| Pathway                                             | Source         | Length | $DS_P$  | $p(DS_P)$ | O.R.  | $q(O.R.)$ |
|----------------------------------------------------|----------------|--------|---------|-----------|-------|-----------|
| Purine metabolism                                  | Kegg           | 136    | 1.86    | 6.36e-03  | 1.59  | 4.15e-21  |
| Calcium signaling pathway                          | Kegg           | 100    | 1.38    | 1.82e-03  | 1.55  | 6.99e-20  |
| Melanogenesis                                       | Kegg           | 84     | 2.36    | 4.55e-03  | 1.53  | 1.47e-18  |
| Gap junction                                        | Kegg           | 80     | 1.54    | 5.45e-03  | 1.49  | 1.49e-16  |
| ErbB signaling pathway                             | Kegg           | 81     | 1.36    | 1.45e-02  | 1.46  | 4.68e-15  |
| Long-term potentiation                              | Kegg           | 60     | 1.71    | 9.09e-04  | 1.45  | 4.34e-15  |
| GnRH signaling pathway                             | Kegg           | 79     | 1.36    | 1.18e-02  | 1.44  | 1.32e-14  |
| TCR signaling in naive CD4+ T cells                | NCI-Nature     | 60     | 2.11    | 5.45e-03  | 1.42  | 7.80e-13  |
| TCR signaling in naive CD8+ T cells                | NCI-Nature     | 48     | 2.03    | 7.27e-03  | 1.38  | 1.11e-11  |
| Prostate cancer                                     | Kegg           | 75     | 1.45    | 4.09e-02  | 1.38  | 4.37e-11  |
| PKC-catalyzed phosphorylation ... myosin phosphatase| BioCarta       | 20     | 1.97    | <1e-04    | 1.30  | 5.82e-09  |
| CCR3 signaling in eosinophils                      | BioCarta       | 21     | 1.59    | 1.09e-02  | 1.29  | 8.86e-08  |
| Biosynthesis of unsaturated fatty acids            | Kegg           | 18     | 1.69    | 2.45e-02  | 1.26  | 1.38e-06  |
| Attenuation of GPCR signaling                      | BioCarta       | 11     | 1.75    | 1.09e-02  | 1.25  | 2.41e-06  |
| Stathmin and breast cancer resistance to antimicrotubule agents | BioCarta       | 18   | 1.84    | 4.82e-02  | 1.24  | 4.96e-06  |
| Visual signal transduction: Cones                  | NCI-Nature     | 20     | 1.56    | 4.73e-02  | 1.24  | 2.24e-06  |
| Dentatorubropallidolysian atrophy (DRPLA)          | Kegg           | 11     | 1.84    | 2.73e-03  | 1.24  | 2.24e-06  |
| Intrinsic prothrombin activation pathway           | BioCarta       | 22     | 1.35    | 3.18e-02  | 1.23  | 4.61e-06  |
| Eicosanoid metabolism                              | BioCarta       | 19     | 1.69    | 1.91e-02  | 1.23  | 3.44e-06  |
| Effects of botulinum toxin                          | NCI-Nature     | 7      | 1.44    | 2.27e-02  | 1.20  | 3.50e-05  |
| Activation of PKC through G-protein coupled receptors | BioCarta       | 10     | 1.50    | 9.09e-03  | 1.20  | 8.42e-06  |
| Ca-calmodulin-dependent protein kinase activation  | BioCarta       | 8      | 1.70    | 1.00e-02  | 1.19  | 5.67e-05  |
| Streptomyacin biosynthesis                          | Kegg           | 9      | 1.36    | 3.55e-02  | 1.17  | 1.89e-04  |
| PECAM1 interactions                                 | Reactome       | 6      | 2.70    | 5.45e-03  | 1.17  | 7.28e-05  |
| HDL-mediated lipid transport                        | Reactome       | 8      | 1.47    | 2.00e-02  | 1.14  | 1.56e-03  |
| Granzyme A mediated apoptosis pathway               | BioCarta       | 8      | 1.97    | 1.73e-02  | 1.12  | 6.60e-04  |

**Supplementary Table S-1.**