**Supplementary Table 4. Enrichment results of all pathways in GSEA**

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| No. | ID | Description | Set  size | Enrichment  score | NES | *p*-value | *p* adjusted | q-values | Rank | Leading edge |
| 1 | hsa04672 | Intestinal immune network for IgA production | 45 | 0.79003159 | 1.953379944 | 0.001594896 | 0.014759809 | 0.011917858 | 5289 | tags=76%, list=14%, signal=65% |
| 2 | hsa05340 | Primary immunodeficiency | 37 | 0.775199608 | 1.856780742 | 0.001618123 | 0.014759809 | 0.011917858 | 4566 | tags=62%, list=12%, signal=54% |
| 3 | hsa05332 | Graft-versus-host disease | 37 | 0.767504956 | 1.838350285 | 0.001618123 | 0.014759809 | 0.011917858 | 6077 | tags=81%, list=17%, signal=68% |
| 4 | hsa05330 | Allograft rejection | 35 | 0.763410104 | 1.792422909 | 0.001650165 | 0.014759809 | 0.011917858 | 4618 | tags=69%, list=13%, signal=60% |
| 5 | hsa04640 | Hematopoietic cell lineage | 96 | 0.744777209 | 2.07295363 | 0.00152439 | 0.014759809 | 0.011917858 | 4848 | tags=60%, list=13%, signal=53% |
| 6 | hsa05144 | Malaria | 50 | 0.744035239 | 1.870300043 | 0.001582278 | 0.014759809 | 0.011917858 | 5423 | tags=62%, list=15%, signal=53% |
| 7 | hsa04061 | Viral protein interaction with cytokine and cytokine receptor | 98 | 0.741490649 | 2.073886337 | 0.001508296 | 0.014759809 | 0.011917858 | 5273 | tags=63%, list=14%, signal=54% |
| 8 | hsa05323 | Rheumatoid arthritis | 89 | 0.727162538 | 1.997336527 | 0.00152207 | 0.014759809 | 0.011917858 | 5809 | tags=64%, list=16%, signal=54% |
| 9 | hsa05140 | Leishmaniasis | 74 | 0.726551918 | 1.960361506 | 0.001508296 | 0.014759809 | 0.011917858 | 5812 | tags=55%, list=16%, signal=47% |
| 10 | hsa04940 | Type I diabetes mellitus | 41 | 0.676748686 | 1.650322692 | 0.006389776 | 0.039567461 | 0.031948882 | 4618 | tags=59%, list=13%, signal=51% |
| 11 | hsa04514 | Cell adhesion molecules (CAMs) | 144 | 0.675138733 | 1.979349484 | 0.001451379 | 0.014759809 | 0.011917858 | 9026 | tags=68%, list=25%, signal=52% |
| 12 | hsa05150 | *Staphylococcus aureus* infection | 92 | 0.674261004 | 1.862565463 | 0.00152207 | 0.014759809 | 0.011917858 | 6346 | tags=57%, list=17%, signal=47% |
| 13 | hsa04612 | Antigen processing and presentation | 70 | 0.671129489 | 1.791391002 | 0.00154321 | 0.014759809 | 0.011917858 | 7599 | tags=59%, list=21%, signal=47% |
| 14 | hsa05321 | Inflammatory bowel disease (IBD) | 63 | 0.670508612 | 1.768632835 | 0.00152439 | 0.014759809 | 0.011917858 | 8127 | tags=73%, list=22%, signal=57% |
| 15 | hsa05416 | Viral myocarditis | 57 | 0.65716031 | 1.70333082 | 0.001531394 | 0.014759809 | 0.011917858 | 9066 | tags=63%, list=25%, signal=48% |
| 16 | hsa04659 | Th17 cell differentiation | 105 | 0.654671738 | 1.845857714 | 0.001519757 | 0.014759809 | 0.011917858 | 5436 | tags=43%, list=15%, signal=37% |
| 17 | hsa04662 | B cell receptor signaling pathway | 79 | 0.647080995 | 1.752952213 | 0.001517451 | 0.014759809 | 0.011917858 | 8127 | tags=49%, list=22%, signal=39% |
| 18 | hsa04380 | Osteoclast differentiation | 125 | 0.64672897 | 1.859951713 | 0.001488095 | 0.014759809 | 0.011917858 | 6321 | tags=46%, list=17%, signal=38% |
| 19 | hsa04064 | NF-kappa B signaling pathway | 100 | 0.632415319 | 1.766685137 | 0.001519757 | 0.014759809 | 0.011917858 | 10145 | tags=56%, list=28%, signal=41% |
| 20 | hsa04660 | T cell receptor signaling pathway | 103 | 0.626535362 | 1.758868017 | 0.001519757 | 0.014759809 | 0.011917858 | 8127 | tags=44%, list=22%, signal=34% |
| 21 | hsa04062 | Chemokine signaling pathway | 187 | 0.626102126 | 1.896024074 | 0.001408451 | 0.014759809 | 0.011917858 | 5408 | tags=40%, list=15%, signal=34% |
| 22 | hsa05146 | Amoebiasis | 101 | 0.625317737 | 1.753545055 | 0.001508296 | 0.014759809 | 0.011917858 | 6672 | tags=46%, list=18%, signal=37% |
| 23 | hsa04512 | ECM-receptor interaction | 88 | 0.608311146 | 1.672053911 | 0.003012048 | 0.022795653 | 0.018406428 | 8116 | tags=56%, list=22%, signal=43% |
| 24 | hsa04668 | TNF signaling pathway | 112 | 0.607427872 | 1.735398146 | 0.001488095 | 0.014759809 | 0.011917858 | 9316 | tags=50%, list=25%, signal=37% |
| 25 | hsa04657 | IL-17 signaling pathway | 94 | 0.606384159 | 1.683259712 | 0.00152439 | 0.014759809 | 0.011917858 | 7669 | tags=41%, list=21%, signal=33% |
| 26 | hsa04060 | Cytokine-cytokine receptor interaction | 292 | 0.604019254 | 1.916358559 | 0.001362398 | 0.014759809 | 0.011917858 | 5842 | tags=48%, list=16%, signal=40% |
| 27 | hsa05142 | Chagas disease (American trypanosomiasis) | 101 | 0.602788696 | 1.690368071 | 0.001508296 | 0.014759809 | 0.011917858 | 5459 | tags=36%, list=15%, signal=30% |
| 28 | hsa05145 | Toxoplasmosis | 110 | 0.600965235 | 1.709635147 | 0.001494768 | 0.014759809 | 0.011917858 | 5423 | tags=36%, list=15%, signal=31% |
| 29 | hsa05410 | Hypertrophic cardiomyopathy (HCM) | 90 | 0.596250612 | 1.64239343 | 0.003025719 | 0.022795653 | 0.018406428 | 6967 | tags=47%, list=19%, signal=38% |
| 30 | hsa04933 | AGE-RAGE signaling pathway in diabetic complications | 100 | 0.595840059 | 1.664510242 | 0.001519757 | 0.014759809 | 0.011917858 | 6789 | tags=40%, list=18%, signal=33% |
| 31 | hsa04666 | Fc gamma R-mediated phagocytosis | 92 | 0.591989654 | 1.635300688 | 0.00304414 | 0.022795653 | 0.018406428 | 9142 | tags=45%, list=25%, signal=34% |
| 32 | hsa04625 | C-type lectin receptor signaling pathway | 104 | 0.591371309 | 1.667339122 | 0.001510574 | 0.014759809 | 0.011917858 | 12298 | tags=69%, list=34%, signal=46% |
| 33 | hsa05235 | PD-L1 expression and PD-1 checkpoint pathway in cancer | 89 | 0.582255542 | 1.599312671 | 0.00304414 | 0.022795653 | 0.018406428 | 12298 | tags=57%, list=34%, signal=38% |
| 34 | hsa04658 | Th1 and Th2 cell differentiation | 90 | 0.581653365 | 1.602184798 | 0.003025719 | 0.022795653 | 0.018406428 | 8164 | tags=60%, list=22%, signal=47% |
| 35 | hsa04145 | Phagosome | 149 | 0.580348215 | 1.70654556 | 0.001459854 | 0.014759809 | 0.011917858 | 8869 | tags=48%, list=24%, signal=36% |
| 36 | hsa05414 | Dilated cardiomyopathy (DCM) | 95 | 0.567259072 | 1.578299152 | 0.006069803 | 0.038323068 | 0.030944092 | 6936 | tags=46%, list=19%, signal=38% |
| 37 | hsa05135 | *Yersinia* infection | 120 | 0.549835437 | 1.582499672 | 0.001474926 | 0.014759809 | 0.011917858 | 12298 | tags=56%, list=34%, signal=37% |
| 38 | hsa04611 | Platelet activation | 124 | 0.549546929 | 1.577654071 | 0.001488095 | 0.014759809 | 0.011917858 | 6936 | tags=40%, list=19%, signal=32% |
| 39 | hsa05152 | Tuberculosis | 177 | 0.547265192 | 1.648764907 | 0.001420455 | 0.014759809 | 0.011917858 | 6842 | tags=40%, list=19%, signal=32% |
| 40 | hsa05166 | Human T cell leukemia virus 1 infection | 217 | 0.531939322 | 1.633966026 | 0.001396648 | 0.014759809 | 0.011917858 | 10221 | tags=43%, list=28%, signal=31% |
| 41 | hsa04650 | Natural killer cell mediated cytotoxicity | 124 | 0.516484611 | 1.482737883 | 0.004464286 | 0.029336735 | 0.023688047 | 9076 | tags=54%, list=25%, signal=41% |
| 42 | hsa04510 | Focal adhesion | 199 | 0.514235998 | 1.570688603 | 0.001412429 | 0.014759809 | 0.011917858 | 9142 | tags=42%, list=25%, signal=32% |
| 43 | hsa04360 | Axon guidance | 181 | 0.508819827 | 1.537901932 | 0.001414427 | 0.014759809 | 0.011917858 | 12305 | tags=58%, list=34%, signal=39% |
| 44 | hsa04621 | NOD-like receptor signaling pathway | 180 | 0.500463765 | 1.51125964 | 0.002820874 | 0.022795653 | 0.018406428 | 7671 | tags=37%, list=21%, signal=30% |
| 45 | hsa04218 | Cellular senescence | 158 | 0.488104155 | 1.448819098 | 0.007163324 | 0.043520571 | 0.035140834 | 13104 | tags=55%, list=36%, signal=36% |
| 46 | hsa04630 | JAK-STAT signaling pathway | 162 | 0.487583378 | 1.453977106 | 0.004273504 | 0.028668091 | 0.023148148 | 6251 | tags=36%, list=17%, signal=30% |
| 47 | hsa05202 | Transcriptional misregulation in cancer | 185 | 0.480417697 | 1.453803377 | 0.004225352 | 0.028668091 | 0.023148148 | 10784 | tags=44%, list=29%, signal=31% |
| 48 | hsa05130 | Pathogenic *Escherichia coli* infection | 201 | 0.479563971 | 1.467362999 | 0.004195804 | 0.028668091 | 0.023148148 | 12465 | tags=52%, list=34%, signal=34% |
| 49 | hsa05205 | Proteoglycans in cancer | 202 | 0.475612803 | 1.455276925 | 0.004219409 | 0.028668091 | 0.023148148 | 11343 | tags=49%, list=31%, signal=34% |
| 50 | hsa04151 | PI3K-Akt signaling pathway | 352 | 0.475048264 | 1.536770047 | 0.001303781 | 0.014759809 | 0.011917858 | 7146 | tags=35%, list=19%, signal=28% |
| 51 | hsa04810 | Regulation of actin cytoskeleton | 213 | 0.47498989 | 1.458137441 | 0.002797203 | 0.022795653 | 0.018406428 | 11397 | tags=54%, list=31%, signal=38% |
| 52 | hsa04014 | Ras signaling pathway | 231 | 0.449962588 | 1.397127222 | 0.005479452 | 0.035287671 | 0.028493151 | 10355 | tags=47%, list=28%, signal=34% |
| 53 | hsa04010 | MAPK signaling pathway | 295 | 0.426003103 | 1.353902705 | 0.00405954 | 0.028668091 | 0.023148148 | 10415 | tags=42%, list=28%, signal=31% |