. Another important issue is the check for the potential batch effects. We evaluate these by generating hierarchical clustering trees of samples. We used average methods with Pearson correlation. For
Figure 4: Clustering of samples after DeSeq normalization. Coloring highlights the clustering of two batches. Notice many large batch-related clusters.

Below we show another coloring where we look at the separation of biological sample groups. Samples had three variables: genotype, diet and measurement time point. Here the coloring shows time points, as they showed strongest correlation with RNAseq data.
Figure 5: Clustering of DeSeq normalized data. Here the coloring highlights the three different time points. Cluster tree is same as in figure 4. Only label coloring is changed.

Notice that the clustering shows more correlation with the batches (figure 4) than with time points (figure 5). This encouraged us to use ComBat normalization\(^2\). The resulting clustering is shown in figure 6. Now the correlation of clusters with batches is totally removed. Also the correlation with time points is improved (see figure 7). Based on these visualizations we chose data with DESeq and ComBat normalizations to further analysis.
Figure 6: Sample clustering after ComBat normalization with different coloring for batches. Now the correlation of clusters with batches has disappeared.
Figure 7: Sample clustering after ComBat normalization with the coloring showing the time points. Notice the large green cluster (18mo time point) and the grouping of black labels (time point 0).

Comparing methods for differential expression analysis

With Differential Expression Analysis (DEA) we look for the genes that show difference in behavior when a subset of samples is compared to the other samples. We considered three DEA methods: Limma with Voom preprocessing, CyberT and Shrinkage t-test. All these methods are variations from the standard t-test. Count-based methods that were specifically designed for RNA-seq data were not considered as the data had continuous values after ComBat normalization. In our evaluations we looked how good the best scoring genes, from each method, are at separating samples from the analyzed subset from the remaining samples. The better the separation is the more specific the expression profile of selected genes is to analyzed subset.

We evaluated these methods by comparing the carcinoma vs. non-carcinoma samples. We looked at the separation with Multi-Dimensional Scaling (MDS) using varying number of top-scoring genes (25, 50, 75, 100, 200) for distance calculus. We show only the results with top-100 genes in figures 8, 9 and 10 as other numbers gave similar results.

Figure 8: Separation of samples in MDS plot based on the top-100 genes, selected with Limma t-test score. Carcinoma samples are shown with green color. Red samples are polyp samples. Remaining samples are black. Only one outlier carcinoma sample is separated from the main mass of samples.
Figure 9: Separation of samples in the MDS plot with top-100 genes selected with cyber-T. Notice the better separation than with Limma, but still quite heterogenous distribution of carcinoma samples.
Figure 10: Separation of samples in MDS plot with top-100 genes selected shrinkage t-test (with unequal variance). Here carcinoma samples form a clear separate group.

Figures 8-10 show that shrinkage-t performs best at selecting genes that can separate carcinoma group. This result was obtained with unequal variance setting, where a separate variance estimate for gene is calculated for both groups. With equal variance setting the shrinkage-t performance did not separate from other methods (data not shown). This suggests that it is beneficial to use separate variance estimates in gene expression data, when comparing a small subset of samples to a larger pool of samples.

We furthermore confirmed these results by analyzing the RNA-seq data with in house created Gene Set Enrichment Analysis method (Gene Set Z-score, GSZ\(^3\)). We ran the GSZ three times, using each of the compared DEA methods in turn as an input to GSZ analysis. Here the stronger signal would suggest stronger correlation between the RNAseq data and gene sets, obtained from Gene Ontology. We obtained stronger p-values with shrinkage-T for the top scoring GO classes (data not shown).

Anders, S. & Huber, W. Differential expression analysis for sequence count data. *Genome Biol* **11**, R106, doi:10.1186/gb-2010-11-10-r106 (2010).

Johnson, W. E., Li, C. & Rabinovic, A. Adjusting batch effects in microarray expression data using empirical Bayes methods. *Biostatistics* **8**, 118-127, doi:10.1093/biostatistics/kxj037 (2007).

Mishra, P., Toronen, P., Leino, Y. & Holm, L. Gene set analysis: limitations in popular existing methods and proposed improvements. *Bioinformatics* **30**, 2747-2756, doi:10.1093/bioinformatics/btu374 (2014).
### Supplementary Table 3: The 300 most regulated genes between carcinoma and non-carcinoma mice

| Symbol | MGI ID     | Name                                                                 | Shrink-T |
|--------|------------|----------------------------------------------------------------------|----------|
| Qrs1   | MGI:1923813| glutaminyl-tRNA synthase (glutamine-hydrolyzing)-like 1              | -7.91    |
| Eftud1 | MGI:2141969| elongation factor Tu GTP binding domain containing 1                  | -7.39    |
| Rad9a  | MGI:1328356| RAD9 homolog A                                                        | -6.64    |
| Scl10a5| MGI:2685251| solute carrier family 10 (sodium/bile acid cotransporter family), member 5 | -6.49    |
| Gpr39  | MGI:1918361| G protein-coupled receptor 39                                        | -6.34    |
| Vamp5  | MGI:1858622| vesicle-associated membrane protein 5                                | -6.27    |
| Tmem82 | MGI:2384869| transmembrane protein 82                                             | -6.23    |
| Tmem180| MGI:1922396| transmembrane protein 180                                            | -6.20    |
| Preb   | MGI:1355326| prolactin regulatory element binding                                  | -6.04    |
| Mtmr9  | MGI:2442842| myotubularin related protein 9                                       | -6.03    |
| Ranbp3 | MGI:1919060| RAN binding protein 3                                                | -6.03    |
| Pard6a | MGI:1927223| par-6 family cell polarity regulator alpha                            | -6.01    |
| D6Wsu163e | MGI:107893 | DNA segment, Chr 6, Wayne State University 163, expressed            | -5.94    |
| Sphk2  | MGI:1861380| sphingosine kinase 2                                                | -5.80    |
| Ncapd3 | MGI:2142989| non-SMC condensin II complex, subunit D3                             | -5.73    |
| Sec16b | MGI:2148802| SEC16 homolog B (S. cerevisiae)                                      | -5.64    |
| Triqk  | MGI:3650048| triple QxxK/R motif containing                                      | -5.63    |
| Rbfa   | MGI:1915981| ribosome binding factor A                                            | -5.61    |
| Pgd    | MGI:97553  | phosphogluconate dehydrogenase                                       | -5.60    |
| Ms4a10 | MGI:1917076| membrane-spanning 4-domains, subfamily A, member 10                  | -5.58    |
| Tle4   | MGI:104633 | transducin-like enhancer of split 4, homolog of Drosophila E(spl)   | 5.57     |
| Mfsd3  | MGI:1916822| major facilitator superfamily domain containing 3                    | -5.53    |
| Tomm40 | MGI:1858259| translocase of outer mitochondrial membrane 40 homolog (yeast)      | -5.52    |
| Ztfp60 | MGI:99207  | zinc finger protein 60                                               | -5.51    |
| Sf3a2  | MGI:104912 | splicing factor 3a, subunit 2                                       | -5.47    |
| Tcalf1 | MGI:1914665| TRPM8 channel-associated factor 1                                    | -5.43    |
| Zcrb1  | MGI:1914447| zinc finger CCHC-type and RNA binding motif 1                        | -5.36    |
| Car9   | MGI:2447188| carbonic anhydrase 9                                                | -5.28    |
| Ankrd27| MGI:2444103| ankyrin repeat domain 27 (VPS9 domain)                              | -5.27    |
| Ktn1   | MGI:109153 | kinetin 1                                                            | -5.26    |
| Tgds   | MGI:1923605| TDP-glucose 4,6-dehydratase                                         | -5.17    |
| Vti1a  | MGI:1855699| vesicle transport through interaction with t-SNAREs 1A               | -5.15    |
| Kbtbd4 | MGI:1914386| kelch repeat and BTB (POZ) domain containing 4                      | -5.09    |
| Tbrg4  | MGI:1100868| transforming growth factor beta regulated gene 4                     | -5.07    |
| Zkscan5| MGI:107533 | zinc finger with KRAB and SCAN domains 5                            | -5.07    |
| Atl3   | MGI:1924270| atlastin GTPase 3                                                   | -5.05    |
| Mis18a | MGI:1913828| MIS18 kinetochore protein homolog A (S. pombe)                       | -5.03    |
| Rnfl5  | MGI:1922078| ring finger protein 185                                             | -5.02    |
| Odf2   | MGI:1098284| outer dense fiber of sperm tails 2                                  | -5.01    |
| Rilpl2 | MGI:1933112| Rab interacting lysosomal protein-like 2                             | -5.00    |
| Lman2  | MGI:1914140| lectin, mannose-binding 2                                           | -4.99    |
| Gle1   | MGI:1921662| GLE1 RNA export mediator (yeast)                                    | -4.97    |
| Pnck   | MGI:1347357| pregnancy upregulated non-ubiquitously expressed CaM kinase         | -4.94    |
| Gnb5   | MGI:101848 | guanine nucleotide binding protein (G protein), beta 5               | -4.92    |
| Dlg3   | MGI:1888986| discs, large homolog 3 (Drosophila)                                 | -4.91    |
| C4bp   | MGI:88229 | complement component 4 binding protein                             | 4.91     |
| Rnf123 | MGI:2148796| ring finger protein 123                                             | -4.89    |
| Serp2  | MGI:1919911| stress-associated endoplasmic reticulum protein family member 2     | 4.88     |
| Foxa3  | MGI:1347477| forkhead box A3                                                   | -4.84    |
| Rpusd1 | MGI:1911986| RNA pseudouridylate synthase domain containing 1                    | -4.81    |
| Gm5803 | MGI:3645633| predicted gene 5803                                               | -4.80    |
| Fbx15  | MGI:1915681| F-box and leucine-rich repeat protein 15                             | -4.78    |
| Sfxn3  | MGI:2137679| sideroflexin 3                                                    | -4.75    |
| Enthd2 | MGI:1926027| ENTH domain containing 2                                           | -4.74    |
| Smagg  | MGI:2448476| small cell adhesion glycoprotein                                   | 4.74     |
| Gene ID     | Description                                                                 | Log2 Fold Change |
|------------|------------------------------------------------------------------------------|------------------|
| Mt2        | metallothionein 2                                                            | -4.72            |
| Sloc4a2    | solute carrier family 44, member 2                                            | -4.72            |
| Pla2g4a    | phospholipase A2, group IVA (cytosolic, calcium-dependent)                    | -4.71            |
| Bola3      | bola-like 3 (E. coli)                                                        | -4.68            |
| Ifrd1      | interferon-related developmental regulator 1                                 | -4.68            |
| Dcre1b     | DNA cross-link repair 1B, PSO2 homolog (S. cerevisiae)                        | -4.66            |
| C3s0007p06 | RIKEN cDNA C3s0007p06 gene                                                    | -4.65            |
| Mospd2     | motile sperm domain containing 2                                             | -4.64            |
| Hspa13     | heat shock protein 70 family, member 13                                       | -4.63            |
| Atp6v0e2   | ATPase, H+ transporting, lysosomal V0 subunit E2                             | -4.63            |
| Cstf2t     | cleavage stimulation factor, 3’ pre-RNA subunit 2, tau                       | -4.61            |
| Ttl1       | tubulin tyrosine ligase-like 1                                               | -4.60            |
| Casp12     | caspase 12                                                                   | -4.59            |
| Pms2       | postmeiotic segregation increased 2 (S. cerevisiae)                          | -4.57            |
| Bcl2a1a    | B cell leukemia/lymphoma 2 related protein A1a                               | -4.56            |
| Trim25     | tripartite motif-containing 25                                                | -4.56            |
| Hist1h1bj  | histone cluster 1, H2bj                                                      | -4.55            |
| Rabgap1    | RAB GTPase activating protein 1                                               | -4.52            |
| Fkbp8      | FK506 binding protein 8                                                       | -4.49            |
| Creb33     | cAMP responsive element binding protein 3-like 3                             | -4.48            |
| Bub1       | budding uninhibited by benzimidazoles 1 homolog (S. cerevisiae)              | -4.48            |
| Tpx2       | TPX2, microtubule-associated protein homolog (Xenopus laevis)                | -4.47            |
| Ints10     | integrator complex subunit 10                                                | -4.43            |
| Dph6       | diphthamine biosynthesis 6                                                   | -4.43            |
| Gpd1       | glycerophosphodiester phosphodiesterase domain containing 1                  | -4.42            |
| 2010003k11 | RIKEN cDNA 2010003k11 gene                                                    | -4.40            |
| Ccd16      | chemokine (C-X-C motif) ligand 16                                             | -4.38            |
| Mrpl10     | mitochondrial ribosomal protein L10                                          | -4.38            |
| Sloc25a12  | solute carrier family 25 (mitochondrial carrier, Aralar), member 2b1         | -4.38            |
| Urah       | urate (5-hydroxyiso-) hydrolase                                               | -4.36            |
| Nfyc       | nuclear transcription factor-Y gamma                                          | -4.32            |
| 1700037c18 | RIKEN cDNA 1700037c18 gene                                                    | -4.29            |
| Ddx23      | DEAD (Asp-Glu-Ala-Asp) box polypeptide 23                                    | -4.27            |
| Cenpe      | centromere protein E                                                         | -4.23            |
| P4ha2      | procollagen-proline, 2-oxoglutarate 4-dioxygenase (proline 4-hydroxylase),   | -4.22            |
| Apol9b     | apolipoprotein L 9b                                                           | -4.21            |
| Ccar2      | cell cycle activator and apoptosis regulator 2                               | -4.20            |
| Plscr3     | mitochondrial ribosomal protein L10                                           | -4.20            |
| Sloc2b1    | solute carrier organic anion transporter family, member 2b1                  | -4.16            |
| Kdm8       | lysine (K)-specific demethylase 8                                             | -4.15            |
| Tmem164    | transmembrane protein 164                                                    | -4.12            |
| Efca11     | EF-hand calcium binding domain 11                                             | -4.12            |
| Wrap53     | WD repeat containing, antisense to Trp53                                     | -4.10            |
| Cenpn      | centromere protein N                                                          | -4.09            |
| Attf6b     | activating transcription factor 6 beta                                        | -4.09            |
| Hspb1      | HSPA (heat shock 70kDa) binding protein, cytoplasmic cochaperone 1           | -4.08            |
| Sfna2      | schlafen 2                                                                   | -4.08            |
| Cenpa      | centromere protein A                                                          | -4.07            |
| 4931414p19 | RIKEN cDNA 4931414p19 gene                                                    | -4.06            |
| Arnt       | aryl hydrocarbon receptor nuclear translocator                               | -4.06            |
| Dok        | dolichol kinase                                                              | -4.06            |
| Tir4       | toll-like receptor 4                                                          | -4.04            |
| Dlst       | dihydrolipoamide S-succinyltransferase (E2 component of 2-oxo-glutarate       | -4.04            |
| Vim        | vimentin                                                                     | 4.04             |
| Uprt       | uracil phosphoribosyltransferase (FUR1) homolog (S. cerevisiae)               | -4.03            |
| 2210016f16 | RIKEN cDNA 2210016f16 gene                                                    | -4.02            |
| Fahd2a     | fumarylacetocetate hydrolase domain containing 2A                             | -4.02            |
| Gene       | MGI     | Description                                                                                     | Log2 Ratio |
|------------|---------|------------------------------------------------------------------------------------------------|------------|
| Ccdc23     | MGI:1916466 | small vasohibin binding protein                                                               | 4.01       |
| Pin4       | MGI:1916963 | protein (peptidyl-prolyl cis/trans isomerase) NIMA-interacting, 4 (parvulin)                   | 3.99       |
| Lxn        | MGI:107633  | latexin                                                                                        | 3.99       |
| Arhgef3    | MGI:1918954 | Rho guanine nucleotide exchange factor (GEF) 3                                                 | -3.99      |
| Zfp748     | MGI:1916455 | zinc finger protein 748                                                                         | -3.98      |
| Fubp1      | MGI:1196294 | far upstream element (FUSE) binding protein 1                                                  | -3.98      |
| Ptdc3      | MGI:1917206 | pentatricopeptide repeat domain 3                                                              | -3.97      |
| Pstpip2    | MGI:1335088 | proline-serine-threonine phosphatase-interacting protein 2                                     | -3.97      |
| Osgr1      | MGI:1919089 | oxidative stress induced growth inhibitor 1                                                     | -3.96      |
| Zfp930     | MGI:2675306 | zinc finger protein 930                                                                        | -3.96      |
| Psmg4      | MGI:1916916 | proteasome (prosome, macropain) assembly chaperone 4                                           | 3.95       |
| Cped1      | MGI:2448414 | cadherin-like and PC-esterase domain containing 1                                              | -3.94      |
| Ptcd1      | MGI:97919   | ribonuclease, RNase A family, 1 (pancreatic)                                                   | -3.93      |
| Lxn        | MGI:107633  | latexin                                                                                        | -3.92      |
| Exoc2      | MGI:1913732 | exocyst complex component 2                                                                   | -3.92      |
| Hist1h4b   | MGI:2448420 | histone cluster 1, H4b                                                                         | -3.92      |
| Fup1       | MGI:95480   | Fanconi anemia, complementation group C                                                         | -3.91      |
| Bud13      | MGI:2443443 | BUD13 homolog (yeast)                                                                          | -3.90      |
| Wdr12      | MGI:1927241 | WD repeat domain 12                                                                            | -3.90      |
| Fadd       | MGI:109324  | Fas (TNFRSF6)-associated via death domain                                                       | -3.90      |
| Stk4       | MGI:1929004 | serine/threonine kinase 4                                                                      | -3.89      |
| Lurap1l    | MGI:106510  | leucine rich adaptor protein 1-like                                                             | 3.88       |
| Cin8       | MGI:1349447 | ceroid-lipofuscinosis, neuronal 8                                                              | 3.87       |
| Btc        | MGI:1338871 | beta-transducin repeat containing protein                                                       | -3.87      |
| Vps13c     | MGI:2444207 | vacuolar protein sorting 13C (yeast)                                                           | -3.87      |
| Trab2      | MGI:106016  | transformer 2 beta homolog (Drosophila)                                                         | 3.86       |
| AA986860   | MGI:2138143 | expressed sequence AA986860                                                                    | 3.86       |
| Pak1       | MGI:1339975 | p21 protein (Cdc42/Rac)-activated kinase 1                                                      | -3.85      |
| Letmd1     | MGI:1915864 | LETM1 domain containing 1                                                                      | -3.85      |
| Pusl1      | MGI:3047787 | pseudouridylate synthase-like 1                                                                | -3.85      |
| Fbxo38     | MGI:2444639 | F-box protein 38                                                                                 | -3.85      |
| Rad54l     | MGI:894697  | RADS4 like (S. cerevisiae)                                                                      | -3.84      |
| Coq10b     | MGI:1915126 | coenzyme Q10 homolog B (S. cerevisiae)                                                          | -3.84      |
| Nme3       | MGI:1930182 | NME/NM23 nucleoside diphosphate kinase 3                                                        | 3.83       |
| Ppp1r2     | MGI:1914099 | protein phosphatase 1, regulatory (inhibitor) subunit 2                                         | -3.83      |
| Ikbg       | MGI:1338074 | inhibitor of kappab kinase gamma                                                                | -3.83      |
| Trmt1l     | MGI:1916185 | tRNA methyltransferase 1                                                                         | -3.83      |
| Ddrk1      | MGI:1924256 | DDRGK domain containing 1                                                                      | 3.83       |
| Zc3h12a    | MGI:2385891 | zinc finger CCCH type containing 12A                                                              | -3.82      |
| Zfp65      | MGI:107769  | zinc finger protein 65                                                                           | -3.82      |
| Zfp808     | MGI:3704127 | zinc finger protein 80                                                                           | -3.82      |
| Nat8       | MGI:1915646 | N-acetyltransferase 8 (GCN5-related)                                                              | -3.81      |
| Slc9a3r2   | MGI:1890662 | solute carrier family 9 (sodium/hydrogen exchanger), member 3 regulator 2                     | -3.81      |
| Pls3       | MGI:104807  | plaslin 3 (T-isofrom)                                                                           | -3.80      |
| Hist1h2an  | MGI:2448300 | histone cluster 1, H2an                                                                         | -3.79      |
| AnkB       | MGI:108297  | ankyrin 3, epithelial                                                                          | -3.75      |
| Cdc36      | MGI:107899  | CD36 antigen                                                                                    | -3.74      |
| Golph3l    | MGI:1917129 | golgi phosphoprotein 3-like                                                                     | -3.74      |
| Slc39a7    | MGI:95909   | solute carrier family 39 (zinc transporter), member 7                                           | -3.74      |
| Stk19      | MGI:1860085 | serine/threonine kinase 19                                                                      | -3.74      |
| Gcdh       | MGI:104541  | glutaryl-Coenzyme A dehydrogenase                                                               | -3.74      |
| Tmx3       | MGI:2442418 | thioredoxin-related transmembrane protein 3                                                      | -3.73      |
| Apol10a    | MGI:3036238 | apolipoprotein L 10A                                                                            | -3.71      |
| Mmgt1      | MGI:2384305 | membrane magnesium transporter 1                                                                | -3.71      |
Ptbp2  MGI:1860489  polypyrimidine tract binding protein 2  -3.71
Tuba1b  MGI:107804  tubulin, alpha 1B  -3.70
Egf7  MGI:2449923  EGF-like domain 7  -3.70
Zfp956  MGI:2141515  zinc finger protein 956  -3.69
Ccnc  MGI:102551  cyclin F  -3.69
9030617O03Rik  MGI:2444813  RIKEN cDNA 9030617O03 gene  -3.68
Slc39a1  MGI:1353474  solute carrier family 39 (zinc transporter), member 1  -3.68
Myd88  MGI:108005  myeloid differentiation primary response gene 88  -3.67
Ace2  MGI:1917258  angiotensin I converting enzyme (peptidyl-dipeptidase A) 2  -3.67
Kif22  MGI:109233  kinesin family member 22  -3.66
Trmt2a  MGI:96270  TRM2 tRNA methyltransferase 2A  -3.65
Gnb1  MGI:95781  guanine nucleotide binding protein (G protein), beta 1  -3.65
Dnajb1  MGI:1931874  DnaJ (Hsp40) homolog, subfamily B, member 1  -3.65
Creld1  MGI:2152539  cysteine-rich with EGF-like domains 1  -3.64
Gba2  MGI:2654325  glucosidase beta 2  -3.64
Pot1a  MGI:2141503  protection of telomeres 1A  -3.64
Sf3a1  MGI:1914715  splicing factor 3a, subunit 1  -3.63
Tmx2  MGI:1914208  thioredoxin-related transmembrane protein 2  -3.63
Gskip  MGI:1914037  GSK3B interacting protein  -3.61
Tnip3  MGI:3041165  TNFAIP3 interacting protein 3  -3.61
Cnot4  MGI:1859026  CCR4-NOT transcription complex, subunit 4  -3.60
Uap1l1  MGI:2443318  UDP-N-acetylglucosamine pyrophosphorylase 1-like 1  -3.60
Ezh1  MGI:1097695  enhancer of zeste 1 polycomb repressive complex 2 subunit  -3.59
Mettl8  MGI:2385142  methyltransferase like 8  -3.59
Mbtps1  MGI:1927235  membrane-bound transcription factor peptidase, site 1  -3.58
Cep95  MGI:2443502  centrosomal protein 95  -3.57
Smg9  MGI:1919247  smg-9 homolog, nonsense mediated mRNA decay factor (C. elegans)  -3.57
Aurkaip1  MGI:1913327  aurora kinase A interacting protein 1  -3.56
Ttf2  MGI:1921294  transcription termination factor, RNA polymerase II  -3.56
Adck4  MGI:1924139  aarF domain containing kinase 4  -3.55
Dpf3  MGI:1917377  D4, zinc and double PHD fingers, family 3  -3.55
H1f0  MGI:95893  H1 histone family, member 0  -3.52
Haus5  MGI:191159  HAUS augmin-like complex, subunit 5  -3.52
Pitx2  MGI:109340  paired-like homeodomain transcription factor 2  -3.51
Wfdc1  MGI:1915116  WAP four-disulfide core domain 1  -3.51
Ubac1  MGI:1920995  mutL homolog 1 (E. coli)  -3.51
Abcf1  MGI:1351658  ATP-binding cassette, sub-family F (GCN20), member 1  -3.51
Sec24c  MGI:1919746  Sec24 related gene family, member C (S. cerevisiae)  -3.50
Gallnt7  MGI:1349449  UDP-N-acetyl-alpha-D-galactosamine: polypeptide N-acetylalpha-D-galactosaminyltransferase  -3.50
Shc1  MGI:98296  src homology 2 domain-containing transforming protein C1  -3.49
P4hb  MGI:97464  prolyl 4-hydroxylase, beta polypeptide  -3.49
Skiv2l  MGI:1099835  superkiller viralicidic activity 2-like (S. cerevisiae)  -3.49
Mlh1  MGI:101938  mutL homolog 1 (E. coli)  -3.49
Gmp2  MGI:1917903  guanosine monophosphate reductase 2  -3.48
Zfp329  MGI:1921283  zinc finger protein 329  -3.48
Abi3bp  MGI:2444583  ABI gene family, member 3 (NESH) binding protein  -3.47
Pax4  MGI:97488  paired box 4  -3.47
Gnpat  MGI:1343460  glyceronephosphate O-acyltransferase  -3.47
Spd1l  MGI:1917635  spindle apparatus coiled-coil protein 1  -3.46
Eps8l3  MGI:2139743  EPS8-like 3  -3.45
Clcn3  MGI:103555  chloride channel, voltage-sensitive 3  -3.45
Cdk5rap1  MGI:1914221  CDK5 regulatory subunit associated protein 1  -3.45
Itgae  MGI:1298377  integrin alpha E, epithelial-associated  -3.44
Rnf121  MGI:1922462  ring finger protein 121  -3.44
Twf2  MGI:1346078  twinfilin, actin-binding protein, homolog 2 (Drosophila)  -3.43
| Gene   | MGI    | Description                                                                 | Log2 Fold Change |}
|--------|--------|------------------------------------------------------------------------------|------------------|
| Polr3a | 2681836| polymerase (RNA) III (DNA directed) polypeptide A                            | -3.43            |
| Tmem176a | 1913308| transmembrane protein 176A                                                   | -3.42            |
| Ccnb2  | 88311  | cyclin B2                                                                    | -3.42            |
| Mt1    | 97171  | metallothionein 1                                                            | 3.42             |
| Pole   | 1196391| polymerase (DNA directed), epsilon                                            | -3.40            |
| Bckdk  | 1276121| branched chain ketoacid dehydrogenase kinase                                  | -3.40            |
| Clps   | 88421  | colipase, pancreatic                                                         | 3.40             |
| Ts1    | 1915061| MGI: TSR1 20S rRNA accumulation                                               | -3.40            |
| Gpalpp1| 1914717| GPALPP motifs containing 1                                                    | -3.39            |
| Stomi2 | 1913842| stomatin (EpB7.2)-like 2                                                     | -3.39            |
| Irgm1  | 107567 | immunity-related GTPase family M member 1                                    | -3.39            |
| Acxo3  | 1933156| acyl-Coenzyme A oxidase 3, pristanoyl                                        | -3.39            |
| Rph3al | 1923492| rabphilin 3A-like (without C2 domains)                                       | -3.39            |
| Fam111a| 1915508| family with sequence similarity 111, member A                                | -3.38            |
| Cit    | 105313 | citron                                                                       | -3.37            |
| Slc5a8 | 2384916| solute carrier family 5 (iodide transporter), member 8                      | -3.37            |
| Cacnb3 | 103307 | calcium channel, voltage-dependent, beta 3 subunit                           | -3.36            |
| Cox4i2 | 2135755| cytochrome c oxidase subunit IV isoform 2                                    | 3.36             |
| Dctn2  | 107733 | dynactin 2                                                                   | 3.36             |
| Mfap2  | 99559  | microfibrillar-associated protein 2                                          | -3.35            |
| C2da2 | 1924487| coiled-coil and C2 domain containing 2A                                      | -3.35            |
| Igf2bp2| 1890358| insulin-like growth factor 2 mRNA binding protein 2                           | -3.35            |
| Opkn1  | 2151070| oligophrenin 1                                                               | -3.35            |
| Rtn3   | 1277122| reticulocalbin 3, EF-hand calcium binding domain                             | -3.35            |
| Ppan   | 2178445| pter pan homolog (Drosophila)                                                | -3.34            |
| Rcl1   | 1913275| RNA terminal phosphate cyclase-like 1                                        | -3.34            |
| Tssc1  | 1289332| tumor suppressing subtransferable candidate 1                                | -3.33            |
| Nnmt   | 1099443| nicotinamide N-methyltransferase                                              | -3.33            |
| Scl25a40| 2442486| solute carrier family 25, member 40                                          | -3.32            |
| Srsf10 | 1333805| serine/arginine-rich splicing factor 10                                      | -3.32            |
| Jup    | 96650  | junction plakoglobin                                                         | -3.32            |
| Tipin  | 1921571| timeless interacting protein                                                  | -3.32            |
| Phgr1  | 1858382| proline/histidine/glycine-rich 1                                             | 3.32             |
| Pcp4   | 97509  | Purkinje cell protein 4                                                      | 3.32             |
| Tbl3   | 2384863| transducin (beta)-like 3                                                     | -3.31            |
| Fancg  | 1926471| Fanconi anemia, complementation group G                                       | -3.30            |
| Laptm5 | 108046 | lysosomal-associated protein transmembrane 5                                  | -3.30            |
| Kpn2a  | 103561 | karyopherin (importin) alpha                                                 | -3.30            |
| Phlda2 | 1202307| pleckstrin homology-like domain, family A, member 2                          | -3.29            |
| Wdr46  | 1931871| WD repeat domain 46                                                          | -3.29            |
| Rsrp1  | 106498 | arginine/serine rich protein 1                                               | 3.29             |
| Irf2   | 96591  | interferon regulatory factor 2                                                | 3.29             |
| Zfp426 | 1920248| zinc finger protein 42                                                        | -3.29            |
| Cdhl   | 88354  | cadherin 1                                                                   | -3.28            |
| Leng1  | 1917007| leukocyte receptor cluster (LRC) member 1                                    | -3.27            |
| Htr2b  | 109323 | 5-hydroxytryptamine (serotonin) receptor 2B                                  | -3.27            |
| Rhbod1 | 1924117| rhomboid domain containing 1                                                 | -3.26            |
| Tbx3   | 98495  | T-box 3                                                                      | -3.26            |
| Arhgap6| 1196332| Rho GTPase activating protein 6                                               | -3.26            |
| Chd4   | 1344380| chromodomain helicase DNA binding protein 4                                  | -3.25            |
| Gm20594| 5295700| predicted gene, 20594                                                        | 3.24             |
| Fcrls  | 1933397| Fc receptor-like S, scavenger receptor                                       | -3.23            |
| Scl35b3| 1913978| solute carrier family 35, member B                                          | -3.23            |
| Pigh   | 99463  | phosphatidylinositol glycan anchor biosynthesis, class H                     | -3.23            |
| Tor1ai1p| 3582693| torsin A interacting protein                                                 | -3.22            |
| Grp    | 95833  | gastrin releasing peptide                                                   | -3.22            |
| Mia2   | 2159614| melanoma inhibitory activity 2                                               | -3.22            |
| Usb1   | 2142454| U6 snRNA biogenesis 1                                                       | -3.21            |
| Cyb5r3 | 94893  | cytochrome b5 reductase                                                     | -3.21            |
| Gene    | MGI     | Description                                                                 | Log2FC |
|---------|---------|------------------------------------------------------------------------------|--------|
| Arhgef38| MGI:1924919 | Rho guanine nucleotide exchange factor (GEF) 38                             | -3.21  |
| Dhps    | MGI:2683592 | deoxyhypusine synthase                                                        | -3.21  |
| Mt3     | MGI:97173  | metallothionein 3                                                            | 3.21   |
| Atxn10  | MGI:1859293 | ataxin 10                                                                    | 3.21   |
| Dimt1   | MGI:1913504 | DIM1 dimethyladenosine transferase 1-like (S. cerevisiae)                     | -3.21  |
| Fcer1g  | MGI:95496  | Fc receptor, IgE, high affinity 1, gamma polypeptide                          | 3.19   |
| Fam49a  | MGI:1261783 | family with sequence similarity 49, member A                                 | -3.18  |
| Hells   | MGI:106209 | helicase, lymphoid specific                                                   | -3.18  |
| Snrpb2  | MGI:104805 | U2 small nuclear ribonucleoprotein B                                          | 3.18   |
| Kdm5c   | MGI:99781  | lysine (K)-specific demethylase 5C                                            | -3.18  |
| Mzb1    | MGI:1917066 | marginal zone B and B1 cell-specific protein 1                               | 3.17   |
| Oma1    | MGI:1914263 | OMA1 homolog, zinc metallopeptidase (S. cerevisiae)                          | -3.17  |
| Slc9a8  | MGI:1924281 | solute carrier family 9 (sodium/hydrogen exchanger), member 8                | -3.17  |
| Abcc3   | MGI:1923658 | ATP-binding cassette, sub-family C (CFTR/MRP), member 3                      | -3.16  |
## Supplementary Table 4. Pathway analysis

### Carcinoma mice vs. non-carcinoma mice

| Categories                                                                 | Diseases or Functions Annotation                          | p-Value   | # Molecules |
|---------------------------------------------------------------------------|------------------------------------------------------------|-----------|-------------|
| Cancer, Organismal Injury and Abnormalities, Renal and Urological Disease | tumorigenesis of urinary tract tumor                        | 2.33E-05  | 3           |
| Inflammatory Response                                                     | innate immune response                                     | 5.94E-05  | 12          |
| Cell Death and Survival                                                   | cell death of connective tissue cells                      | 7.30E-05  | 25          |
| Cell Cycle, Cellular Assembly and Organization, DNA Replication, Recombination, and Repair | segregation of chromosomes                              | 9.24E-05  | 9           |
| Cell Cycle, DNA Replication, Recombination, and Repair                   | checkpoint control                                          | 1.10E-04  | 8           |
| Cell Death and Survival, Cellular Function and Maintenance               | colony survival of pancreatic cancer cell lines            | 1.79E-04  | 2           |
| Cell Death and Survival, Cellular Compromise, Hepatic System Development and Function | cytotoxicity of hepatocytes                               | 1.79E-04  | 2           |
| Cancer, Endocrine System Disorders, Gastrointestinal Disease, Organismal Injury and Abnormalities | early-onset pancreatic cancer                              | 1.79E-04  | 2           |
| Cell Death and Survival, Cellular Assembly and Organization, Cellular Compromise | formation of lead inclusion bodies                        | 1.79E-04  | 2           |
| Cell Death and Survival                                                   | killing of skin cell lines                                 | 1.79E-04  | 2           |
| Molecular Transport, Small Molecule Biochemistry                          | release of Zn2+                                            | 1.79E-04  | 2           |
| Organismal Injury and Abnormalities, Renal and Urological Disease        | severity of renal lesion                                   | 1.79E-04  | 2           |
| Cell Cycle, DNA Replication, Recombination, and Repair                   | DNA replication checkpoint                                 | 1.88E-04  | 3           |
| Cellular Function and Maintenance, Hematological System Development and Function, Nervous System Development and Function | function of microglia                                    | 1.90E-04  | 4           |
| Cell Death and Survival                                                   | necrosis                                                  | 2.58E-04  | 74          |
| Cell Death and Survival                                                   | cell death of renal tubule                                 | 2.75E-04  | 6           |
| Cell Death and Survival                                                   | apoptosis of tumor cell lines                              | 3.19E-04  | 40          |
| Cell Morphology, Nervous System Development and Function                  | morphology of astrocytes                                   | 3.63E-04  | 5           |
| RNA Post-Transcriptional Modification                                     | processing of RNA                                          | 3.90E-04  | 14          |
| Cell Death and Survival                                                   | cell death of fibroblast cell lines                        | 4.08E-04  | 18          |
| Cell-To-Cell Signaling and Interaction                                    | response of macrophage cancer cell lines                  | 4.33E-04  | 4           |
| Cell Death and Survival                                                   | apoptosis of connective tissue cells                       | 4.60E-04  | 14          |
| Cell Death and Survival, Gastrointestinal Disease, Hepatic System Disease, Organismal Injury and Abnormalities | necrosis of liver                                         | 4.74E-04  | 12          |
| Cell-To-Cell Signaling and Interaction, Inflammatory Response            | innate immune response of tumor cell lines                | 4.78E-04  | 3           |
| Cell Morphology, Hematological System Development and Function, Nervous System Development and Function | morphology of microglia                                  | 5.00E-04  | 4           |
| Cell Cycle, Connective Tissue Development and Function                   | aneuploidy of fibroblasts                                  | 5.31E-04  | 2           |
| Cancer, Organismal Injury and Abnormalities, Renal and Urological Disease | formation of renal-cell carcinoma                         | 5.31E-04  | 2           |
| Amino Acid Metabolism, Post-Translational Modification, Small Molecule Biochemistry | hydroxylation of L-proline                               | 5.31E-04  | 2           |
| Cell Death and Survival                                                   | killing of epithelial cell lines                          | 5.31E-04  | 2           |
| Organismal Injury and Abnormalities, Renal and Urological Disease        | nephromegaly                                              | 5.31E-04  | 2           |
| Cancer, Hematological Disease, Immunological Disease, Organismal Injury and Abnormalities | small B-cell lymphocytic lymphoma                       | 5.74E-04  | 4           |
| Cellular Function and Maintenance, Molecular Transport, Small Molecule Biochemistry | homeostasis of Zn2+                                     | 6.15E-04  | 3           |
| Cell Death and Survival                                                   | apoptosis of renal tubule                                  | 6.45E-04  | 5           |
Cancer, Organismal Injury and Abnormalities
cancer 6,51E-04 244

Cellular Assembly and Organization
misseggregation of chromosomes 6,55E-04 4

Infectious Diseases
protozoan infection 8,16E-04 6

Cell Death and Survival
apoptosis of fibroblasts 8,54E-04 11

Cell Death and Survival
apoptosis of epithelial cells 8,83E-04 13

Cell Death and Survival
cell death 9,43E-04 88

Cell Death and Survival, Cellular Function and Maintenance
colony survival of tumor cell lines 9,48E-04 4

Cell Death and Survival
apoptosis of cervical cancer cell lines 9,55E-04 13

Cell Death and Survival
cell death of tumor cell lines 9,84E-04 46

Cancer, Gastrointestinal Disease, Hereditary Disorder, Organismal Injury and Abnormalities
Turcot syndrome type 1 1,05E-03 2

Neurological Disease
Wallerian degeneration of sciatic nerve 1,05E-03 2

Gastrointestinal Disease
abnormal absorption of mineral in intestine 1,05E-03 2

Cell-To-Cell Signaling and Interaction
aggregation of bone cancer cell lines 1,05E-03 2

Cell-To-Cell Signaling and Interaction
aggregation of sarcoma cell lines 1,05E-03 2

Cellular Assembly and Organization
binding of chromosomes 1,05E-03 2

clearance of nontypeable Haemophilus influenzae strain 12 1,05E-03 2

Cell Death and Survival, Cellular Function and Maintenance
dead by human herpesvirus 2 1,05E-03 2

Hereditary nonpolyposis colorectal cancer type 1 1,05E-03 2

Neurological Disease
neuropathy of brain 1,05E-03 2

Tissue Morphology
quantity of Francisella tularensis 1,05E-03 2

Tissue Morphology
quantity of Salmonella enterica serovar Typhimurium C5 strain 1,05E-03 2

Cellular Development, Cellular Growth and Proliferation, Embryonic Development, Organismal Development, Tissue Morphology
quantity of mesodermal cells 1,05E-03 2

Cell Morphology, Nervous System Development and Function
abnormal morphology of astrocytes 1,06E-03 4

Lipid Metabolism, Small Molecule Biochemistry
synthesis of prostaglandin D2 1,06E-03 4

Cell Death and Survival
arrest in mitosis of cervical cancer cell lines 1,07E-03 5

Cell Death and Survival
cell death of cervical cancer cell lines 1,08E-03 15

Cell-To-Cell Signaling and Interaction
clustering of cells 1,19E-03 4

Cell Death and Survival, Organismal Injury and Abnormalities, Renal and Urological Disease
necrosis of renal tubule 1,24E-03 5

Cell Death and Survival, Organismal Injury and Abnormalities, Renal and Urological Disease
necrosis of kidney 1,32E-03 15

Cell Morphology
polarization of Th17 cells 1,40E-03 3

Cellular Assembly and Organization, DNA Replication, Recombination, and Repair
quantity of mitotic spindle 1,40E-03 3

Cell Death and Survival
cell death of fibroblasts 1,41E-03 12

Cell Signaling
I-kappaB kinase/NF-kappaB cascade 1,44E-03 9

Cell Cycle
arrest in mitosis 1,49E-03 6

Cell Death and Survival, Connective Tissue Development and Function
cell viability of fibroblast cell lines 1,49E-03 7

Cell Morphology
morphology of antigen presenting cells 1,49E-03 7
| Category                                                                 | Event                                                                 | Value     | Rank |
|-------------------------------------------------------------------------|-----------------------------------------------------------------------|-----------|------|
| Protein Synthesis                                                       | quantity of GPT in blood                                              | 1.55E-03  | 5    |
| Cell Morphology, Nervous System Development and Function                | morphology of neuroglia                                              | 1.56E-03  | 7    |
| Inflammatory Response                                                   | acute inflammatory response of lung                                  | 1.74E-03  | 2    |
| Cell-To-Cell Signaling and Interaction, Cellular Compromise, Neurological Disease, Organismal Injury and Abnormalities | damage of dopaminergic neurons                                       | 1.74E-03  | 2    |
| Cell Death and Survival                                                 | killing of gonadal cell lines                                        | 1.74E-03  | 2    |
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities   | tumorigenesis of intestinal tissue                                   | 1.74E-03  | 2    |
| Hematological Disease, Infectious Diseases                              | parasitemia                                                          | 1.78E-03  | 5    |
| Cell Death and Survival                                                 | apoptosis                                                             | 1.84E-03  | 70   |
| Cellular Assembly and Organization                                      | organization of organelle                                            | 1.94E-03  | 20   |
| Tissue Morphology                                                       | abnormal morphology of atrioventricular canal cushion                | 1.96E-03  | 3    |
| Inflammatory Response                                                   | inflammatory response of lung                                        | 1.96E-03  | 3    |
| Hematological System Development and Function, Inflammatory Response, Tissue Morphology | quantity of myeloid dendritic cells                                 | 1.96E-03  | 3    |
| Cell Cycle                                                              | cell cycle progression                                               | 1.97E-03  | 33   |
| Hematological System Development and Function, Tissue Morphology        | quantity of antigen presenting cells                                 | 2.01E-03  | 12   |
| Cancer, Hematological Disease, Immunological Disease, Organismal Injury and Abnormalities | Waldenstrom’s macroglobulinemia                                     | 2.38E-03  | 9    |
| Cancer, Hematological Disease, Immunological Disease, Organismal Injury and Abnormalities | grade 1 lymphocytic cancer                                             | 2.47E-03  | 5    |
| Behavior                                                                | sickness behavior                                                    | 2.59E-03  | 2    |
| Tissue Morphology                                                       | abnormal morphology of abdominal fat pad                             | 2.64E-03  | 3    |
| Cell Cycle                                                              | mitosis                                                              | 2.86E-03  | 18   |
| Reproductive System Development and Function                            | decidualization of uterus                                            | 3.03E-03  | 3    |
| Cell Death and Survival                                                 | cell death of tubular cells                                          | 3.04E-03  | 4    |
| Developmental Disorder                                                  | incomplete turning of embryo                                         | 3.04E-03  | 4    |
| Cell Cycle                                                              | formation of mitotic spindle                                         | 3.15E-03  | 5    |
| Cell Death and Survival                                                 | apoptosis of intestinal cells                                         | 3.57E-03  | 4    |
| Tissue Morphology                                                       | lack of vitelline vessel                                             | 3.57E-03  | 4    |
| Connective Tissue Development and Function, Skeletal and Muscular System Development and Function | abnormal morphology of secondary center of ossification             | 3.59E-03  | 2    |
| Cell-To-Cell Signaling and Interaction, Hematological System Development and Function, Hypersensitivity Response, Immune Cell Trafficking, Inflammatory Response | activation of bone marrow-derived mast cells                        | 3.59E-03  | 2    |
| Cellular Development, Skeletal and Muscular System Development and Function, Tissue Development | differentiation of skeletal muscle satellite cells                   | 3.59E-03  | 2    |
| Cell Cycle                                                              | length of mitotic spindle                                            | 3.59E-03  | 2    |
| Cellular Compromise, Gastrointestinal Disease, Hepatic System Disease, Organismal Injury and Abnormalities | oxidative stress response of hepatocytes                            | 3.59E-03  | 2    |
| Cellular Movement, Hematological System Development and Function, Immune Cell Trafficking, Inflammatory Response | sequestration of neutrophils                                         | 3.59E-03  | 2    |
| Developmental Disorder, Endocrine System Disorders, Hereditary Disorder, Organismal Injury and Abnormalities, Reproductive System Disease | globozoospermia                                                     | 3.90E-03  | 3    |
| Infectious Diseases                                                     | Parasitic Infection                                                  | 3.92E-03  | 8    |
| Tissue Morphology                                                       | quantity of bacteria                                                 | 4.15E-03  | 4    |
| Cell Death and Survival                                                 | cell death of renal tubular epithelial cells                        | 4.39E-03  | 3    |
| Lipid Metabolism, Molecular Transport, Small Molecule Biochemistry      | release of eicosanoid                                                 | 4.46E-03  | 7    |
Embryonic Development, Tissue Morphology
- abnormal morphology of atrioventricular canal

Cell Death and Survival
- apoptosis of colonocytes

Neurological Disease
- clonic seizure

Cellular Growth and Proliferation, Organismal Development
- growth of Chlamydia pneumoniae

Cellular Function and Maintenance, Hematopoiesis
- homeostasis of hematopoietic progenitor cells

Infectious Diseases
- infection by chlamydia

Cell Signaling
- integration of HIV-1

Neurological Disease
- preclinical stage amyotrophic lateral sclerosis

Embryonic Development, Tissue Morphology
- morphology of yolk sac

Cell Death and Survival, Hematological System Development and Function
- cell viability of neutrophils

Digestive System Development and Function, Hepatic System Development and Function, Organ Morphology
- regeneration of liver

Nervous System Development and Function, Skeletal and Muscular System Development and Function
- motor function

Cell Cycle, Reproductive System Development and Function
- meiosis of germ cells

Developmental Disorder
- abnormal turning of embryo

Cellular Assembly and Organization, DNA Replication, Recombination, and Repair
- alignment of chromosomes

Carbohydrate Metabolism, Lipid Metabolism, Small Molecule Biochemistry
- hydrolysis of choline-phospholipid

Cell Death and Survival
- cell death of macrophage cancer cell lines

Cell Death and Survival
- cell death of epithelial cells

Cellular Function and Maintenance, Hematological System Development and Function
- function of macrophages

Cardiovascular Disease, Developmental Disorder, Organismal Injury and Abnormalities
- hypoplasia of heart ventricle

Cell Morphology
- polarization of cells

Nervous System Development and Function, Organ Morphology, Organismal Development
- abnormal morphology of optic tract

Cell-To-Cell Signaling and Interaction
- clustering of tumor cell lines

Cell Death and Survival
- necroptosis of fibroblasts

Cell Death and Survival
- phagocytosis by dendritic cells

Cell-To-Cell Signaling and Interaction
- recognition of bacteria

Lipid Metabolism, Molecular Transport, Small Molecule Biochemistry
- release of prostaglandin D2

Cell Death and Survival, Organismal Injury and Abnormalities, Renal and Urological Disease
- cell death of kidney cells

Lipid Metabolism, Small Molecule Biochemistry
- incorporation of fatty acid

RNA Post-Transcriptional Modification
- processing of rRNA

Cancer, Organismal Injury and Abnormalities
- malignant solid tumor

Inflammatory Response
- acute inflammatory response

Cardiovascular Disease
- advanced stage peripheral arterial disease

Tissue Morphology
- abnormal morphology of fat pad

Hematological Disease, Infectious Diseases
- malaria

Lipid Metabolism, Molecular Transport, Small Molecule Biochemistry
- release of prostaglandin
| Category                                                                 | Event Description                                      | p-value   | Rank |
|------------------------------------------------------------------------|---------------------------------------------------------|-----------|------|
| Protein Synthesis                                                      | quantity of enzyme                                      | 7.32E-03  | 6    |
| Infectious Diseases                                                    | Streptococcal infection                                 | 7.38E-03  | 3    |
| Cell Morphology, Hematological System Development and Function, Inflammatory Response | M1 polarization of macrophages                          | 7.49E-03  | 2    |
| Cell Death and Survival, Cellular Function and Maintenance             | clearance of E. coli                                    | 7.49E-03  | 2    |
| Cellular Function and Maintenance                                       | endocytosis by dendritic cells                          | 7.49E-03  | 2    |
| Embryonic Development, Gastrointestinal Disease, Hepatic System Development and Function, Organismal Development, Cell-To-Cell Signaling and Interaction, Cellular Function and Maintenance, Inflammatory Response | fibrogenesis of liver                                   | 7.49E-03  | 2    |
| Cell Morphology, Hematological System Development and Function, Humoral Immune Response | phagocytosis of connective tissue cells                 | 7.49E-03  | 2    |
| Antigen Presentation, Inflammatory Response                            | processing of antigen                                   | 7.49E-03  | 2    |
| Cardiovascular Disease, Organisnmal Injury and Abnormalities           | systolic heart failure                                  | 7.49E-03  | 2    |
| Cancer, Organismal Injury and Abnormalities                            | tumorigenesis of tissue                                 | 7.86E-03  | 225  |
| Organismal Injury and Abnormalities, Reproductive System Disease       | oligozoospermia                                          | 7.88E-03  | 6    |
| Lipid Metabolism, Molecular Transport, Small Molecule Biochemistry     | release of arachidonic acid                             | 7.92E-03  | 5    |
| Gastrointestinal Disease, Hepatic System Disease, Organismal Injury and Abnormalities | bleeding of liver                                       | 8.09E-03  | 3    |
| Cellular Development, Cellular Growth and Proliferation, Nervous System Development and Function, Tissue Development | development of astrocytes                               | 8.09E-03  | 3    |
| Gastrointestinal Disease, Hepatic System Disease, Organismal Injury and Abnormalities | degeneration of liver                                   | 8.84E-03  | 3    |
| Organismal Injury and Abnormalities, Skeletal and Muscular Disorders   | atrophy of gastrocnemius                                | 9.07E-03  | 2    |
| Cellular Function and Maintenance, Hematological System Development and Function | function of natural killer T lymphocytes                | 9.07E-03  | 2    |
| Gastrointestinal Disease, Organismal Injury and Abnormalities           | injury of colon                                          | 9.07E-03  | 2    |
| DNA Replication, Recombination, and Repair                              | mutation of gene                                         | 9.07E-03  | 2    |
| Hematological Disease, Immunological Disease, Organismal Injury and Abnormalities, Respiratory Disease | neutrophilia of airway                                  | 9.07E-03  | 2    |
| Gene Expression                                                         | paternal imprinting                                     | 9.07E-03  | 2    |
| Cell Death and Survival                                                 | apoptosis of myeloid cells                               | 9.08E-03  | 8    |
| Lipid Metabolism, Small Molecule Biochemistry                          | homeostasis of lipid                                    | 9.08E-03  | 8    |
| Connective Tissue Development and Function, Skeletal and Muscular System Development and Function | abnormal morphology of compact bone                    | 9.63E-03  | 3    |
| Cell Death and Survival, Cellular Function and Maintenance             | clearance of cells                                       | 9.84E-03  | 5    |
| Cell Death and Survival, Gastrointestinal Disease, Hepatic System Disease, Organismal Injury and Abnormalities | apoptosis of liver cells                                | 9.98E-03  | 7    |
| Organ Morphology, Organismal Development, Renal and Urological System Development and Function | abnormal morphology of dilated renal tubule            | 1.01E-02  | 4    |
| Hematological System Development and Function, Inflammatory Response, Tissue Morphology | quantity of dendritic cells                            | 1.04E-02  | 6    |
| RNA Post-Transcriptional Modification                                  | splicing of RNA                                         | 1.06E-02  | 7    |
| Cellular Function and Maintenance, Hematological System Development and Function | function of CD4+ T-lymphocytes                          | 1.07E-02  | 4    |
| Cellular Assembly and Organization, DNA Replication, Recombination, and Repair | chromosomal congergation of chromosomes               | 1.08E-02  | 2    |
| Respiratory Disease                                                     | constriction of bronchus                                 | 1.08E-02  | 2    |
| Cell-To-Cell Signaling and Interaction, Inflammatory Response          | immune response of epithelial cells                     | 1.08E-02  | 2    |
| Lipid Metabolism, Small Molecule Biochemistry                          | incorporation of palmitic acid                           | 1.08E-02  | 2    |
| Nucleic Acid Metabolism, Small Molecule Biochemistry                   | metabolism of NADH                                      | 1.08E-02  | 2    |
| Category                                                                 | Description                                                                 | P-value | Ranked |
|-------------------------------------------------------------------------|------------------------------------------------------------------------------|---------|--------|
| Cardiovascular System Development and Function, Embryonic Development, Organismal Development, Tissue Development | vascularization of yolk sac                                                   | 1,08E-02 | 2      |
| Cellular Assembly and Organization, Cellular Function and Maintenance    | maintenance of telomeres                                                     | 1,12E-02 | 4      |
| Cell Cycle, Cell Morphology, Cellular Assembly and Organization, DNA Replication, Recombination, and Repair | abnormal morphology of chromosomes                                           | 1,13E-02 | 3      |
| Cell Morphology, Cellular Assembly and Organization, Cellular Function and Maintenance | reorganization of actin filaments                                            | 1,13E-02 | 3      |
| Energy Production                                                        | consumption of oxygen                                                        | 1,15E-02 | 7      |
| Organismal Development                                                   | morbidity or mortality                                                       | 1,15E-02 | 61     |
| Embryonic Development, Tissue Morphology                                 | abnormal morphology of visceral yolk sac                                     | 1,18E-02 | 4      |
| Cell Morphology, Cellular Assembly and Organization, Cellular Function and Maintenance | reorganization of actin cytoskeleton                                         | 1,19E-02 | 6      |
| Cellular Function and Maintenance                                         | function of phagocytes                                                       | 1,20E-02 | 11     |
| Cellular Movement, Reproductive System Development and Function          | cell movement of breast cell lines                                           | 1,21E-02 | 5      |
| Cell-To-Cell Signaling and Interaction, Inflammatory Response            | immune response of leukocyte cell lines                                      | 1,22E-02 | 3      |
| Protein Synthesis                                                        | quantity of aspartate transaminase in blood                                  | 1,22E-02 | 3      |
| Cell Death and Survival, Gastrointestinal Disease, Hepatic System Disease, Organismal Injury and Abnormalities | cell death of liver cells                                                    | 1,23E-02 | 8      |
| Organismal Development                                                   | abnormal morphology of body cavity                                           | 1,26E-02 | 33     |
| Protein Synthesis                                                        | abnormal quantity of enzyme in blood                                         | 1,26E-02 | 2      |
| Cellular Compromise, DNA Replication, Recombination, and Repair           | breakdown of chromosomes                                                    | 1,26E-02 | 2      |
| Infectious Diseases, Organismal Injury and Abnormalities, Renal and Urological Disease | infection of kidney                                                         | 1,26E-02 | 2      |
| Tissue Morphology                                                        | morphology of extraembryonic tissue                                          | 1,29E-02 | 8      |
| Organismal Survival                                                       | organisinal death                                                           | 1,30E-02 | 60     |
| Cardiovascular Disease, Developmental Disorder, Organismal Injury and Abnormalities | hypoplasia of trabecuiae carne                                              | 1,32E-02 | 3      |
| Protein Synthesis                                                        | quantity of alkaline phosphatase in blood                                    | 1,32E-02 | 3      |
| Hematological Disease, Hereditary Disorder, Organismal Injury and Abnormalities | CD36 deficiency                                                             | 1,34E-02 | 1      |
| Connective Tissue Disorders, Developmental Disorder, Hereditary Disorder, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders | Catel-Manzke syndrome                                                       | 1,34E-02 | 1      |
| Organismal Injury and Abnormalities, Skeletal and Muscular Disorders     | Cole-Carpenter syndrome type 1                                               | 1,34E-02 | 1      |
| Connective Tissue Disorders, Developmental Disorder, Hereditary Disorder, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders | Fanconis anaemia group G                                                    | 1,34E-02 | 1      |
| Developmental Disorder, Endocrine System Disorders, Hematological Disease, Hereditary Disorder, Metabolic Disease, Organismal Injury and Abnormalities | Kenny-Caffey syndrome type 2                                                | 1,34E-02 | 1      |
| Connective Tissue Disorders, Developmental Disorder, Skeletal and Muscular Disorders | Lethal arthrogryposis with anterior horn cell disease                        | 1,34E-02 | 1      |
| Neurological Disease, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders | Lethal congenital contractual syndrom finnish type                          | 1,34E-02 | 1      |
| Disorder, Hereditary Disorder, Immunological Disease, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders | OL-EDA-ID syndrome                                                          | 1,34E-02 | 1      |
| Cardiovascular Disease, Developmental Disorder, Hematological Disease, Hereditary Disorder, Immunological Disease, Organismal Injury and Abnormalities | T-cell immunodeficiency, recurrent infections, autoimmunity, and cardiac malformations | 1,34E-02 | 1      |
| Developmental Disorder, Hereditary Disorder, Neurological Disease, Organismal Injury and Abnormalities | X-linked mental retardation syndromic jagrid1c-related                      | 1,34E-02 | 1      |
| Hereditary Disorder, Immunological Disease, Infectious Diseases, Organismal Injury and Abnormalities | X-linked familial atypical mycobacteriosis                                  | 1,34E-02 | 1      |
| Disease, Hereditary Disorder, Immunological Disease, Organismal Injury and Abnormalities | X-linked hyper-igM syndrome with etodermal dysplasia                         | 1,34E-02 | 1      |
| Developmental Disorder, Hereditary Disorder, Neurological Disease, Organismal Injury and Abnormalities | X-linked mental retardation type 100                                      | 1,34E-02 | 1      |
| Developmental Disorder, Hereditary Disorder, Neurological Disease, Organismal Injury and Abnormalities | X-linked mental retardation with cerebellar hypoplasia and distinctive facial appearance | 1,34E-02 | 1      |
| Cardiovascular System Development and Function, Tissue Morphology         | abnormal morphology of superior vena cava                                   | 1,34E-02 | 1      |
| Category                                                                 | Event                                                                 | Log Value  |
|-------------------------------------------------------------------------|----------------------------------------------------------------------|------------|
| Small Molecule Biochemistry                                            | absorption of fexofenadine                                            | 1,34E-02   |
| Lipid Metabolism, Molecular Transport, Small Molecule Biochemistry     | absorption of pravastatin                                             | 1,34E-02   |
| Tissue Development                                                     | accumulation of lymphoblastoid cell lines                            | 1,34E-02   |
| Organismal Development                                                 | accumulation of mucus                                                 | 1,34E-02   |
| Cellular Compromise, Nervous System Development and Function            | acidification of synaptic vesicles                                    | 1,34E-02   |
| Lipid Metabolism, Small Molecule Biochemistry                          | activation of epoprostenol                                            | 1,34E-02   |
| Cell-To-Cell Signaling and Interaction, Hematological System Development and Function | activation of follicular dendritic cells                              | 1,34E-02   |
| Inflammatory Response, Respiratory System Development and Function     | acute inflammatory response of airway                                 | 1,34E-02   |
| Cell-To-Cell Signaling and Interaction, Hematological System Development and Function | adhesion of Langerhans cells                                          | 1,34E-02   |
| Embryonic Development, Tissue Development                              | adhesion of embryoblast                                              | 1,34E-02   |
| Cell-To-Cell Signaling and Interaction                                  | adhesion of neural stem cells                                         | 1,34E-02   |
| Ophthalmic Disease, Organismal Injury and Abnormalities                | anisocoria                                                            | 1,34E-02   |
| Developmental Disorder, Organismal Injury and Abnormalities, Reproductive System Disease | apocrine metaplasia of mammary gland                                  | 1,34E-02   |
| Cell Death and Survival                                                | apoptosis of B-2 lymphocytes                                          | 1,34E-02   |
| Cell Death and Survival                                                | apoptosis of fibroblastoids                                           | 1,34E-02   |
| Cell Death and Survival, Neurological Disease                          | apoptosis of gonadotropes                                             | 1,34E-02   |
| Cell Death and Survival, Skeletal and Muscular Disorders               | apoptosis of neoptropes                                               | 1,34E-02   |
| Cardiovascular System Development and Function, Organismal Development, Tissue Morphology | area of left common carotid artery                                    | 1,34E-02   |
| Cardiovascular System Development and Function, Organismal Development, Tissue Morphology | area of right common carotid artery                                   | 1,34E-02   |
| Cell Cycle                                                              | arrest in G2/M phase transition of lymphoblasts                      | 1,34E-02   |
| Cell Cycle                                                              | arrest in cell division of bone cancer cell lines                     | 1,34E-02   |
| Cell Cycle                                                              | arrest in cell division of sarcoma cell lines                        | 1,34E-02   |
| Development and Function, Hematopoiesis, Humoral Immune Response, Lymphoid Tissue Structure and Development, Tissue Development | arrest in development of B-1 lymphocytes                             | 1,34E-02   |
| Hematological System Development and Function, Hematopoiesis, Humoral Immune Response, Lymphoid Tissue Structure and Development, Organ Development, Development and Function, Hematopoiesis, Humoral Immune Response, Lymphoid Tissue Structure and Development, Tissue Development | arrest in development of marginal-zone B lymphocytes                 | 1,34E-02   |
| Development and Function, Hematopoiesis, Humoral Immune Response, Lymphoid Tissue Structure and Development, Tissue Development | arrest in development of transitional B lymphocytes                   | 1,34E-02   |
| Development and Function, Hematopoiesis, Organismal Immune Response, Lymphoid Tissue Structure and Development, Tissue Development | arrest in development of transitional type 1 B lymphocytes           | 1,34E-02   |
| Development and Function, Hematopoiesis, Organismal Immune Response, Lymphoid Tissue Structure and Development, Tissue Development | arrest in maturation of thymocytes                                   | 1,34E-02   |
| Cell Cycle, Reproductive System Development and Function               | arrest in meiosis of sperm                                           | 1,34E-02   |
| Cardiovascular Disease, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders | arrhythmogenic right ventricular dysplasia familial 12              | 1,34E-02   |
| Cell-To-Cell Signaling and Interaction                                  | attachment of blood platelets                                        | 1,34E-02   |
| Dermatological Diseases and Conditions, Developmental Disorder, Hereditary Disorder, Organismal Injury and Abnormalities | atypical incontinentia pigmenti                                      | 1,34E-02   |
| Cell Death and Survival, Cell Morphology, Cellular Function and Maintenance | autophagic cell death of cervical cancer cell lines                 | 1,34E-02   |
| Cancer, Gastrointestinal Disease, Hereditary Disorder, Organismal Injury and Abnormalities | autosomal dominant hereditary diffuse gastric cancer                 | 1,34E-02   |
Dermatological Diseases and Conditions, Developmental Disorder, Hereditary Disorder, Organismal Injury and Abnormalities
autosomal recessive dyskeratosis congenita type 3 1.34E-02 1
Developmental Disorder, Hereditary Disorder, Neurological Disease, Organismal Injury and Abnormalities
autosomal recessive mental retardation type 37 1.34E-02 1
Hereditary Disorder, Neurological Disease, Organismal Injury and Abnormalities
autosomal recessive spastic paraplegia type 46 1.34E-02 1
Cell-To-Cell Signaling and Interaction
binding of colon cell lines 1.34E-02 1
Cell-To-Cell Signaling and Interaction
binding of colonocytes 1.34E-02 1
Gene Expression
binding of double-stranded DNA 1.34E-02 1
Gene Expression
binding of origin of replication in the short region 1.34E-02 1
Carbohydrate Metabolism, Lipid Metabolism, Small Molecule Biochemistry
binding of phosphatidylinositol 4-phosphate 1.34E-02 1
Cellular Assembly and Organization
biogenesis of lateral plasma membrane 1.34E-02 1
Lipid Metabolism, Small Molecule Biochemistry, Vitamin and Mineral Metabolism
biosynthesis of dolichol monophosphate 1.34E-02 1
Developmental Disorder, Hereditary Disorder, Metabolic Disease, Organismal Injury and Abnormalities
branched-chain ketoacid dehydrogenase kinase deficiency 1.34E-02 1
Cell Morphology, Cellular Development, Cellular Growth and Proliferation, Embryonic Development
branching of breast cancer cell lines 1.34E-02 1
Respiratory Disease
bronchoconstriction of lung 1.34E-02 1
Small Molecule Biochemistry
catabolism of spermidine 1.34E-02 1
Cell Death and Survival
cell death of Fanconi's anemia cell lines 1.34E-02 1
Cellular Movement
cell movement of keratinocyte cancer cell lines 1.34E-02 1
Cell Death and Survival
cell viability of gonadotropes 1.34E-02 1
Cell Death and Survival, Hematological System Development and Function
cell viability of long-term hematopoietic stem cells 1.34E-02 1
Cell-To-Cell Signaling and Interaction
cell-cell contact of breast cell lines 1.34E-02 1
Cell-To-Cell Signaling and Interaction, Embryonic Development
cell-cell contact of embryonic stem cell lines 1.34E-02 1
Cell-To-Cell Signaling and Interaction, Embryonic Development
cell-cell contact of embryonic stem cells 1.34E-02 1
Cell-To-Cell Signaling and Interaction
cell-cell contact of squamous carcinoma cells 1.34E-02 1
Connective Tissue Disorders, Developmental Disorder, Hereditary Disorder, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders
chondrolysis of femur 1.34E-02 1
Connective Tissue Disorders, Developmental Disorder, Hereditary Disorder, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders
chondrolysis of humerus 1.34E-02 1
Cell Death and Survival, Cellular Function and Maintenance
clerance of Burkholderia pseudomallei strain 1026b 1.34E-02 1
Antimicrobial Response
clearance of human respiratory syncytial virus A2 1.34E-02 1
Function, Humoral Immune Response, Immune Cell Trafficking, Inflammatory Response
clustering of B lymphocytes 1.34E-02 1
Cell-To-Cell Signaling and Interaction, Skeletal and Muscular System Development and Function
clustering of muscle cell lines 1.34E-02 1
Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities
colorectal cancer with distant metastasis 1.34E-02 1
Developmental Disorder, Hereditary Disorder, Metabolic Disease, Organismal Injury and Abnormalities
congenital disorder of glycosylation type 1m 1.34E-02 1
Carbohydrate Metabolism, Lipid Metabolism, Small Molecule Biochemistry
conjugation of phosphatidylethanolamine 1.34E-02 1
Amino Acid Metabolism, Post-Translational Modification, Small Molecule Biochemistry
conversion of L-lysine 1.34E-02 1
Cell Death and Survival, Cellular Compromise
cytotoxicity of lymphoma cell lines 1.34E-02 1
Cellular Compromise, Neurological Disease, Organismal Injury and Abnormalities
damage of CA3 neurons 1.34E-02 1
Hereditary Disorder, Metabolic Disease, Organismal Injury and Abnormalities
deficiency of group IV A phospholipase A2 1.34E-02 1
Cellular Compromise
deforation of spindle pole 1.34E-02 1
Developmental Disorder, Embryonic Development, Tissue Morphology
degeneration of yolk sac 1.34E-02 1

Cellular Compromise, Inflammatory Response
degrannulation of dendritic epidermal T cells 1.34E-02 1

Reproductive System Development and Function
delay in gestation 1.34E-02 1

Cellular Development, Cellular Growth and Proliferation
delay in growth of breast cancer cell lines 1.34E-02 1
delay in initiation of chromosomal congression of chromosomes 1.34E-02 1

Cellular Assembly and Organization, DNA Replication, Recombination, and Repair
delay in initiation of clearance of pneumocytes 1.34E-02 1

Cell Death and Survival, Cellular Function and Maintenance
depletion of hippocampal neurons 1.34E-02 1

Cancer, Dermatological Diseases and Conditions, Organismal Injury and Abnormalities
dermal neurofibroma 1.34E-02 1

Organ Morphology, Respiratory Disease, Tissue Morphology
destruction of lung tissue 1.34E-02 1

Embryonic Development, Hair and Skin Development and Function, Organ Development, Organismal Development, Tissue Development
development of hair cuticle 1.34E-02 1

Nervous System Development and Function
development of limbic system 1.34E-02 1

Growth and Proliferation, Embryonic Development, Organ Development, Organismal Development, Tissue Development
development of pacemaker cells 1.34E-02 1

Cardiovascular System Development and Function, Tissue Morphology
diameter of left common carotid artery 1.34E-02 1
diameter of right common carotid artery 1.34E-02 1

Cellular Development, Endocrine System Development and Function
differentiation of enteroendocrine cells 1.34E-02 1

Cellular Compromise, DNA Replication, Recombination, and Repair

disintegration of genomes 1.34E-02 1

Cellular Assembly and Organization, Cellular Compromise

disruption of vimentin filaments 1.34E-02 1
dystonia progressive cerebellar atrophy and dilated cardiomyopathy 1.34E-02 1

Cardiovascular Disease, Neurological Disease, Organisim Injury and Abnormalities, Skeletal and Muscular Disorders
electrical capacitance of ventricular myocytes 1.34E-02 1

Cardiovascular System Development and Function, Cell Morphology, Skeletal and Muscular System Development and Function

endoplasmic reticulum stress response of melanoma cell lines 1.34E-02 1

Cellular Compromise, Cellular Function and Maintenance

enlargement of kidney 1.34E-02 1

Cell Cycle

entry into S phase of skin cancer cell lines 1.34E-02 1
dyserythropoietic anemia, and calvarial hyperostosis 1.34E-02 1

Endocrine System Disorders, Gastrointestinal Disease, Hematological Disease, Hereditary Disorder, Organismal Injury and Abnormalities, Skeletal and Muscular

expansion of bladder cancer cell lines 1.34E-02 1

Cellular Development, Cellular Growth and Proliferation

expansion of brown adipose tissue 1.34E-02 1

Connective Tissue Development and Function, Tissue Development

expansion of epididymal fat 1.34E-02 1

Connective Tissue Development and Function, Organ Development, Reproductive System Development and Function, Tissue Development

expansion of inguinal fat pad 1.34E-02 1

Connective Tissue Development and Function, Tissue Development

expansion of mesenteric fat 1.34E-02 1

Connective Tissue Development and Function, Tissue Development

expansion of retroperitoneal white adipose tissue 1.34E-02 1

Lipid Metabolism, Molecular Transport, Small Molecule Biochemistry

extrusion of bile acid 1.34E-02 1

Facial dysmorphism, immunodeficiency, livedo, and short stature syndrome 1.34E-02 1

familial MYD88 deficiency 1.34E-02 1

Cardiovascular Disease, Organismal Injury and Abnormalities

fibrosis of portal artery 1.34E-02 1

Embryonic Development, Organismal Development, Tissue Development

formation of blastocele 1.34E-02 1

Cellular Assembly and Organization

formation of macronuclei 1.34E-02 1

Cancer, Endocrine System Disorders, Organismal Injury and Abnormalities, Reproductive System Disease

formation of ovarian adenocarcinoma 1.34E-02 1
Embryonic Development, Organismal Development, Tissue Development
formation of trophoectoderm 1,34E-02
Cardiovascular System Development and Function, Organ Development
function of right ventricle 1,34E-02
Neurological Disease
Developmental Disorder, Hereditary Disorder, Metabolic Disease, Organismal Injury and Abnormalities, Renal and Urological Disease
global cerebral hypomyelination 1,34E-02
Connective Tissue Disorders, Developmental Disorder, Hereditary Disorder, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders
glutaric acidemia type I 1,34E-02
Cancer, Organismal Injury and Abnormalities
Cellular Development, Cellular Growth and Proliferation, Connective Tissue Development and Function, Tissue Development
growth of cardiovascular neoplasm 1,34E-02
growth of fibroblastoids 1,34E-02
Organismal Functions
healing of gastric epithelial cells 1,34E-02
Organismal Functions, Tissue Morphology
Disease, Hereditary Disorder, Organismal Development, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders
hepatic diffuse gastric cancer and cleft lip 1,34E-02
Cancer, Gastrointestinal Disease, Hereditary Disorder, Organismal Injury and Abnormalities
hereditary nonpolyposis colorectal cancer type 2 1,34E-02
hereditary nonpolyposis colorectal cancer type 4 1,34E-02
Cellular Function and Maintenance
homeostasis of tumor cells 1,34E-02
Carbohydrate Metabolism, Lipid Metabolism, Small Molecule Biochemistry
hydrolysis of sn-2-arachidonoylphosphatidylcholine 1,34E-02
Cell Death and Survival, DNA Replication, Recombination, and Repair
hypercondensation of chromatin 1,34E-02
DNA Replication, Recombination, and Repair
hypercondensation of chromosomes 1,34E-02
Cardiovascular Disease, Endocrine System Disorders, Hematological Disease, Metabolic Disease
hyperglycemia of portal vein 1,34E-02
Cardiovascular Disease, Endocrine System Disorders, Gastrointestinal Disease, Metabolic Disease
hyperinsulinism of portal vein 1,34E-02
Developmental Disorder, Ophthalmic Disease, Organismal Injury and Abnormalities
hypertrophy of cornea 1,34E-02
System Development and Function, Endocrine System Disorders, Gastrointestinal Disease, Hereditary Disorder, Neurological Disease, Organismal Development, Hereditary Disorder, Neurological Disease, Organismal Injury and Abnormalities, Psychological Disorders
hypomyelinating leukodystrophy type 7 without oligodendria or hypogonadotropic hypogonadism 1,34E-02
Cell-To-Cell Signaling and Interaction, Inflammatory Response
immune response of renal tubular epithelial cells 1,34E-02
infection by Streptococcus pyogenes 1,34E-02
Cancer, Hematological Disease, Immunological Disease, Organismal Injury and Abnormalities
immunoglobulin M monoclonal gammopathy of undetermined significance 1,34E-02
infection of thymus gland 1,34E-02
Infectious Diseases
infection of alveolar epithelium 1,34E-02
infection by mouse mammary tumor virus 1,34E-02
infection of cholangiocytes 1,34E-02
Immunological Disease, Infectious Diseases
infection of thymus gland 1,34E-02
Cell Death and Survival
initiation of apoptosis of colorectal cancer cell lines 1,34E-02
Function and Maintenance, Cellular Growth and Proliferation, Nervous System Development and Function, Tissue Development
initiation of formation of dendrites 1,34E-02
Organismal Injury and Abnormalities, Respiratory Disease
injury of alveolar epithelium 1,34E-02
Injury of enterocytes
Cell-to-cell communication of peritoneal macrophages
Invasion of enterocytes
Invasion of papillary thyroid carcinoma
Iridogoniodygenesis syndrome type 2
Isolated immunodeficiency
Joubert syndrome type 9
Ketosis-prone diabetes mellitus
Lack of coronary sinus
Lack of metacarpal bone
Laterization
Leakage of interstitial fluid
Length of apical membrane
Length of basal membrane
Loss of arachidonic acid
Loss of lateral plasma membrane
Malignant breast cancer
Maturation of myeloma cell lines
Maturity-onset diabetes of the young type 9
Metastasis of papillary thyroid carcinoma
Metastatic hydatidiform mole
Mixed ductal lobular breast carcinoma in situ
Morphogenesis of hepatoma cell lines
Morphogenesis of superior vena cava
Morphology of nuclear matrix
Multiple mitochondrial dysfunctions syndrome type 2
Nephrotic syndrome type 9
Neuronal ceroid lipofuscinosis 8 northern epilepsy variant
Neuronal ceroid lipofuscinosis-8
Organization of gonadal cell lines
Oxidation of blood
Oxidative stress response of adductor muscle
Partial atrioventricular septal defect with heterotaxy syndrome
Patterning of sinus venosus
Persistence of Schwann cells
Phosphorylation of phytosphingosine
poikiloderma with neutropenia
polyplloidization of epithelial cell lines
polyplloidization of kidney cell lines
poorly differentiated skin squamous cell carcinoma
production of germinal center B lymphocytes
progression of myoblasts
progressive early-onset ataxia
progressive epidermal hyperplasia
quantity of Brucella abortus
quantity of embryoid body cells
quantity of mesangial matrix
re-innervation of skeletal muscle
recognition of heparan sulfate
recognition of hyaluronic acid
recognition of paclitaxel
recruitment of activated T lymphocyte
hepatic dysfunction, and cardiovascular malformations
recurrent isolated invasive pneumococcal disease type 2
regeneration of adductor muscle
regulation of enterocytes
regulation of nitric oxide
relocalization of stromal cells
remodeling of left common carotid artery
replication of Human rhinovirus 1B
response of bronchial tissue
restoration of actin cytoskeleton
retention of regulatory T lymphocytes
rhizomelic chondrodysplasia punctata type 2
ring dermoid of cornea
severe malaria
shape of muscle cell lines
spinocerebellar ataxia type 10
spondyloepimetaphyseal dysplasia with joint laxity type 2
stimulation of BMMC cells
stress response of ventricular septum
susceptibility to cutaneous malignant melanoma type 10
| Category                                                                 | Event                                                                                           | p-value | q-value |
|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|---------|---------|
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities   | susceptibility to sporadic colorectal cancer                                                   | 1.34E-02| 1       |
| Inflammatory Disease, Inflammatory Response, Organismal Injury and Abnormalities | swelling of renal glomerulus                                                                   | 1.34E-02| 1       |
| Renal and Urological Disease                                            | tachycardia of atrium                                                                           | 1.34E-02| 1       |
| Cardiovascular Disease, Organismal Injury and Abnormalities             | thickness of glomerular basement membrane                                                       | 1.34E-02| 1       |
| Cancer, Endocrine System Disorders, Organismal Injury and Abnormalities | thyroid gland fetal adenoma                                                                     | 1.34E-02| 1       |
| Hereditary Disorder, Immunological Disease, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders | trichohepatoenteric syndrome type 2                                                             | 1.34E-02| 1       |
| Lipid Metabolism, Small Molecule Biochemistry                          | turnover of arachidonic acid                                                                    | 1.34E-02| 1       |
| Developmental Disorder                                                 | ulnar-mammary syndrome                                                                          | 1.34E-02| 1       |
| DNA Replication, Recombination, and Repair                             | unwinding of origin of replication in the short region                                          | 1.34E-02| 1       |
| Infectious Diseases                                                    | uptake of Human adenovirus 35                                                                    | 1.34E-02| 1       |
| Lipid Metabolism, Molecular Transport, Small Molecule Biochemistry      | uptake of omega-(4-iodophenyl)pentadecanoic acid                                                | 1.34E-02| 1       |
| Cardiovascular System Development and Function, Organ Morphology       | volume of right ventricle                                                                       | 1.34E-02| 1       |
| Developmental Disorder, Hereditary Disorder, Neurological Disease, Organismal Injury and Abnormalities | x-linked mental retardation type 90                                                             | 1.34E-02| 1       |
| Cellular Function and Maintenance, Hematological System Development and Function, Inflammatory Response, Tissue Morphology | function of myeloid cells                                                                       | 1.38E-02| 9       |
| Cellular Function and Maintenance, Hematological System Development and Function, Organ Morphology | quantity of macrophages                                                                        | 1.38E-02| 8       |
| Cancer, Organismal Injury and Abnormalities                            | metastatic carcinoma                                                                            | 1.39E-02| 7       |
| Organ Morphology, Reproductive System Development and Function         | abnormal morphology of seminiferous tubule                                                      | 1.39E-02| 6       |
| Cell-To-Cell Signaling and Interaction                                  | response of granulocytes                                                                         | 1.41E-02| 5       |
| Molecular Transport                                                     | transport of transition metal ion                                                                | 1.42E-02| 3       |
| Cell Death and Survival, Gastrointestinal Disease, Hepatic System Disease, Organismal Injury and Abnormalities | apoptosis of hepatocytes                                                                         | 1.44E-02| 6       |
| Embryonic Development, Organ Development, Organ Morphology, Organismal Development, Tissue Development, Visual System Development and Function | abnormal morphology of anterior chamber of eye                                                 | 1.46E-02| 2       |
| Lipid Metabolism, Molecular Transport, Small Molecule Biochemistry      | abnormal quantity of bile salt                                                                   | 1.46E-02| 2       |
| Cell Death and Survival                                                 | apoptosis of airway epithelial cells                                                             | 1.46E-02| 2       |
| Infectious Diseases                                                    | infection by respiratory epithelial cells                                                        | 1.46E-02| 2       |
| Cell Cycle                                                              | metaphase/anaphase transition                                                                    | 1.46E-02| 2       |
| Cellular Development, Cellular Growth and Proliferation, Organ Development, Skeletal and Muscular System Development and Function, Tissue Development | proliferation of skeletal muscle satellite cells                                                | 1.46E-02| 2       |
| Cellular Assembly and Organization, Cellular Function and Maintenance   | organization of actin filaments                                                                 | 1.51E-02| 5       |
| Cell Death and Survival, Organismal Injury and Abnormalities, Renal and Urological Disease | apoptosis of tubular cells                                                                     | 1.52E-02| 3       |
| Cellular Compromise, Hypersensitivity Response, Inflammatory Response   | degranulation of mast cells                                                                      | 1.57E-02| 6       |
| Cellular Function and Maintenance                                       | function of antigen presenting cells                                                             | 1.59E-02| 9       |
| Molecular Transport                                                     | transport of heavy metal                                                                          | 1.62E-02| 6       |
| Cell Death and Survival                                                 | necrosis of epithelial tissue                                                                    | 1.63E-02| 18      |
| Molecular Transport                                                     | release of metal ion                                                                               | 1.66E-02| 8       |
| Cell Morphology, Cellular Assembly and Organization, DNA Replication, Recombination, and Repair | abnormal morphology of mitotic spindle                                                         | 1.67E-02| 2       |
| Cancer, Organismal Injury and Abnormalities, Respiratory Disease        | development of lung tumor                                                                        | 1.67E-02| 2       |
| Cellular Function and Maintenance, Molecular Transport                  | efflux of anion                                                                                   | 1.67E-02| 2       |
Organismal Functions, Tissue Morphology
- healing of epithelial tissue
- phagocytosis by microglia

Cell-To-Cell Signaling and Interaction, Cellular Function and Maintenance, Hematological System Development and Function, Inflammatory Response
- taste discrimination
- apoptosis of macrophages
- apoptosis of splenocytes

Behavior
- taste discrimination
- apoptosis of macrophages

Cell Death and Survival
- apoptosis of macrophages

Cell Death and Survival
- apoptosis of macrophages

Gene Expression
- synthesis of RNA

Cardiovascular Disease
- peripheral arterial disease

Cancer, Organismal Injury and Abnormalities
- thoracic neoplasm

Organ Morphology, Organismal Development, Renal and Urological System Development and Function
- abnormal morphology of renal tubule

Embryonic Development, Tissue Morphology
- abnormal morphology of yolk sac

Cancer, Organismal Injury and Abnormalities
- epithelial cancer

Molecular Transport
- secretion of molecule

Organ Morphology, Organismal Development, Renal and Urological System Development and Function
- abnormal morphology of proximal convoluted tubule

Cellular Movement
- migration of prostate cancer cell lines

Cell Morphology, Nervous System Development and Function
- morphology of central nervous system cells

Gastrointestinal Disease, Hepatic System Disease, Organismal Injury and Abnormalities
- liver lesion

Organ Morphology, Organismal Development, Renal and Urological System Development and Function
- abnormal morphology of dilated proximal convoluted tubule

Cardiovascular System Development and Function
- abnormal morphology of vascular plexus

Cell-To-Cell Signaling and Interaction, Hematological System Development and Function, Immune Cell Trafficking, Inflammatory Response
- activation of monocyte-derived dendritic cells

Tissue Development
- formation of lumen

Cellular Assembly and Organization
- formation of micronuclei

Cell Morphology, Hematological System Development and Function, Hematopoiesis, Lymphoid Tissue Structure and Development, Tissue Morphology
- lack of bone marrow cells

Cellular Assembly and Organization, Cellular Function and Maintenance
- quantity of lamellipodia

Infectious Diseases
- replication of Enterovirus

Cell-To-Cell Signaling and Interaction
- response of endothelial cells

Cell Signaling, Molecular Transport, Small Molecule Biochemistry
- secretion of nitric oxide

Lipid Metabolism, Small Molecule Biochemistry, Vitamin and Mineral Metabolism
- steroidogenesis of cells

Cellular Movement, Reproductive System Development and Function
- migration of breast cell lines

Cellular Assembly and Organization, Cellular Function and Maintenance
- organization of mitochondria

Cell Morphology, Hematological System Development and Function
- morphology of myeloid cells

Cell Death and Survival, Skeletal and Muscular Disorders
- apoptosis of smooth muscle cells

Drug Metabolism, Lipid Metabolism, Molecular Transport, Small Molecule Biochemistry
- release of prostaglandin E2

Development and Function, Hepatic System Disease, Inflammatory Disease, Inflammatory Response, Metabolic Disease, Organ Development, Organismal Injury
- steatohepatitis

Cell Cycle
- G2/M phase

Cancer, Organismal Injury and Abnormalities
- neoplasia of epithelial tissue
| Categories                                                                 | Diseases or Functions Annotation                          | p-Value     | # Molecules |
|--------------------------------------------------------------------------|----------------------------------------------------------|-------------|-------------|
| Cancer, Organismal Injury and Abnormalities                               | cancer                                                   | 8,50E-09    | 251         |
| Cancer, Organismal Injury and Abnormalities                               | malignant solid tumor                                    | 1,27E-08    | 248         |
| Cancer, Organismal Injury and Abnormalities                               | neoplasia of epithelial tissue                           | 1,65E-08    | 237         |
| Cancer, Organismal Injury and Abnormalities                               | epithelial cancer                                         | 1,91E-08    | 236         |
| Cancer, Organismal Injury and Abnormalities                               | tumorigenesis of tissue                                   | 2,25E-08    | 239         |
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities     | digestive organ tumor                                     | 4,79E-07    | 219         |
| Cancer, Organismal Injury and Abnormalities                               | abdominal cancer                                          | 7,10E-07    | 228         |
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities     | digestive system cancer                                   | 8,41E-07    | 217         |
| Cancer, Organismal Injury and Abnormalities                               | abdominal neoplasm                                        | 8,87E-07    | 229         |
| Cancer, Organismal Injury and Abnormalities                               | adenocarcinoma                                            | 9,34E-06    | 208         |
| Cell Cycle, Cellular Assembly and Organization, DNA Replication, Recombination, and Repair | segregation of chromosomes                              | 1,03E-05    | 10          |
| Cell Death and Survival                                                  | apoptosis of fibroblasts                                  | 5,44E-05    | 13          |
| Cell Cycle                                                               | cell cycle progression                                    | 7,22E-05    | 37          |
| Cellular Assembly and Organization, DNA Replication, Recombination, and Repair | quantity of mitotic spindle                              | 7,80E-05    | 4           |
| Cell Death and Survival                                                  | apoptosis of cervical cancer cell lines                   | 1,10E-04    | 15          |
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities     | gastrointestinal tract cancer                             | 1,23E-04    | 185         |
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities     | Gastrointestinal Tract Cancer and Tumors                  | 1,30E-04    | 186         |
| Cell Death and Survival                                                  | cell death of cervical cancer cell lines                  | 1,48E-04    | 17          |
| Cell Death and Survival                                                  | apoptosis of tumor cell lines                             | 1,49E-04    | 42          |
| Nervous System Development and Function, Neurological Disease, Organ Morphology, Organismal Development, Organismal Injury and Abnormalities | abnormal morphology of optic tract                        | 1,51E-04    | 3           |
| Cell Signaling                                                           | integration of HIV-1                                      | 1,51E-04    | 3           |
| Cell Death and Survival, Cellular Function and Maintenance               | colony survival of pancreatic cancer cell lines           | 1,54E-04    | 2           |
| Cancer, Endocrine System Disorders, Gastrointestinal Disease, Organismal Injury and Abnormalities | early-onset pancreatic cancer                            | 1,54E-04    | 2           |
| Cell Death and Survival                                                  | killing of skin cell lines                               | 1,54E-04    | 2           |
| Cell Morphology, Cellular Assembly and Organization                      | reorientation of actin cytoskeleton                       | 1,54E-04    | 2           |
| Cell Death and Survival                                                  | apoptosis of connective tissue cells                      | 1,80E-04    | 15          |
| Cell Death and Survival                                                  | cell death of connective tissue cells                     | 2,34E-04    | 24          |
| Organismal Development                                                   | morphology of body cavity                                 | 3,01E-04    | 44          |
| Developmental Disorder, Embryonic Development, Organismal Survival        | death of embryo                                           | 3,12E-04    | 9           |
| Cell Morphology                                                          | elongation of cells                                       | 3,18E-04    | 6           |
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities     | large intestine neoplasm                                  | 3,22E-04    | 177         |
| Cancer, Organismal Injury and Abnormalities                               | breast or colorectal cancer                               | 3,41E-04    | 145         |
| Cell Morphology, Cellular Assembly and Organization                      | morphology of cytoskeleton                               | 3,55E-04    | 8           |
| Cell Cycle                                                               | mitosis                                                  | 3,73E-04    | 20          |
malignant neoplasm of large intestine 3.76E-04
alignment of chromosomes 3.77E-04
chromosomal congression of chromosomes 3.84E-04
checkpoint control 4.29E-04
aneuploidy of fibroblasts 4.57E-04
killing of epithelial cell lines 4.57E-04
quantity of chromosomes 4.95E-04
cell death of tumor cell lines 5.42E-04
misregulation of chromosomes 6.37E-04
arrest in mitosis of cervical cancer cell lines 7.64E-04
I-kappaB kinase/NF-kappaB cascade 7.74E-04
aggregation of bone cancer cell lines 9.07E-04
aggregation of sarcoma cell lines 9.07E-04
binding of chromosomes 9.07E-04
contact growth inhibition of vascular endothelial cells 9.07E-04
migration of enterocytes 9.07E-04
migration of squamous carcinoma cells 9.07E-04
quantity of mesodermal cells 9.07E-04
trafficking of secretory vesicles 9.07E-04
migration of prostate cancer cell lines 9.26E-04
regeneration of liver 9.60E-04
liver carcinoma 9.77E-04
morphology of mitotic spindle 1.00E-03
abnormal morphology of body cavity 1.13E-03
length of filaments 1.13E-03
quantity of lamellipodia 1.13E-03
cell death of fibroblast cell lines 1.19E-03
abdominal adenocarcinoma 1.21E-03
organismal death 1.29E-03
Waldenstrom’s macroglobulinemia 1.44E-03
hepatobiliary system cancer 1.44E-03
organization of organelle 1.45E-03
liver cancer 1.47E-03
abnormal morphology of optic chiasm 1.50E-03
accumulation of red blood cells 1.50E-03
arrest in G2 phase of hematopoietic progenitor cells 1.50E-03
| Biological Process | Disease | Term | Significance | Genes | Gene Count |
|-------------------|---------|------|--------------|-------|------------|
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities | | colorectal cancer | 6.07E-03 | 124 |
| Cell Cycle | | G2/M phase | 6.25E-03 | 9 |
| Cell Death and Survival | | necrosis of prostate cancer cell lines | 6.25E-03 | 9 |
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities | | colorectal neoplasia | 6.32E-03 | 125 |
| Cellular Growth and Proliferation | | proliferation of cells | 6.37E-03 | 90 |
| Embryonic Development, Organismal Development, Tissue Development | | development of epiblast | 6.48E-03 | 2 |
| Tissue Development | | development of organoid | 6.48E-03 | 2 |
| Connective Tissue Disorders, Hereditary Disorder, Metabolic Disease, Organismal Injury and Abnormalities | | familial partial lipodystrophy | 6.48E-03 | 2 |
| Cell Signaling, Nucleic Acid Metabolism, Small Molecule Biochemistry | | loading of GTP | 6.48E-03 | 2 |
| Embryonic Development, Tissue Development | | patterning of epithelial tissue | 6.48E-03 | 2 |
| Cell-To-Cell Signaling and Interaction, Cellular Function and Maintenance, Inflammatory Response | | phagocytosis by dendritic cells | 6.48E-03 | 2 |
| Cardiovascular Disease, Organismal Injury and Abnormalities | | systolic heart failure | 6.48E-03 | 2 |
| Cardiovascular System Development and Function | | pressure of heart | 6.59E-03 | 3 |
| Cellular Assembly and Organization | | development of cytoplasm | 6.88E-03 | 16 |
| Cell Death and Survival, Connective Tissue Development and Function | | cell viability of fibroblast cell lines | 6.89E-03 | 6 |
| Cell Death and Survival | | apoptosis of prostate cancer cell lines | 7.30E-03 | 8 |
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities | | colorectal carcinoma | 7.34E-03 | 112 |
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities | | colon tumor | 7.41E-03 | 114 |
| Cell Morphology | | polarization of cells | 7.49E-03 | 8 |
| Cellular Growth and Proliferation | | proliferation of central nervous system cells | 7.85E-03 | 7 |
| Cell-To-Cell Signaling and Interaction | | cell-cell adhesion of epithelial cells | 7.85E-03 | 2 |
| Cell Death and Survival, Cellular Function and Maintenance | | clearance of E. coli | 7.85E-03 | 2 |
| Embryonic Development, Organismal Development, Tissue Development | | development of trophoblast | 7.85E-03 | 2 |
| Cell-To-Cell Signaling and Interaction, Cellular Function and Maintenance, Inflammatory Response | | phagocytosis of connective tissue cells | 7.85E-03 | 2 |
| Cellular Assembly and Organization, Cellular Function and Maintenance, Cellular Movement, Nervous System Development and Function | | endocytosis of synaptic vesicles | 7.86E-03 | 3 |
| Cellular Function and Maintenance | | internalization of E. coli | 7.86E-03 | 3 |
| Cardiovascular Disease, Organismal Injury and Abnormalities | | systolic dysfunction | 7.86E-03 | 3 |
| Dermatological Diseases and Conditions, Organismal Injury and Abnormalities | | ulceration of skin | 7.86E-03 | 3 |
| Cell Signaling | | viral life cycle | 7.91E-03 | 5 |
| Hematological Disease | | hemorrhagic disease | 8.22E-03 | 10 |
| Cancer, Organismal Injury and Abnormalities, Respiratory Disease | | non-small cell lung cancer | 8.24E-03 | 42 |
| Cellular Assembly and Organization, Cellular Function and Maintenance | | maintenance of telomeres | 8.26E-03 | 4 |
| Protein Degradation, Protein Synthesis | | stabilization of protein | 8.31E-03 | 7 |
| Cell-To-Cell Signaling and Interaction, Inflammatory Response | | immune response of tumor cell lines | 8.55E-03 | 7 |
| Developmental Disorder, Hereditary Disorder, Neurological Disease, Organismal Injury and Abnormalities | | X-linked mental retardation | 8.58E-03 | 5 |
| Neurological Disease, Organismal Injury and Abnormalities | | neurodegeneration of cerebral cortex | 8.72E-03 | 4 |
| Category                                                                 | Term                                                                 | EASE Score | Adjusted p-value |
|-------------------------------------------------------------------------|----------------------------------------------------------------------|------------|-----------------|
| Cellular Function and Maintenance                                        | endocytosis                                                          | 8.72E-03   | 16              |
| Neurological Disease, Organismal Injury and Abnormalities                | abnormality of cerebrum                                              | 8.91E-03   | 10              |
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities    | colon cancer                                                         | 8.91E-03   | 113             |
| Cancer, Gastrointestinal Disease, Organismal Injury and Abnormalities    | colon carcinoma                                                      | 9.19E-03   | 109             |
| Lipid Metabolism, Small Molecule Biochemistry                            | incorporation of fatty acid                                          | 9.25E-03   | 3               |
| Cardiovascular Disease, Developmental Disorder, Organismal Injury and Abnormalities | ventricular hypertrophy                                              | 9.33E-03   | 6               |
| Embryonic Development, Organ Development, Organ Morphology, Organismal Development, Organismal Injury and Abnormalities, Respiratory Disease, Respiratory Cardiovascular Disease | abnormal morphology of lung interstitium                            | 9.35E-03   | 2               |
| Cellular Function and Maintenance                                        | breakage of blood vessel                                             | 9.35E-03   | 2               |
| Cardiovascular System Development and Function, Embryonic Development, Organ Development, Tissue Development | endocytosis by dendritic cells                                      | 9.35E-03   | 2               |
| Cell Morphology, Cellular Assembly and Organization                      | vascularization of yolk sac                                          | 9.35E-03   | 2               |
| Cell Cycle, Cell Morphology, Cellular Assembly and Organization, DNA Replication, Recombination, and Repair | morphology of nucleus                                                | 9.55E-03   | 7               |
| Cell-To-Cell Signaling and Interaction                                   | abnormal morphology of chromosomes                                   | 1.00E-02   | 3               |
| Cellular Assembly and Organization, Cellular Function and Maintenance    | clustering of cells                                                  | 1.00E-02   | 3               |
| Hematological Disease, Infectious Diseases                               | quantity of cellular protrusions                                      | 1.01E-02   | 7               |
| Cellular Assembly and Organization, Cellular Function and Maintenance    | malaria                                                              | 1.02E-02   | 4               |
| Cell Death and Survival, Organismal Injury and Abnormalities             | organization of Golgi apparatus                                      | 1.02E-02   | 4               |
| Cellular Development, Cellular Growth and Proliferation, Reproductive System Development and Function | apoptosis of epithelial cells                                       | 1.05E-02   | 11              |
| Cell Death and Survival, Cellular Function and Maintenance               | cell proliferation of breast cell lines                              | 1.06E-02   | 6               |
| Cell Cycle                                                               | colony survival of tumor cell lines                                  | 1.08E-02   | 3               |
| Cardiovascular Disease, Organismal Injury and Abnormalities              | polyplloidization of cells                                           | 1.08E-02   | 3               |
| Cardiovascular System Development and Function, Organ Morphology, Organismal Development | morphology of heart ventricle                                       | 1.09E-02   | 9               |
| Cell Death and Survival                                                  | apoptosis of pancreatic cancer cell lines                            | 1.09E-02   | 9               |
| Cellular Assembly and Organization                                        | clustering of membrane rafts                                         | 1.10E-02   | 2               |
| Embryonic Development, Nervous System Development and Function, Organ Development, Organismal Development, Tissue Development | formation of anterior commissure                                    | 1.10E-02   | 2               |
| Cellular Assembly and Organization                                        | formation of endosomes                                               | 1.10E-02   | 2               |
| Cell-To-Cell Signaling and Interaction, Cellular Assembly and Organization, Cellular Function and Maintenance | formation of focal complexes                                        | 1.10E-02   | 2               |
| Lipid Metabolism, Small Molecule Biochemistry                            | incorporation of palmitic acid                                       | 1.10E-02   | 2               |
| Cell Morphology, Hematological System Development and Function           | polarization of leukocyte cell lines                                 | 1.10E-02   | 2               |
| Cell Morphology, Cellular Assembly and Organization, Cellular Function and Maintenance | reorganization of actin stress fibers                               | 1.10E-02   | 2               |
| Cellular Assembly and Organization, Cellular Function and Maintenance, Tissue Development | formation of actin filaments                                       | 1.12E-02   | 11              |
| Cardiovascular Disease, Organismal Injury and Abnormalities              | abnormality of ventricular septum                                     | 1.13E-02   | 4               |
| Cellular Growth and Proliferation, Organismal Development                | growth of yeast has                                                  | 1.13E-02   | 5               |
| Cell Cycle                                                               | G2 phase                                                             | 1.15E-02   | 10              |
| Cardiovascular System Development and Function, Cellular Function and Maintenance, Organ Development, Skeletal and Muscular System Development and Function | function of cardiomyocytes                                         | 1.16E-02   | 3               |
| Cell Morphology, Embryonic Development                                   | patterning of cells                                                  | 1.16E-02   | 3               |
anisocoria 1.24E-02
apocrine metaplasia of mammary gland 1.24E-02
apoptosis of B-2 lymphocytes 1.24E-02
apoptosis of fibroblastoids 1.24E-02
apoptosis of gonadotropes 1.24E-02
apoptosis of neointimal cells 1.24E-02
apoptosis of B-2 lymphocytes 1.24E-02
apoptosis of fibroblastoids 1.24E-02
apoptosis of gonadotropes 1.24E-02
apoptosis of neointimal cells 1.24E-02
arrhythmogenic right ventricular dysplasia familial 12 1.24E-02
attachment of blood platelets 1.24E-02
atypical incontinentia pigmenti 1.24E-02
autophagy of intestinal cell lines 1.24E-02
autosomal dominant hereditary diffuse gastric cancer 1.24E-02
autosomal recessive cutis laxa type IB 1.24E-02
autosomal recessive cutis laxa type IIA 1.24E-02
autosomal recessive dyskeratosis congenita type 3 1.24E-02
autosomal recessive early-onset parkinson disease 23 1.24E-02
autosomal recessive osteopetrosis type 6 1.24E-02
autosomal recessive primary microcephaly type 13 1.24E-02
autosomal recessive spastic paraplegia type 46 1.24E-02
binding of colon cell lines 1.24E-02
binding of colonocytes 1.24E-02
binding of origin of replication in the short region 1.24E-02
binding of phosphatidylinositol 4-phosphate 1.24E-02
branched-chain ketoacid dehydrogenase kinase deficiency 1.24E-02
branching of bone marrow cell lines 1.24E-02
branching of skin cell lines 1.24E-02
catabolism of spermidine 1.24E-02
| Process                                                                 | Class                                                                 | p-value | q-value |
|------------------------------------------------------------------------|-----------------------------------------------------------------------|---------|---------|
| Depletion of hippocampal neurons                                       | Embryonic Development, Nervous System Development and Function, Organ | 1.24E-02 | 1       |
| Development of dorsal lateral geniculate nucleus                       | Development, Organismal Development, Tissue Development               | 1.24E-02 | 1       |
| Development of hair cuticle                                             | Embryonic Development, Hair and Skin Development and Function, Organ   | 1.24E-02 | 1       |
| Development of layer IV                                                 | Development, Organismal Development, Tissue Development               | 1.24E-02 | 1       |
| Development of left common carotid artery                              | Nervous System Development and Function                                | 1.24E-02 | 1       |
| Development of limbic system                                           | Cardiovascular System Development and Function                        | 1.24E-02 | 1       |
| Development of pacemaker cells                                         | Embryonic Development, Organismal Development, Organismal Development  | 1.24E-02 | 1       |
| Development of vibrissae                                               | Development, Organismal Development, Tissue Development               | 1.24E-02 | 1       |
| Differentiation of enteroendocrine cells                                | Development, Organismal Development, Tissue Development               | 1.24E-02 | 1       |
| Dilated cardiomyopathy type 1JJ                                         | Cardiovascular Disease, Connective Tissue Development and Function,    | 1.24E-02 | 1       |
| Elongation of fibroblasts                                              | Tissue Development                                                    | 1.24E-02 | 1       |
| Elongation of neuroblastoma cell lines                                  | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Emperipolesis of megakaryocytes                                        | Development, Organismal Development, Organismal Development, Organismal | 1.24E-02 | 1       |
| Entry into S phase of skin cancer cell lines                           | Development, Organismal Development, Tissue Development               | 1.24E-02 | 1       |
| Expansion of bladder cancer cell lines                                 | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Expansion of brown adipose tissue                                      | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Expansion of epiblast                                                  | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Expansion of epididymal fat                                            | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Expansion of inguinal fat pad                                          | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Expansion of mesenteric fat                                            | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Expansion of retroperitoneal white adipose tissue                      | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Facial dysmorphism, immunodeficiency, livedo, and short stature syndrome| Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Fibrosis of portal artery                                              | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Formation of blastocele                                                | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Formation of colony forming unit-megakaryocytes                        | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Formation of ectoplacental cone                                        | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Formation of filopodial tip                                            | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Formation of macronuclei                                               | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Formation of ovarian adenocarcinoma                                     | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Formation of peripheral lamellae                                       | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Formation of trophoectoderm                                            | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Function of right ventricle                                            | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Glioma susceptibility 9                                                 | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Glutaric acidemia type I                                               | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Growth of Sindbis virus                                                | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
| Growth of cardiovascular neoplasm                                      | Connective Tissue Development and Function, Tissue Development         | 1.24E-02 | 1       |
Cellular Development, Cellular Growth and Proliferation, Connective Tissue Development and Function, Cellular Movement

Organismal Functions

Organismal Functions, Tissue Morphology

Cardiovascular System Development and Function, Cellular Movement

Cell Death and Survival, DNA Replication, Recombination, and Repair

DNA Replication, Recombination, and Repair

Cardiovascular Disease, Endocrine System Disorders, Hematological Disease, Metabolic Disease

Cardiovascular Disease, Endocrine System Disorders, Gastrointestinal Disease, Metabolic Disease, Organismal Injury and Abnormalities

Developmental Disorder, Ophthalmic Disease, Organismal Injury and Abnormalities

Cellular Function and Maintenance

Carbohydrate Metabolism, Lipid Metabolism, Small Molecule Biochemistry

Cell Death and Survival, DNA Replication, Recombination, and Repair

DNA Replication, Recombination, and Repair

Cellular Function and Maintenance, Connective Tissue Development and Function

Cell-to-Cell Signaling and Interaction, Inflammatory Response

Hereditary Disorder, Immunological Disease, Organismal Injury and Abnormalities

Behavior

Lipid Metabolism, Small Molecule Biochemistry

Cell Signaling, Vitamin and Mineral Metabolism

Cellular Function and Maintenance, Connective Tissue Development and Function

Cell-to-Cell Signaling and Interaction, Small Molecule Biochemistry

Lipid Metabolism, Small Molecule Biochemistry

Cell-to-Cell Signaling and Interaction, Cellular Growth and Proliferation, Connective Tissue Development and Function

Organ Development, Organ Morphology, Reproductive System Development and Function

Infectious Diseases

Gastrointestinal Disease, Infectious Diseases, Organismal Injury and Abnormalities

Gastrointestinal Disease, Infectious Diseases, Organismal Injury and Abnormalities

Infectious Diseases, Organismal Injury and Abnormalities, Respiratory Disease

Cell Death and Survival

Cell Morphology, Cellular Assembly and Organization, Cellular Development, Cellular Function and Maintenance, Cellular Growth and Proliferation, Nervous System

growth of fibroblastoids

haptotaxis of endothelial cells

healing of gastric epithelial cells

healing of intestinal epithelium

heart and brain malformation syndrome

hereditary diffuse gastric cancer and cleft lip

hereditary folate malabsorption

hereditary nonpolyposis colorectal cancer type 4

hereditary sensory neuropathy type IF

homeostasis of tumor cells

hydrolysis of sn-2-arachidonylphosphatidylcholine

hypercondensation of chromatin

hypercondensation of chromosomes

hypermethylating leukodystrophy type 7 without oligodendria or hypogonadotropic hypogonadism

immune response of renal tubular epithelial cells

hypoinsulinemic hypoglycemia with hemihypertrophy

hypomethylating leukodystrophy type 7 with oligodendria and hypogonadotropic hypogonadism

hypertrphy of cornea

immunodeficiency 28

immunodeficiency-centromeric instability-facial anomalies syndrome type 4

impulsive behavior

incorporation of 15-(4-iodophenyl)-3-methylpentadecanoic acid

incorporation of Ca2+

incorporation of fibroblast cell lines

induction of acetylcholine

induction of diacylglycerol

induction of fibroblast cell lines

induction of mammary gland

infection by mouse mammary tumor virus

infection of cecum

infection of colon

infection of pneumocytes

initiation of apoptosis of colorectal cancer cell lines

initiation of formation of dendrites
Organismal Injury and Abnormalities, Respiratory Disease

Cellular Compromise, Gastrointestinal Disease, Organismal Injury and Abnormalities

Cell Morphology, Cellular Movement, Nervous System Development and Function

Cellular Movement

Developmental Disorder, Hereditary Disorder, Ophthalmic Disease, Organismal Injury and Abnormalities

Hereditary Disorder, Immunological Disease, Organismal Injury and Abnormalities

Developmental Disorder, Hereditary Disorder, Neurological Disease, Organismal Injury and Abnormalities, Renal and Urological Disease, Skeletal and Muscular Disorders

Endocrine System Disorders, Gastrointestinal Disease, Immunological Disease, Metabolic Disease, Organismal Injury and Abnormalities

Cardiovascular Disease, Cardiovascular System Development and Function, Organ Morphology, Organismal Development, Organismal Injury and Abnormalities, Tissue Connective Tissue Development and Function, Connective Tissue Disorders, Organ Morphology, Organismal Development, Organismal Injury and Abnormalities, Skeletal Nervous System Development and Function, Neurological Disease, Organ Morphology, Organismal Development, Organismal Injury and Abnormalities

Organismal Injury and Abnormalities

Behavior

Cell Death and Survival, Connective Tissue Disorders, Organismal Injury and Abnormalities, Tissue Morphology

Lipid Metabolism, Small Molecule Biochemistry

Cellular Function and Maintenance, Hematological System Development and Function

Cancer, Organismal Injury and Abnormalities, Reproductive System Disease

Cellular Development

Endocrine System Disorders, Gastrointestinal Disease, Hereditary Disorder, Metabolic Disease, Organismal Injury and Abnormalities

Cancer, Organismal Injury and Abnormalities

Cancer, Organismal Injury and Abnormalities, Reproductive System Disease

Cellular Movement, Embryonic Development

Cellular Movement

Embryonic Development

Connective Tissue Disorders, Inflammatory Disease, Inflammatory Response, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders

Cancer, Organismal Injury and Abnormalities, Reproductive System Disease

Cell Morphology, Cellular Development, Cellular Growth and Proliferation

Cardiovascular System Development and Function, Cellular Development, Cellular Growth and Proliferation

Cell Morphology, Cellular Compromise, Hair and Skin Development and Function

Developmental Disorder, Hereditary Disorder, Neurological Disease, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders

Metabolic Disease

Hereditary Disorder, Organismal Injury and Abnormalities, Renal and Urological Disease

Cellular Function and Maintenance, Reproductive System Development and Function

Hematological System Development and Function, Tissue Morphology

Inflammatory Disease, Inflammatory Response, Skeletal and Muscular Disorders

Cardiovascular Disease, Developmental Disorder, Organismal Injury and Abnormalities

- injury of alveolar epithelium: 1.24E-02
- injury of enterocytes: 1.24E-02
- innervation of serotonergic neurons: 1.24E-02
- invasion of enterocytes: 1.24E-02
- iridogoniodygenesis syndrome type 2: 1.24E-02
- isolated immunodeficiency: 1.24E-02
- joubert syndrome type 9: 1.24E-02
- ketosis-prone diabetes mellitus: 1.24E-02
- lack of coronary sinus: 1.24E-02
- lack of metacarpal bone: 1.24E-02
- lack of optic tract: 1.24E-02
- leakage of interstitial fluid: 1.24E-02
- licking behavior of paw: 1.24E-02
- loss of adipocytes: 1.24E-02
- loss of arachidonic acid: 1.24E-02
- maintenance of long-term culture-initiating cells: 1.24E-02
- malignant breast cancer: 1.24E-02
- maturation of myeloma cell lines: 1.24E-02
- maturity-onset diabetes of the young type 9: 1.24E-02
- metastasis of ovarian cancer cells: 1.24E-02
- metastatic hydatidiform mole: 1.24E-02
- migration of epiblast cells: 1.24E-02
- migration of neuroblastoma cells: 1.24E-02
- migration of trophoblast: 1.24E-02
- mild synovitis: 1.24E-02
- mixed ductal lobular breast carcinoma in situ: 1.24E-02
- morphogenesis of hepatoma cell lines: 1.24E-02
- morphogenesis of superior vena cava: 1.24E-02
- multinucleation of epithelial cell lines: 1.24E-02
- multiple congenital anomalies-hypotonia-seizures syndrome type 1: 1.24E-02
- multiple mitochondrial dysfunctions syndrome type 2: 1.24E-02
- nephrotic syndrome type 9: 1.24E-02
- organization of gonadal cell lines: 1.24E-02
- oxidation of blood: 1.24E-02
- paralytic autoimmune myositis: 1.24E-02
- partial atrioventricular septal defect with heterotaxy syndrome: 1.24E-02
Embryonic Development, Organismal Development, Tissue Development

Cellular Compromise, Free Radical Scavenging, Lipid Metabolism, Small Molecule Biochemistry
Small Molecule Biochemistry

Inflammatory Disease, Organismal Injury and Abnormalities, Reproductive System Disease
Cell Cycle

Cell Cycle, DNA Replication, Recombination, and Repair
Cell Cycle

Cell Cycle

Cancer, Organismal Injury and Abnormalities, Respiratory Disease

Cellular Function and Maintenance, Cellular Growth and Proliferation, Hematological System Development and Function, Humoral Immune Response
Cellular Function and Maintenance

Cancer, Dermatological Diseases and Conditions, Organismal Injury and Abnormalities
Endocrine System Disorders, Metabolic Disease, Organismal Injury and Abnormalities
Cellular Function and Maintenance, Cellular Growth and Proliferation, Hematological System Development and Function

Cancer, Dermatological Diseases and Conditions, Organismal Injury and Abnormalities
Hereditary Disorder, Neurological Disease, Organismal Injury and Abnormalities

Cell Morphology, Cellular Assembly and Organization, Nervous System Development and Function
Embryonic Development, Tissue Development

Cellular Growth and Proliferation, Connective Tissue Development and Function, Tissue Development
Organ Morphology

Nervous System Development and Function, Organ Morphology

Cellular Development, Cellular Growth and Proliferation, Embryonic Development, Organismal Development, Tissue Morphology
Organ Morphology, Renal and Urological System Development and Function

Hematological System Development and Function, Tissue Morphology

Cell Morphology, Nervous System Development and Function, Skeletal and Muscular System Development and Function
Carbohydrate Metabolism

Carbohydrate Metabolism

Lipid Metabolism, Small Molecule Biochemistry

Cell-To-Cell Signaling and Interaction, Cell-mediated Immune Response, Cellular Movement
Hematological System Development and Function, Immune Cell Trafficking
Cardiovascular Disease, Developmental Disorder, Gastrointestinal Disease, Hepatic System Disease, Hereditary Disorder, Infectious Diseases, Neurological Disease, Hereditary Disorder, Infectious Diseases, Organismal Injury and Abnormalities

Carbohydrate Metabolism, Lipid Metabolism, Molecular Transport, Small Molecule Biochemistry
Cellular Function and Maintenance

Cellular Assembly and Organization, Cellular Function and Maintenance
Tissue Morphology

Respiratory System Development and Function, Tissue Development

Cell-To-Cell Signaling and Interaction, Cell-mediated Immune Response, Cellular Function and Maintenance, Cellular Movement, Hematological System Development

patterning of sinus venosus
peroxidation of monohydroperoxy-linoleic acid
phosphorylation of phytosphingosine
placentitis
polyploidization of T lymphocytes
polyploidization of chromosomes
polyploidization of epithelial cell lines
polyploidization of kidney cell lines

poorly differentiated non-small cell lung cancer
poorly differentiated skin squamous cell carcinoma
primary hyperthyroidism
production of germinal center B lymphocytes
progression of myoblasts

progressive epidermal hyperplasia
progressive myoclonic epilepsy type 9
projection of corticothalamic axons
proliferation of ectoplacental cone
proliferation of non-parenchymal cells
quantity of anterior commissure
quantity of corpus callosum
quantity of embryoid body cells
quantity of mesangial matrix
quantity of nuocytes
re-innervation of skeletal muscle
recognition of heparan sulfate
recognition of hyaluronic acid
recognition of paclitaxel
recruitment of activated T lymphocyte
recruitment of neutrophil, recipient monocytopenia, hepatic dysfunction, and cardiovascular collapse
recurrent isolated invasive pneumococcal disease type 2
redistribution of phosphatidylinositol-3,4,5-triphosphate
regulation of enterocytes
release of microvesicles
remodeling of left common carotid artery
response of bronchial tissue
retention of regulatory T lymphocytes
| Network analysis | Score | Focus Molecules | ID |
|------------------|-------|----------------|----|
| Connective Tissue Disorders, Developmental Disorder, Hereditary Disorder, Metabolic Disease, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders | rhizomelic chondrodysplasia punctata type 2 | 1,24E-02 | 1 |
| | ring dermoid of cornea | 1,24E-02 | 1 |
| | severe malaria | 1,24E-02 | 1 |
| | shrinkage of astrocytes | 1,24E-02 | 1 |
| | size of optic chiasm | 1,24E-02 | 1 |
| | specific gravity of brain tissue | 1,24E-02 | 1 |
| | spondyloepimetaphyseal dysplasia with joint laxity type 2 | 1,24E-02 | 1 |
| | stimulation of BMCC cells | 1,24E-02 | 1 |
| | stress response of ventricular septum | 1,24E-02 | 1 |
| | sulfation of lactose | 1,24E-02 | 1 |
| | susceptibility to colorectal cancer type 12 | 1,24E-02 | 1 |
| | susceptibility to cutaneous malignant melanoma type 10 | 1,24E-02 | 1 |
| | tachycardia of atrium | 1,24E-02 | 1 |
| | thickness of glomerular basement membrane | 1,24E-02 | 1 |
| | transport of calcifediol | 1,24E-02 | 1 |
| | turnover of arachidonic acid | 1,24E-02 | 1 |
| | ulnar-mammary syndrome | 1,24E-02 | 1 |
| | unilateral hearing loss | 1,24E-02 | 1 |
| | unwinding of origin of replication in the short region | 1,24E-02 | 1 |
| | uptake of Human adenovirus 35 | 1,24E-02 | 1 |
| | uptake of omega-(4-iodophenyl)pentadecanoic acid | 1,24E-02 | 1 |
| | volume of right ventricle | 1,24E-02 | 1 |
| | wrinkly skin syndrome | 1,24E-02 | 1 |
| | x-linked mental retardation type 90 | 1,24E-02 | 1 |
| | x-linked mental retardation type 96 | 1,24E-02 | 1 |
| | development of megakaryocytes | 1,25E-02 | 3 |
| | cell proliferation of tumor cell lines | 1,26E-02 | 43 |
| | abnormal morphology of anterior chamber of eye | 1,27E-02 | 2 |
| | elongation of tumor cell lines | 1,27E-02 | 2 |
| | epithelial-mesenchymal transition of hepatoma cell lines | 1,27E-02 | 2 |
| | familial ventricular fibrillation | 1,27E-02 | 2 |
| | tumorigenesis of breast adenocarcinoma | 1,27E-02 | 2 |
| | breast adenocarcinoma | 1,27E-02 | 14 |
| | abnormal morphology of seminiferous tubule | 1,27E-02 | 6 |
| Categories (Network 1)                                                                 | Diseases or Functions Annotation relevant to Top network               | p-Value   |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------|-----------|
| Cell Cycle, Cellular Assembly and Organization, DNA Replication, Recombination, and Repair | tumorigenesis of urinary tract tumor                                    | 2.33E-05  |
| Cell Cycle, DNA Replication, Recombination, and Repair, Cancer                      | morphology of mitotic spindle                                           | 6.45E-05  |
| Neurological Disease, Carbohydrate Metabolism, Molecular Transport                 | segregation of chromosomes                                              | 9.24E-05  |
| Cardiovascular Disease, Cell-To-Cell Signaling and Interaction, Cellular Function and Maintenance | morphology of cytoskeleton                                               | 1.87E-04  |
| Cell Signaling, Molecular Transport, Embryonic Development                          | necrosis                                                                | 2.58E-04  |
| Cardiovascular Disease, Connective Tissue Disorders, Developmental Disorder        | apoptosis of tumor cell lines                                            | 3.19E-04  |
| Connective Tissue Disorders, Developmental Disorder, Gastrointestinal Disease      | autosomal recessive primary microcephaly                                | 3.39E-04  |
| Carbohydrate Metabolism, Lipid Metabolism, Small Molecule Biochemistry            | aneuploidy of fibroblasts                                               | 5.31E-04  |
| Cancer, Neurological Disease, Organismal Injury and Abnormalities                  | homeostasis of Zn2+                                                    | 6.15E-04  |
| Cell Cycle, Cellular Assembly and Organization, DNA Replication, Recombination, and Repair | apoptosis of fibroblasts                                                | 8.54E-04  |
| Cell Death and Survival                                                             | cell death                                                             | 9.43E-04  |
| Cell Death and Survival                                                             | cell death of tumor cell lines                                         | 9.84E-04  |
| Cellular Assembly and Organization                                                  | binding of chromosomes                                                 | 1.05E-03  |
| Domain                                                                 | Concept                                                                 | Significance |
|----------------------------------------------------------------------|-------------------------------------------------------------------------|--------------|
| Cell Cycle                                                            | arrest in mitosis of cervical cancer cell lines                         | 1.07E-03     |
| Dermatological Diseases and Conditions, Hair and Skin Development     | abnormal morphology of sparse hair                                      | 1.22E-03     |
| and Function, Organ Morphology, Organismal Injury and Abnormalities   |                                                                         |              |
| Cellular Assembly and Organization, DNA Replication, Recombination,   | quantity of mitotic spindle                                             | 1.40E-03     |
| and Repair                                                            |                                                                         |              |
| Protein Synthesis                                                     | quantity of GPT in blood                                                | 1.55E-03     |
| Neurological Disease, Organismal Injury and Abnormalities, Skeletal   | autosomal recessive primary microcephaly type 13                        | 1.56E-03     |
| and Muscular Disorders                                                |                                                                         |              |
| Cell Death and Survival                                               | apoptosis                                                               | 1.84E-03     |
| Dermatological Diseases and Conditions, Hair and Skin Development     | abnormal morphology of hair                                             | 1.96E-03     |
| and Function, Organ Morphology, Organismal Injury and Abnormalities   |                                                                         |              |
| Cell Cycle                                                            | cell cycle progression                                                  | 1.97E-03     |
| Neurological Disease, Organismal Injury and Abnormalities             | seizures                                                                | 2.50E-03     |
| Cell Cycle                                                            | mitosis                                                                 | 2.86E-03     |
| Cell Cycle                                                            | formation of mitotic spindle                                            | 3.15E-03     |
| Cellular Development, Skeletal and Muscular System Development and    | differentiation of skeletal muscle satellite cells                      | 3.59E-03     |
| Function, Tissue Development                                          | length of mitotic spindle                                               | 3.59E-03     |
| Lipid Metabolism, Small Molecule Biochemistry                         | binding of tricaprilin                                                 | 3.75E-03     |
| Cellular Assembly and Organization, Cellular Function and Maintenance | formation of midbody                                                   | 3.75E-03     |
| Cell Cycle, DNA Replication, Recombination, and Repair                | DNA replication checkpoint of cells                                    | 4.06E-03     |
| Skeletal and Muscular System Development and Function                 | isometric tetanic force of skeletal muscle                              | 4.06E-03     |
| Connective Tissue Disorders, Organismal Injury and Abnormalities,     | abnormal morphology of mesenteric fat pad                              | 4.37E-03     |
| Tissue Morphology                                                     | delay in regeneration of muscle                                        | 4.37E-03     |
| Tissue Development                                                    |                                                                        |              |
| Organ Development, Skeletal and Muscular System Development and       | isometric twitch force of skeletal muscle                              | 4.37E-03     |
| Function, Embryonic Development, Organ Development, Organismal        | development of female genital organ                                    | 4.69E-03     |
| Development, Reproductive System Development and Function, Tissue     | fate determination of myoblasts                                        | 4.69E-03     |
| Development                                                           |                                                                        |              |
| Cellular Development, Tissue Development                               | formation of midzone                                                   | 4.69E-03     |
| Cell Death and Survival                                               | apoptosis of pancreatic cancer cell lines                               | 4.73E-03     |
| Development Disorder, Embryonic Development, Organismal Development,  | abnormal morphology of atrioventricular canal                          | 4.74E-03     |
| Tissue Morphology                                                     |                                                                         |              |
| Cell Death and Survival, Organismal Injury and Abnormalities          | apoptosis of colonocytes                                                | 4.74E-03     |
| Neurological Disease, Organismal Injury and Abnormalities             | epileptic seizure                                                      | 4.94E-03     |
| Development Disorder, Embryonic Development, Organismal Development,  | abnormal morphology of thin apical ectodermal ridge                    | 5.00E-03     |
| Tissue Morphology                                                     |                                                                         |              |
| Hair and Skin Development and Function, Organ Development             | pigmentation of epidermis                                              | 5.00E-03     |
| Digestive System Development and Function, Hepatic System Development  | regeneration of liver                                                  | 5.15E-03     |
| and Function, Liver Regeneration, Organ Morphology                    |                                                                         |              |
| Cancer, Organismal Injury and Abnormalities, Reproductive System      | formation of uterine carcinoma                                         | 5.31E-03     |
| Disease                                                               |                                                                         |              |
| Cardiovascular System Development and Function                        | hypoperfusion of brain                                                 | 5.31E-03     |
| Cardiovascular System Development and Function, Organismal Development | vascularization of aorta                                               | 5.31E-03     |
| Cardiovascular System Development and Function, Embryonic Development,| vascularization of somites                                             | 5.31E-03     |
| Organismal Development, Tissue Development                            |                                                                         |              |
| Cellular Assembly and Organization, DNA Replication, Recombination,   | alignment of chromosomes                                               | 5.47E-03     |
| and Repair                                                            |                                                                         |              |
| Cell Death and Survival, Cellular Compromise, Nervous System           | cytotoxicity of medium spiny neurons                                   | 5.62E-03     |
| Development and Function                                              |                                                                         |              |
| Category                                                                 | Example Event                                                                 | p-value   |
|--------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------|
| Cell Cycle, Embryonic Development                                         | polyploidization of embryonic cell lines                                       | 5.62E-03  |
| Cellular Compromise                                                       | damage of endothelial cell lines                                                | 5.93E-03  |
| Digestive System Development and Function, Organ Morphology, Organismal Development | mass of small intestine                                                        | 5.93E-03  |
| Digestive System Development and Function, Endocrine System Development and Function, Organ Morphology, Tissue Morphology | quantity of enteroendocrine L cells                                             | 5.93E-03  |
| Cell Death and Survival                                                   | necroptosis of fibroblasts                                                      | 6.04E-03  |
| Organ Morphology, Skeletal and Muscular System Development and Function   | isometric tension of skeletal muscle                                            | 6.24E-03  |
| Cell Morphology, Cellular Assembly and Organization, DNA Replication,    | abnormal morphology of meiotic spindles                                         | 6.56E-03  |
| Recombination, and Repair                                                 | developmental delay of cardiac spindles                                         | 6.56E-03  |
| Developmental Disorder                                                    | cell death of pancreatic cancer cell lines                                      | 6.72E-03  |
| Neurological Disease, Organismal Injury and Abnormalities                 | limbic seizure                                                                  | 6.87E-03  |
| Nervous System Development and Function, Neurological Disease, Organ       | abnormal morphology of Ammon's horn                                            | 7.18E-03  |
| Organismal Development, Organismal Injury and Abnormalities               | endocytosis by dendritic cells                                                  | 7.49E-03  |
| Cellular Function and Maintenance                                         | sporadic schizophrenia                                                          | 7.49E-03  |
| Neurological Disease, Psychological Disorders                              | expression of RNA                                                               | 7.63E-03  |
| Organ Morphology, Organismal Injury and Abnormalities, Reproductive System | abnormal morphology of clitoris                                                | 7.80E-03  |
| Development and Function, Reproductive System Disease                     | abnormal morphology of foot plate                                              | 7.80E-03  |
| Developmental Disorder, Embryonic Development, Organismal Development,    | meiosis of male germ cells                                                     | 7.80E-03  |
| Tissue Morphology                                                         | bleeding of liver                                                               | 8.09E-03  |
| Gastrointestinal Disease, Hepatic System Disease, Liver Hemorrhaging,     | lack of megakaryocytes                                                          | 8.11E-03  |
| Organismal Injury and Abnormalities                                        | development of neuroectoderm                                                    | 8.42E-03  |
| Function, Hematopoiesis, Lymphoid Tissue Structure and Development,       | accumulation of embryonic cell lines                                           | 9.04E-03  |
| Organismal Injury and Abnormalities                                       | accumulation of kidney cell lines                                               | 9.04E-03  |
| Embryonic Development, Organismal Development, Tissue Development         | fragmentation of spindle pole                                                   | 9.04E-03  |
| Tissue Development                                                        | formation of filament barbed ends                                               | 9.35E-03  |
| Cellular Compromise                                                       | urothelial cancer                                                               | 9.38E-03  |
| Cellular Assembly and Organization, Cellular Function and Maintenance,    | differentiation of muscle                                                       | 9.38E-03  |
| Tissue Development                                                        | ploidy                                                                        | 9.52E-03  |
| Cancer, Organismal Injury and Abnormalities, Renal and Urological Disease| morphology of mammary gland                                                    | 9.58E-03  |
| Cellular Development, Skeletal and Muscular System Development and Function| mitotic index of tumor cell lines                                               | 9.66E-03  |
| Gastrointestinal Disease, Hepatic System Disease, Organismal Injury and    | severe jaundice                                                                 | 9.66E-03  |
| Abnormalities                                                             | hydrolysis of retinyl ester                                                    | 9.97E-03  |
| Lipid Metabolism, Small Molecule Biochemistry, Vitamin and Mineral        | fusion of skeletal muscle satellite cells                                       | 1.03E-02  |
| Metabolism, Cell-To-Cell Signaling and Interaction, Skeletal and Muscular System Development and Function | lack of carpal bone                                                            | 1.03E-02  |
| Morphology, Organismal Development, Organismal Injury and Abnormalities,  | lack of mammary gland                                                          | 1.03E-02  |
| Skeletal and Muscular Disorders, Skeletal and Muscular System Development and Function | abnormal quantity of mineral                                                   | 1.06E-02  |
| Development, Organismal Injury and Abnormalities, Reproductive System     |                                                                              |           |
| Development and Function, Reproductive System Disease, Tissue Development |                                                                              |           |
vascularization of yolk sac
movement of chromosomes
accumulation of epithelial cell lines
consumption of oxygen
cell death of retinoblastoma cell lines
polarization of B-lymphocyte derived cell lines
function of salivary gland
tumorigenesis of intestinal adenoma
quantity of aspartate transaminase in blood
length of microtubules
binding of origin of replication in the short region
| Category                                                                 | Term and Description                                                                 | p-value   |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------|
| Cancer, Endocrine System Disorders, Organismal Injury and Abnormalities, Reproductive System Disease | formation of ovarian adenocarcinoma                                                   | 1.34E-02  |
| DNA Replication, Recombination, and Repair                               | hypercondensation of chromosomes                                                      | 1.34E-02  |
| Organ Development, Organ Morphology, Reproductive System Development and Function | induction of mammary gland                                                            | 1.34E-02  |
| Hereditary Disorder, Immunological Disease, Organismal Injury and Abnormalities | isolated immunodeficiency                                                              | 1.34E-02  |
| Endocrine System Disorders, Gastrointestinal Disease, Immunological Disease, Metabolic Disease, Organismal Injury and Abnormalities | ketosis-prone diabetes mellitus                                                       | 1.34E-02  |
| Morphology, Organismal Development, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders, Skeletal and Muscular System Development and Function, Endocrine System Disorders, Gastrointestinal Disease, Hereditary Disorder, Metabolic Disease, Organismal Injury and Abnormalities | lack of metacarpal bone                                                                | 1.34E-02  |
| Cell Cycle                                                               | polyploidization of epithelial cell lines                                             | 1.34E-02  |
| Cell Cycle                                                               | polyploidization of kidney cell lines                                                | 1.34E-02  |
| Cell Cycle, Nervous System Development and Function, Skeletal and Muscular System Development and Function | re-innervation of skeletal muscle                                                     | 1.34E-02  |
| Hereditary Disorder, Infectious Diseases, Organismal Injury and Abnormalities | recurrent isolated invasive pneumococcal disease type 2                               | 1.34E-02  |
| Connective Tissue Disorders, Developmental Disorder, Hereditary Disorder, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders | spondyloepimetaphyseal dysplasia with joint laxity type 2                               | 1.34E-02  |
| Cardiac Stress Response, Cardiovascular Disease, Cellular Compromise, Organ Morphology, Organismal Injury and Abnormalities | stress response of ventricular septum                                                 | 1.34E-02  |
| Cancer, Endocrine System Disorders, Organismal Injury and Abnormalities | thyroid gland fetal adenoma                                                           | 1.34E-02  |
| Developmental Disorder                                                   | ulnar-mammary syndrome                                                                 | 1.34E-02  |
| DNA Replication, Recombination, and Repair                               | unwinding of origin of replication in the short region                                | 1.34E-02  |
| Developmental Disorder, Hereditary Disorder, Neurological Disease, Organismal Injury and Abnormalities | X-linked mental retardation                                                            | 1.34E-02  |
| Cancer, Endocrine System Disorders, Organismal Injury and Abnormalities | Hurthle cell adenoma                                                                  | 1.37E-02  |
| Cell Morphology, Humoral Immune Response, Immunological Disease, Lymphoid Tissue Structure and Development, Tissue Morphology | abnormal morphology of marginal-zone B lymphocytes                                    | 1.37E-02  |
| Organismal Development, Skeletal and Muscular System Development and Function | morphology of hindlimb                                                                | 1.40E-02  |
| Infectious Diseases, Inflammatory Response, Organismal Injury and Abnormalities, Respiratory Disease | Pneumocystosis jiroveci pneumonia                                                     | 1.40E-02  |
| Endocrine System Development and Function, Organ Development Cell Death and Survival, Gastrointestinal Disease, Hepatic System Disease, Liver Necrosis/Cell Death, Organismal Injury and Abnormalities | proliferation of islets of Langerhans                                                 | 1.43E-02  |
| Organ Morphology, Organismal Injury and Abnormalities, Reproductive System Development and Function, Reproductive System Disease | apoptosis of hepatocytes                                                               | 1.44E-02  |
| Cell Cycle                                                               | abnormal morphology of vaginal opening                                                | 1.46E-02  |
| Cell Cycle                                                               | metaphase/anaphase transition                                                          | 1.46E-02  |
| Cellular Assembly and Organization                                       | chromosomal congression of metaphase plate                                             | 1.49E-02  |
| Dermatological Diseases and Conditions, Organismal Injury and Abnormalities | disorder of hair                                                                       | 1.54E-02  |
| Embryonic Development, Organismal Development, Tissue Development         | morphogenesis of mesoderm                                                              | 1.55E-02  |
| Gastrointestinal Disease, Inflammatory Disease                           | severe inflammatory bowel disease                                                      | 1.55E-02  |
| Cell Cycle                                                               | interaction of DNA                                                                     | 1.58E-02  |
| Cancer, Organismal Injury and Abnormalities                              | adenoma                                                                               | 1.59E-02  |
| Cancer, Organismal Injury and Abnormalities, Reproductive System Disease | female genital tract serous carcinoma                                                 | 1.64E-02  |
| Cell Morphology, Cellular Assembly and Organization, DNA Replication, Recombination, and Repair | abnormal morphology of mitotic spindle                                               | 1.67E-02  |
| Cancer, Organismal Injury and Abnormalities, Respiratory Disease         | development of lung tumor                                                              | 1.67E-02  |
| Cell Death and Survival                                                   | apoptosis of placenta                                                                  | 1.68E-02  |
| Dermatological Diseases and Conditions, Inflammatory Disease, Inflammatory Response, Organismal Injury and Abnormalities | erythroderma                                                                           | 1.71E-02  |
quantity of alveolar type I cells

Gastrointestinal Disease, Organismal Injury and Abnormalities

steatorrhea

Cell Morphology, Skeletal and Muscular System Development and Function

el elongation of muscle cells

Cellular Assembly and Organization

formation of mitochondrial cristae

Dermatological Diseases and Conditions, Organ Morphology, Organismal Injury and Abnormalities

abnormal morphology of suprabasal layer of epidermis

Gene Expression

binding of androgen-responsive element

Cell-To-Cell Signaling and Interaction, Cell-mediated Immune Response, Hematological System Development and Function, Inflammatory Response

cytotoxic reaction of natural killer cells

Immunological Disease, Lymphoid Tissue Structure and Development, Organ Morphology, Organismal Injury and Abnormalities, Tissue Morphology

abnormal morphology of T-cell zone

Cancer, Dermatological Diseases and Conditions, Organismal Injury and Abnormalities Development and Function, Hepatic System Disease, Inflammatory Disease, Inflammatory Response, Liver Inflammation/Hepatitis, Liver Steatosis, Metabolic

steatohepatitis

Cell Cycle

M phase

Gene Expression

transcription of RNA

Drug Metabolism, Endocrine System Development and Function, Lipid Metabolism, Small Molecule Biochemistry

binding of progesterone

Cardiovascular System Development and Function, Organismal Development

vascularization of blood vessel

Dermatological Diseases and Conditions, Hair and Skin Development and Function, Organ Morphology, Organismal Injury and Abnormalities

abnormal morphology of fur

Organ Development, Organ Morphology, Organismal Development, Skeletal and Muscular System Development and Function

mass of soleus muscle

Cellular Assembly and Organization

attachment of spindle fibers

Cardiovascular Disease, Neurological Disease, Organismal Injury and Abnormalities

damage of blood-brain barrier

Cell Cycle, Reproductive System Development and Function

melosis of spermatocytes

Molecular Transport

transport of Zn2+

Digestive System Development and Function, Hepatic System Development and Function, Organ Development

function of liver

Post-Translational Modification, Protein Synthesis

tetramerization of protein

Lipid Metabolism, Small Molecule Biochemistry, Vitamin and Mineral Metabolism

catabolism of cholesterol

Cell Death and Survival

loss of exocrine cells

Lipid Metabolism, Small Molecule Biochemistry

binding of lipid

Connective Tissue Disorders, Organismal Injury and Abnormalities, Tissue Morphology Developmental Disorder, Organismal Injury and Abnormalities, Reproductive System Disease

lack of subcutaneous fat

Embryonic Development, Organ Development, Organismal Development, Respiratory System Development and Function, Tissue Development

hypoplasia of mammary gland

Cellular Movement

maturation of lung

Cell Death and Survival

translocation of bacteria

Cancer

sphere formation of breast cancer cell lines

Cardiovascular System Development and Function, Embryonic Development, Organ Development, Organismal Development, Tissue Development

formation of endocardium

Reproductive System Development and Function

morphology of reproductive system

Cell Cycle, Connective Tissue Development and Function

ploidy of fibroblast cell lines

Cell Morphology, Nervous System Development and Function, Neurological Disease, Tissue Morphology

abnormal morphology of mossy fibers

Cell-To-Cell Signaling and Interaction, Hematological System Development and Function

binding of B-lymphocyte derived cell lines

Cell Morphology, Lymphoid Tissue Structure and Development

morphology of lymphatic system cells
| Term                                                                 | Description                                                                 | Score  |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------|--------|
| Cancer, Gastrointestinal Disease, Hepatic System Disease, Hepatocellular Carcinoma, Liver Hyperplasia/Hyperproliferation, Organismal Injury and Abnormalities, Cell Cycle, Cellular Assembly and Organization, DNA Replication, Recombination, and Repair Developmental Disorder, Embryonic Development, Organismal Development, Tissue Morphology | growth of hepatocellular carcinoma | 3.17E-02 |
| Cellular Assembly and Organization                                    | attachment of kinetochores                                                    | 3.33E-02 |
| Cell Cycle, DNA Replication, Recombination, and Repair Developmental Disorder, Embryonic Development, Organismal Development, Tissue Morphology Cardiovascular System Development and Function, Cell Morphology, Embryonic Development | growth of hepatocellular carcinoma | 3.17E-02 |
| Organismal Development, Reproductive System Development and Function, Tissue Development Hereditary Disorder, Organismal Injury and Abnormalities Organ Morphology, Respiratory System Development and Function, Tissue Morphology | abnormal morphology of adipose tissue | 3.57E-02 |
| Enzyme System Disorders, Organismal Injury and Abnormalities, Tissue Morphology | abnormal morphology of adipose tissue | 3.57E-02 |
| Development, Reproductive System Development and Function, Tissue Development | morphogenesis of male genital organ | 3.57E-02 |
| Organismal Development, Reproductive System Development and Function, Tissue Development | osteoclastogenesis of osteoclast precursor cells | 3.60E-02 |
| Hereditary Disorder, Organismal Injury and Abnormalities Organ Morphology, Respiratory System Development and Function, Tissue Morphology | X-linked hereditary disease | 3.62E-02 |
| Organismal Development, Reproductive System Development and Function, Tissue Morphology | quantity of type II pneumocytes | 3.63E-02 |
| Connective Tissue Disorders, Organismal Injury and Abnormalities, Tissue Morphology Embryonic Development, Organ Development, Organ Morphology, Organismal Development, Reproductive System Development and Function, Tissue Development | abnormal morphology of adipose tissue | 3.57E-02 |
| Development, Reproductive System Development and Function, Tissue Development | morphogenesis of male genital organ | 3.57E-02 |
| Organismal Development, Reproductive System Development and Function, Tissue Development | osteoclastogenesis of osteoclast precursor cells | 3.60E-02 |
| Gene Expression Cellular Development, Skeletal and Muscular System Development and Function, Tissue Development | transcription of DNA | 4.00E-02 |
| Organismal Injury and Abnormalities, Renal and Urological Disease Cellular Assembly and Organization, Cellular Compromise, DNA Replication, Recombination, and Repair | differentiation of myoblasts | 4.01E-02 |
| Energy Production, Nucleic Acid Metabolism, Small Molecule Biochemistry | binding of ATP | 3.66E-02 |
| Cardiovascular System Development and Function Cancer, Gastrointestinal Disease, Hepatic System Disease, Liver Hyperplasia/Hyperproliferation, Organismal Injury and Abnormalities, Cardiac Enlargement, Cardiovascular System Development and Function, Organ Morphology, Organismal Development | ejection fraction of left ventricle | 3.81E-02 |
| Organismal Injury and Abnormalities, Renal and Urological Disease | liver cancer | 3.92E-02 |
| Cardiovascular System Development and Function, Organ Development, Organ Morphology, Organismal Development | enlargement of left ventricle | 3.96E-02 |
| Gene Expression Cellular Development, Skeletal and Muscular System Development and Function, Tissue Development | transcription of DNA | 4.00E-02 |
| Organismal Injury and Abnormalities, Renal and Urological Disease Cellular Assembly and Organization, Cellular Compromise, DNA Replication, Recombination, and Repair | differentiation of myoblasts | 4.01E-02 |
| Energy Production, Nucleic Acid Metabolism, Small Molecule Biochemistry | binding of ATP | 3.66E-02 |
| Cardiovascular System Development and Function Cancer, Gastrointestinal Disease, Hepatic System Disease, Liver Hyperplasia/Hyperproliferation, Organismal Injury and Abnormalities, Cardiac Enlargement, Cardiovascular System Development and Function, Organ Morphology, Organismal Development | ejection fraction of left ventricle | 3.81E-02 |
| Organismal Injury and Abnormalities, Renal and Urological Disease | liver cancer | 3.92E-02 |
| Cardiovascular System Development and Function, Organ Development, Organ Morphology, Organismal Development | enlargement of left ventricle | 3.96E-02 |
| Gene Expression Cellular Development, Skeletal and Muscular System Development and Function, Tissue Development | transcription of DNA | 4.00E-02 |
| Organismal Injury and Abnormalities, Renal and Urological Disease Cellular Assembly and Organization, Cellular Compromise, DNA Replication, Recombination, and Repair | differentiation of myoblasts | 4.01E-02 |
| Energy Production, Nucleic Acid Metabolism, Small Molecule Biochemistry | binding of ATP | 3.66E-02 |
| Cardiovascular System Development and Function Cancer, Gastrointestinal Disease, Hepatic System Disease, Liver Hyperplasia/Hyperproliferation, Organismal Injury and Abnormalities, Cardiac Enlargement, Cardiovascular System Development and Function, Organ Morphology, Organismal Development | ejection fraction of left ventricle | 3.81E-02 |
| Organismal Injury and Abnormalities, Renal and Urological Disease | liver cancer | 3.92E-02 |
| Cardiovascular System Development and Function, Organ Development, Organ Morphology, Organismal Development | enlargement of left ventricle | 3.96E-02 |
| Gene Expression Cellular Development, Skeletal and Muscular System Development and Function, Tissue Development | transcription of DNA | 4.00E-02 |
| Organismal Injury and Abnormalities, Renal and Urological Disease Cellular Assembly and Organization, Cellular Compromise, DNA Replication, Recombination, and Repair | differentiation of myoblasts | 4.01E-02 |
| Energy Production, Nucleic Acid Metabolism, Small Molecule Biochemistry | binding of ATP | 3.66E-02 |
| Cardiovascular System Development and Function Cancer, Gastrointestinal Disease, Hepatic System Disease, Liver Hyperplasia/Hyperproliferation, Organismal Injury and Abnormalities, Cardiac Enlargement, Cardiovascular System Development and Function, Organ Morphology, Organismal Development | ejection fraction of left ventricle | 3.81E-02 |
| Organismal Injury and Abnormalities, Renal and Urological Disease | liver cancer | 3.92E-02 |
| Cardiovascular System Development and Function, Organ Development, Organ Morphology, Organismal Development | enlargement of left ventricle | 3.96E-02 |
| Gene Expression Cellular Development, Skeletal and Muscular System Development and Function, Tissue Development | transcription of DNA | 4.00E-02 |
| Organismal Injury and Abnormalities, Renal and Urological Disease Cellular Assembly and Organization, Cellular Compromise, DNA Replication, Recombination, and Repair | differentiation of myoblasts | 4.01E-02 |
DNA Replication, Recombination, and Repair  
condensation of chromosomes  4.68E-02

Developmental Disorder, Embryonic Development, Organismal Survival  
death of embryo  4.82E-02

Embryonic Development, Organismal Development, Tissue Development  
development of heart tube  4.83E-02

Endocrine System Disorders, Gastrointestinal Disease, Hereditary Disorder, Metabolic Disease, Organismal Injury and Abnormalities  
familial non-insulin-dependent diabetes mellitus  4.83E-02

Embryonic Development, Organismal Development  
specification of rostrocaudal axis  4.86E-02

Cellular Development  
immortalization of fibroblast cell lines  4.95E-02

Cell Cycle  
delay in mitosis of cervical cancer cell lines  4.98E-02

Cell Death and Survival, Cellular Development, Cellular Function and Maintenance, Cell Death and Survival, Organismal Injury and Abnormalities, Renal Necrosis/Cell Death, Renal and Urological Disease  
self-renewal of embryonic stem cells  4.98E-02

cell death of kidney cell lines  6.29E-02

Cardiac Dysfunction, Cardiac Fibrosis, Cardiovascular Disease, Organismal Injury and Abnormalities, Liver Hyperplasia/Hyperproliferation, Organismal Injury and Abnormalities, Tissue Morphology  
interstitial fibrosis of left ventricle  9.00E-02

Cancer, Gastrointestinal Disease, Hepatic System Disease, Hepatocellular Carcinoma, Liver Hyperplasia/Hyperproliferation, Organismal Injury and Abnormalities  
quantity of hepatocellular carcinoma  9.73E-02

Cardiovascular Disease, Heart Failure, Organismal Injury and Abnormalities  
failure of heart  1.12E-01

Gastrointestinal Disease, Hepatic System Disease, Liver Fibrosis, Organismal Injury and Abnormalities  
fiбросis of liver  1.12E-01

Cardiac Necrosis/Cell Death, Cardiovascular Disease, Cell Death and Survival, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders  
apoptosis of cardiomyocytes  1.50E-01

Cancer, Gastrointestinal Disease, Hepatic System Disease, Liver Hyperplasia/Hyperproliferation, Organismal Injury and Abnormalities  
liver carcinoma  1.86E-01

Hepatic System Development and Function, Liver Proliferation, Organ Morphology, Tissue Morphology  
quantity of hepatocytes  2.15E-01

Cardiac Arrhythmia, Cardiovascular Disease, Organismal Injury and Abnormalities  
arrhythmia  2.35E-01

Cardiovascular Disease, Congenital Heart Anomaly, Developmental Disorder, Organismal Injury and Abnormalities  
congenital heart disease  2.42E-01

Gastrointestinal Disease, Hepatic System Disease, Liver Steatosis, Metabolic Disease, Organismal Injury and Abnormalities  
hepatic steatosis  2.89E-01

Cell Death and Survival, Organismal Injury and Abnormalities, Renal Necrosis/Cell Death, Renal and Urological Disease  
apoptosis of kidney cell lines  3.29E-01

Cardiac Necrosis/Cell Death, Cardiovascular Disease, Cell Death and Survival, Organismal Injury and Abnormalities, Skeletal and Muscular Disorders  
apoptosis of ventricular myocytes  3.42E-01

Cardiovascular Disease, Congenital Heart Anomaly, Developmental Disorder, Organismal Injury and Abnormalities  
failure of heart looping  3.42E-01

Cardiac Arrhythmia, Cardiovascular Disease, Organismal Injury and Abnormalities  
long-QT syndrome  3.59E-01

Gastrointestinal Disease, Hepatic System Disease, Liver Cholestasis  
cholestasis  3.93E-01

Cancer, Gastrointestinal Disease, Hepatic System Disease, Liver Hyperplasia/Hyperproliferation, Organismal Injury and Abnormalities  
tumorigenesis of liver tumor  4.25E-01

Cancer, Gastrointestinal Disease, Hepatic System Disease, Hepatocellular Carcinoma, Liver Hyperplasia/Hyperproliferation, Organismal Injury and Abnormalities  
incidence of hepatocellular carcinoma  5.17E-01