

Supplementary Table 1. Up- or down-retulated gene list after knockdown of cohesin components.

## A. Upregulated gene list after knockdown of SMC3, RAD21, and REC8.

| Gene symbol | Fold change          |                       |                      | Average of normalized data (log2) |        |         |        | Average of raw data |         |         |         |
|-------------|----------------------|-----------------------|----------------------|-----------------------------------|--------|---------|--------|---------------------|---------|---------|---------|
|             | siRec8<br>/siControl | siRad21<br>/siControl | siSMC3<br>/siControl | siControl                         | siRec8 | siRad21 | siSMC3 | siControl           | siRec8  | siRad21 | siSMC3  |
| Rb1         | 2.702                | 3.349                 | 2.759                | 1.504                             | 2.938  | 3.248   | 2.968  | 1.832               | 6.644   | 8.523   | 6.802   |
| Cyr61       | 6.957                | 6.534                 | 7.080                | 1.343                             | 4.142  | 4.051   | 4.167  | 1.533               | 16.609  | 15.629  | 16.905  |
| Sdc4        | 5.813                | 4.674                 | 4.016                | 2.964                             | 5.504  | 5.189   | 4.970  | 6.798               | 44.259  | 35.604  | 30.235  |
| Serpine2    | 5.304                | 6.725                 | 5.395                | 1.919                             | 4.326  | 4.669   | 4.351  | 2.778               | 19.013  | 24.511  | 19.341  |
| Plk2        | 5.129                | 4.518                 | 3.732                | 2.774                             | 5.133  | 4.950   | 4.675  | 5.831               | 34.004  | 30.006  | 24.452  |
| Mt2         | 3.233                | 2.839                 | 3.785                | 7.986                             | 9.679  | 9.492   | 9.907  | 252.392             | 816.647 | 721.423 | 955.671 |
| Perp        | 3.138                | 3.170                 | 2.889                | 3.321                             | 4.970  | 4.985   | 4.851  | 8.980               | 30.271  | 30.774  | 27.770  |
| Trp53inp1   | 3.131                | 3.374                 | 2.720                | 4.691                             | 6.337  | 6.445   | 6.135  | 24.801              | 79.657  | 86.424  | 69.017  |
| Btg2        | 3.086                | 3.264                 | 2.897                | 3.173                             | 4.799  | 4.879   | 4.707  | 8.011               | 26.763  | 28.528  | 25.038  |
| Ptpn14      | 2.951                | 3.309                 | 2.829                | 2.619                             | 4.180  | 4.345   | 4.119  | 5.135               | 17.077  | 19.380  | 16.318  |
| Ccng1       | 2.633                | 1.817                 | 1.678                | 5.605                             | 7.001  | 6.466   | 6.351  | 47.605              | 126.776 | 87.722  | 80.349  |
| Gpx3        | 2.442                | 2.209                 | 1.896                | 3.763                             | 5.051  | 4.906   | 4.685  | 12.557              | 32.065  | 29.077  | 24.644  |
| Cald1       | 2.410                | 1.784                 | 1.779                | 3.664                             | 4.933  | 4.499   | 4.496  | 11.669              | 29.483  | 21.689  | 21.485  |
| Gsto1       | 2.329                | 1.626                 | 1.728                | 4.308                             | 5.527  | 5.009   | 5.097  | 18.793              | 45.010  | 31.306  | 33.111  |
| Mdm2        | 2.265                | 2.152                 | 1.827                | 5.078                             | 6.258  | 6.184   | 5.948  | 32.753              | 75.316  | 71.945  | 60.520  |
| Plod2       | 2.236                | 2.625                 | 2.632                | 2.854                             | 4.015  | 4.247   | 4.250  | 6.224               | 15.129  | 18.041  | 17.973  |
| Pdrg1       | 2.235                | 2.174                 | 2.035                | 3.335                             | 4.496  | 4.455   | 4.360  | 9.084               | 21.508  | 21.008  | 19.470  |
| Tex19.1     | 2.215                | 2.415                 | 2.174                | 3.308                             | 4.455  | 4.580   | 4.428  | 8.894               | 20.875  | 22.986  | 20.456  |
| Pisd-ps1    | 2.214                | 2.935                 | 2.366                | 3.207                             | 4.354  | 4.761   | 4.450  | 8.228               | 19.397  | 26.193  | 20.783  |
| Snhg12      | 2.186                | 2.706                 | 2.521                | 3.463                             | 4.591  | 4.899   | 4.797  | 10.011              | 23.039  | 28.925  | 26.701  |
| Mrgpra6     | 2.163                | 2.781                 | 2.222                | 6.593                             | 7.706  | 8.069   | 7.745  | 95.469              | 207.292 | 268.417 | 212.821 |
| B2m         | 2.109                | 2.058                 | 1.922                | 3.421                             | 4.497  | 4.462   | 4.363  | 9.695               | 21.526  | 21.105  | 19.511  |
| Plk7        | 2.056                | 2.566                 | 2.298                | 4.500                             | 5.540  | 5.860   | 5.701  | 21.610              | 45.418  | 57.252  | 50.840  |
| Gm11974     | 1.974                | 2.433                 | 2.795                | 3.489                             | 4.470  | 4.772   | 4.972  | 10.216              | 21.111  | 26.412  | 30.285  |
| Olf856-ps1  | 1.948                | 2.805                 | 1.846                | 3.809                             | 4.771  | 5.297   | 4.694  | 13.005              | 26.231  | 38.442  | 24.790  |
| Rev1        | 1.947                | 1.952                 | 1.757                | 3.205                             | 4.166  | 4.170   | 4.018  | 8.209               | 16.903  | 17.056  | 15.150  |
| Ptp4a3      | 1.939                | 1.991                 | 1.831                | 3.362                             | 4.317  | 4.355   | 4.235  | 9.272               | 18.888  | 19.532  | 17.768  |
| Crip2       | 1.907                | 1.769                 | 1.608                | 4.148                             | 5.080  | 4.971   | 4.834  | 16.722              | 32.733  | 30.464  | 27.423  |
| Slc26a2     | 1.869                | 1.812                 | 2.017                | 3.185                             | 4.087  | 4.042   | 4.197  | 8.085               | 15.958  | 15.530  | 17.277  |
| Susd6       | 1.867                | 2.003                 | 1.867                | 3.249                             | 4.150  | 4.252   | 4.150  | 8.500               | 16.713  | 18.107  | 16.701  |
| S100a11     | 1.863                | 1.816                 | 2.024                | 5.827                             | 6.725  | 6.688   | 6.845  | 55.730              | 104.529 | 102.454 | 113.519 |
| Ece1        | 1.858                | 2.138                 | 1.819                | 3.727                             | 4.621  | 4.823   | 4.590  | 12.228              | 23.541  | 27.397  | 23.012  |
| Lama5       | 1.841                | 3.223                 | 2.630                | 3.219                             | 4.099  | 4.907   | 4.614  | 8.300               | 16.095  | 29.098  | 23.403  |
| Ccp110      | 1.813                | 1.821                 | 1.948                | 3.507                             | 4.365  | 4.372   | 4.469  | 10.358              | 19.558  | 19.765  | 21.075  |
| Rbms1       | 1.783                | 1.817                 | 1.983                | 3.205                             | 4.040  | 4.067   | 4.193  | 8.217               | 15.406  | 15.808  | 17.227  |
| Arl6ip5     | 1.727                | 1.720                 | 2.002                | 4.034                             | 4.822  | 4.816   | 5.035  | 15.367              | 27.205  | 27.266  | 31.674  |
| Tnpo2       | 1.721                | 2.065                 | 1.940                | 4.037                             | 4.820  | 5.084   | 4.993  | 15.405              | 27.180  | 33.016  | 30.747  |
| Eda2r       | 1.709                | 2.223                 | 2.165                | 3.281                             | 4.054  | 4.434   | 4.396  | 8.713               | 15.569  | 20.685  | 19.988  |
| Mbnl2       | 1.695                | 2.117                 | 1.878                | 3.627                             | 4.389  | 4.709   | 4.536  | 11.346              | 19.893  | 25.241  | 22.132  |
| Paip2b      | 1.673                | 1.887                 | 1.848                | 4.356                             | 5.098  | 5.272   | 5.242  | 19.455              | 33.167  | 37.766  | 36.726  |
| Serpinh1    | 1.653                | 2.570                 | 2.221                | 4.057                             | 4.781  | 5.418   | 5.208  | 15.624              | 26.426  | 41.895  | 35.842  |
| Ptgr1       | 1.648                | 1.646                 | 1.618                | 3.766                             | 4.487  | 4.486   | 4.461  | 12.594              | 21.376  | 21.475  | 20.950  |
| Ifrd1       | 1.628                | 2.138                 | 2.076                | 4.392                             | 5.095  | 5.488   | 5.445  | 19.973              | 33.085  | 44.020  | 42.423  |
| Plin2       | 1.589                | 1.712                 | 1.521                | 3.448                             | 4.117  | 4.224   | 4.053  | 9.909               | 16.308  | 17.747  | 15.547  |
| Tmtc3       | 1.578                | 1.645                 | 1.575                | 3.608                             | 4.266  | 4.327   | 4.263  | 11.181              | 18.192  | 19.129  | 18.136  |
| Cldn6       | 1.575                | 1.595                 | 1.548                | 3.774                             | 4.430  | 4.448   | 4.404  | 12.665              | 20.496  | 20.892  | 20.105  |
| Anxa2       | 1.567                | 2.773                 | 2.635                | 3.852                             | 4.500  | 5.323   | 5.250  | 13.418              | 21.560  | 39.152  | 36.914  |
| Stk25       | 1.553                | 2.230                 | 1.989                | 3.392                             | 4.027  | 4.549   | 4.384  | 9.486               | 15.261  | 22.480  | 19.818  |
| Hspg2       | 1.522                | 3.283                 | 2.255                | 3.905                             | 4.511  | 5.620   | 5.078  | 13.964              | 21.734  | 48.328  | 32.662  |
| Laptn4a     | 1.517                | 1.514                 | 1.552                | 5.207                             | 5.808  | 5.805   | 5.841  | 35.898              | 54.864  | 55.094  | 56.126  |

B. Downregulated gene list after knockdown of SMC3, RAD21, and REC8.

| Gene symbol | Fold change          |                       |                      | Average of normalized data (log2) |        |         |        | Average of raw data |          |          |          |
|-------------|----------------------|-----------------------|----------------------|-----------------------------------|--------|---------|--------|---------------------|----------|----------|----------|
|             | siRec8<br>/siControl | siRad21<br>/siControl | siSMC3<br>/siControl | siControl                         | siRec8 | siRad21 | siSMC3 | siControl           | siRec8   | siRad21  | siSMC3   |
| Oaz1-ps     | 0.474                | 0.004                 | 0.047                | 7.818                             | 6.741  | 0.006   | 3.420  | 224.432             | 105.700  | 0.009    | 9.648    |
| Med8        | 0.666                | 0.546                 | 0.630                | 5.306                             | 4.720  | 4.432   | 4.639  | 38.519              | 25.289   | 20.663   | 23.822   |
| Slc25a5     | 0.666                | 0.405                 | 0.515                | 9.367                             | 8.781  | 8.063   | 8.410  | 658.866             | 437.633  | 267.430  | 337.859  |
| Rps14       | 0.665                | 0.445                 | 0.510                | 12.563                            | 11.976 | 11.395  | 11.591 | 6046.390            | 4015.820 | 2700.600 | 3073.470 |
| Nr2f6       | 0.665                | 0.644                 | 0.659                | 4.722                             | 4.134  | 4.087   | 4.121  | 25.375              | 16.513   | 16.045   | 16.333   |
| Eif2d       | 0.665                | 0.502                 | 0.588                | 7.808                             | 7.220  | 6.813   | 7.042  | 222.933             | 147.680  | 111.859  | 130.254  |
| Ndufaf3     | 0.664                | 0.646                 | 0.647                | 4.369                             | 3.779  | 3.740   | 3.741  | 19.652              | 12.695   | 12.403   | 12.325   |
| Ppa1        | 0.664                | 0.468                 | 0.533                | 7.999                             | 7.409  | 6.905   | 7.093  | 254.664             | 168.462  | 119.261  | 134.962  |
| Alb37181    | 0.664                | 0.478                 | 0.606                | 4.974                             | 4.384  | 3.909   | 4.251  | 30.408              | 19.819   | 14.072   | 17.974   |
| Msto1       | 0.664                | 0.383                 | 0.500                | 6.223                             | 5.631  | 4.837   | 5.222  | 73.623              | 48.443   | 27.691   | 36.168   |
| Cct6a       | 0.663                | 0.455                 | 0.526                | 9.349                             | 8.757  | 8.215   | 8.424  | 650.784             | 430.614  | 297.136  | 341.132  |
| Mbd3        | 0.663                | 0.563                 | 0.567                | 6.818                             | 6.226  | 5.990   | 6.001  | 111.785             | 73.645   | 62.772   | 62.787   |
| Eif2s2      | 0.663                | 0.424                 | 0.531                | 8.270                             | 7.677  | 7.034   | 7.356  | 307.461             | 203.126  | 130.477  | 162.178  |
| Cuedc2      | 0.662                | 0.588                 | 0.647                | 6.121                             | 5.527  | 5.356   | 5.494  | 68.550              | 44.987   | 40.095   | 43.898   |
| Ndufs7      | 0.662                | 0.599                 | 0.611                | 6.972                             | 6.377  | 6.233   | 6.261  | 124.404             | 81.880   | 74.468   | 75.417   |
| Aven        | 0.662                | 0.539                 | 0.638                | 5.747                             | 5.152  | 4.854   | 5.098  | 52.659              | 34.464   | 28.022   | 33.113   |
| Tkt         | 0.662                | 0.595                 | 0.641                | 8.097                             | 7.501  | 7.348   | 7.454  | 272.466             | 179.641  | 162.467  | 173.677  |
| Rassf7      | 0.662                | 0.462                 | 0.575                | 4.688                             | 4.092  | 3.574   | 3.889  | 24.756              | 16.010   | 10.951   | 13.762   |
| Bysl        | 0.660                | 0.437                 | 0.539                | 5.884                             | 5.285  | 4.691   | 4.991  | 58.004              | 37.890   | 24.925   | 30.686   |
| Smpd2       | 0.660                | 0.460                 | 0.547                | 4.270                             | 3.671  | 3.149   | 3.401  | 18.281              | 11.705   | 7.903    | 9.524    |
| Tead2       | 0.660                | 0.573                 | 0.619                | 6.358                             | 5.758  | 5.555   | 5.666  | 80.961              | 52.969   | 46.166   | 49.583   |
| Maz         | 0.659                | 0.559                 | 0.646                | 7.329                             | 6.728  | 6.489   | 6.699  | 159.641             | 104.707  | 89.124   | 102.540  |
| Rps3        | 0.658                | 0.529                 | 0.584                | 10.668                            | 10.065 | 9.749   | 9.893  | 1624.680            | 1067.465 | 862.603  | 946.001  |
| Ndufs8      | 0.658                | 0.606                 | 0.638                | 6.952                             | 6.349  | 6.229   | 6.304  | 122.704             | 80.285   | 74.276   | 77.741   |
| Pagr1a      | 0.658                | 0.507                 | 0.614                | 5.553                             | 4.949  | 4.572   | 4.849  | 45.910              | 29.798   | 22.863   | 27.721   |
| Basp1       | 0.657                | 0.566                 | 0.627                | 7.237                             | 6.632  | 6.417   | 6.565  | 149.742             | 97.893   | 84.724   | 93.309   |
| Atic        | 0.657                | 0.512                 | 0.606                | 7.834                             | 7.228  | 6.867   | 7.110  | 226.945             | 148.488  | 116.119  | 136.653  |
| Ssbp4       | 0.657                | 0.568                 | 0.641                | 6.707                             | 6.101  | 5.892   | 6.065  | 103.392             | 67.448   | 58.571   | 65.729   |
| Tfpt        | 0.657                | 0.419                 | 0.506                | 5.207                             | 4.600  | 3.953   | 4.224  | 35.891              | 23.188   | 14.536   | 17.618   |
| Taf10       | 0.656                | 0.647                 | 0.656                | 7.341                             | 6.734  | 6.714   | 6.734  | 161.021             | 105.133  | 104.348  | 105.030  |
| Pold2       | 0.656                | 0.516                 | 0.583                | 7.003                             | 6.395  | 6.049   | 6.225  | 127.160             | 82.955   | 65.428   | 73.504   |
| Grtp1       | 0.656                | 0.640                 | 0.651                | 6.028                             | 5.419  | 5.383   | 5.409  | 64.188              | 41.669   | 40.865   | 41.354   |
| Psph        | 0.655                | 0.587                 | 0.604                | 5.672                             | 5.062  | 4.905   | 4.944  | 49.945              | 32.310   | 29.056   | 29.679   |
| Trmt112     | 0.655                | 0.497                 | 0.535                | 7.271                             | 6.660  | 6.262   | 6.369  | 153.324             | 99.842   | 76.013   | 81.345   |
| Pih1d1      | 0.655                | 0.452                 | 0.497                | 6.187                             | 5.576  | 5.041   | 5.178  | 71.798              | 46.573   | 32.038   | 35.053   |
| Mrp11       | 0.654                | 0.428                 | 0.508                | 5.403                             | 4.790  | 4.179   | 4.426  | 41.266              | 26.590   | 17.182   | 20.421   |
| Smarchb1    | 0.654                | 0.482                 | 0.575                | 6.982                             | 6.369  | 5.929   | 6.183  | 125.273             | 81.413   | 60.140   | 71.378   |
| Stub1       | 0.653                | 0.542                 | 0.620                | 6.512                             | 5.898  | 5.629   | 5.822  | 90.149              | 58.463   | 48.643   | 55.384   |
| Arl6ip4     | 0.653                | 0.440                 | 0.550                | 6.098                             | 5.484  | 4.913   | 5.237  | 67.453              | 43.628   | 29.232   | 36.561   |
| Timm23      | 0.653                | 0.442                 | 0.558                | 8.228                             | 7.612  | 7.048   | 7.387  | 298.490             | 194.158  | 131.821  | 165.695  |
| Psmc13      | 0.653                | 0.566                 | 0.657                | 7.544                             | 6.928  | 6.722   | 6.939  | 185.468             | 120.471  | 104.945  | 121.216  |
| Eif3d       | 0.652                | 0.475                 | 0.569                | 8.208                             | 7.591  | 7.134   | 7.394  | 294.338             | 191.321  | 139.924  | 166.544  |
| Rab8a       | 0.652                | 0.523                 | 0.651                | 5.790                             | 5.173  | 4.855   | 5.171  | 54.283              | 34.986   | 28.038   | 34.897   |
| Sra1        | 0.651                | 0.563                 | 0.647                | 6.408                             | 5.787  | 5.579   | 5.779  | 83.830              | 54.082   | 46.960   | 53.699   |
| Hnrnpab     | 0.650                | 0.425                 | 0.554                | 9.477                             | 8.857  | 8.244   | 8.626  | 711.120             | 461.300  | 303.145  | 392.603  |
| Rnaseh2a    | 0.650                | 0.517                 | 0.579                | 6.014                             | 5.391  | 5.062   | 5.225  | 63.544              | 40.855   | 32.517   | 36.259   |
| Rpl30       | 0.648                | 0.368                 | 0.441                | 8.298                             | 7.672  | 6.856   | 7.116  | 313.455             | 202.459  | 115.238  | 137.159  |
| Tsen34      | 0.648                | 0.508                 | 0.599                | 7.073                             | 6.446  | 6.097   | 6.333  | 133.479             | 85.955   | 67.669   | 79.331   |
| Dohh        | 0.647                | 0.464                 | 0.529                | 6.807                             | 6.180  | 5.698   | 5.888  | 110.895             | 71.305   | 51.086   | 57.990   |
| Ubxn6       | 0.646                | 0.558                 | 0.571                | 5.326                             | 4.696  | 4.484   | 4.517  | 39.081              | 24.854   | 21.458   | 21.817   |
| Gltscr2     | 0.646                | 0.397                 | 0.490                | 8.156                             | 7.526  | 6.823   | 7.127  | 283.887             | 182.778  | 112.647  | 138.219  |
| Anp32b      | 0.646                | 0.535                 | 0.578                | 9.770                             | 9.140  | 8.867   | 8.980  | 871.179             | 561.650  | 467.548  | 502.084  |
| Sphk2       | 0.646                | 0.485                 | 0.605                | 4.090                             | 3.459  | 3.046   | 3.365  | 16.018              | 9.973    | 7.287    | 9.264    |
| Isyna1      | 0.646                | 0.523                 | 0.617                | 6.895                             | 6.264  | 5.960   | 6.199  | 117.927             | 75.662   | 61.447   | 72.200   |

|            |       |       |       |        |        |        |        |          |          |          |          |
|------------|-------|-------|-------|--------|--------|--------|--------|----------|----------|----------|----------|
| Chchd1     | 0.645 | 0.579 | 0.627 | 7.248  | 6.615  | 6.460  | 6.575  | 150.824  | 96.728   | 87.307   | 93.967   |
| Ruvbl1     | 0.645 | 0.451 | 0.549 | 7.722  | 7.088  | 6.572  | 6.858  | 209.943  | 134.712  | 94.479   | 114.529  |
| Rabif      | 0.644 | 0.559 | 0.636 | 5.890  | 5.254  | 5.051  | 5.236  | 58.238   | 37.063   | 32.274   | 36.542   |
| Nme6       | 0.644 | 0.491 | 0.539 | 5.109  | 4.473  | 4.084  | 4.219  | 33.488   | 21.155   | 16.017   | 17.552   |
| Rnf187     | 0.643 | 0.423 | 0.506 | 7.455  | 6.819  | 6.213  | 6.472  | 174.339  | 111.583  | 73.438   | 87.419   |
| Sgk1       | 0.642 | 0.427 | 0.648 | 8.199  | 7.560  | 6.969  | 7.573  | 292.553  | 187.200  | 124.752  | 188.702  |
| Yif1b      | 0.641 | 0.583 | 0.666 | 6.320  | 5.678  | 5.541  | 5.734  | 78.808   | 50.069   | 45.713   | 52.020   |
| Rdh11      | 0.640 | 0.657 | 0.658 | 4.634  | 3.991  | 4.029  | 4.031  | 23.817   | 14.859   | 15.374   | 15.289   |
| Gm4737     | 0.640 | 0.468 | 0.586 | 6.017  | 5.373  | 4.921  | 5.245  | 63.691   | 40.323   | 29.396   | 36.788   |
| Eif2b4     | 0.639 | 0.376 | 0.522 | 6.152  | 5.505  | 4.741  | 5.213  | 70.055   | 44.290   | 25.837   | 35.948   |
| Ube2r2     | 0.638 | 0.627 | 0.590 | 5.556  | 4.907  | 4.882  | 4.795  | 46.013   | 28.930   | 28.584   | 26.669   |
| Tbcb       | 0.638 | 0.329 | 0.481 | 6.806  | 6.156  | 5.204  | 5.751  | 110.770  | 70.144   | 35.989   | 52.652   |
| Serbp1     | 0.636 | 0.520 | 0.604 | 8.334  | 7.682  | 7.391  | 7.606  | 321.302  | 203.744  | 167.399  | 193.034  |
| Csrp2      | 0.635 | 0.401 | 0.499 | 8.353  | 7.699  | 7.034  | 7.350  | 325.698  | 206.179  | 130.503  | 161.554  |
| Nr0b1      | 0.635 | 0.406 | 0.561 | 7.002  | 6.347  | 5.702  | 6.168  | 127.093  | 80.199   | 51.224   | 70.625   |
| Apex1      | 0.634 | 0.352 | 0.500 | 6.629  | 5.972  | 5.122  | 5.631  | 97.913   | 61.610   | 33.949   | 48.359   |
| Pmvk       | 0.633 | 0.563 | 0.570 | 6.384  | 5.724  | 5.555  | 5.573  | 82.424   | 51.732   | 46.183   | 46.424   |
| Gjb5       | 0.633 | 0.349 | 0.384 | 4.777  | 4.116  | 3.258  | 3.397  | 26.385   | 16.303   | 8.602    | 9.497    |
| Tgif1      | 0.633 | 0.480 | 0.629 | 7.377  | 6.717  | 6.319  | 6.709  | 165.106  | 103.921  | 79.099   | 103.251  |
| Carkd      | 0.633 | 0.522 | 0.655 | 4.350  | 3.690  | 3.413  | 3.739  | 19.383   | 11.872   | 9.686    | 12.309   |
| Uqcc2      | 0.631 | 0.597 | 0.633 | 8.393  | 7.729  | 7.649  | 7.734  | 334.899  | 210.581  | 200.454  | 211.123  |
| Srm        | 0.631 | 0.363 | 0.446 | 8.185  | 7.520  | 6.724  | 7.020  | 289.673  | 182.018  | 105.097  | 128.306  |
| Bckdk      | 0.631 | 0.523 | 0.612 | 5.154  | 4.489  | 4.218  | 4.444  | 34.572   | 21.390   | 17.674   | 20.692   |
| Rangrf     | 0.630 | 0.382 | 0.461 | 7.154  | 6.487  | 5.764  | 6.038  | 141.308  | 88.477   | 53.542   | 64.460   |
| Ict1       | 0.630 | 0.403 | 0.464 | 6.493  | 5.826  | 5.183  | 5.385  | 89.022   | 55.570   | 35.464   | 40.621   |
| Nubp1      | 0.629 | 0.471 | 0.599 | 5.560  | 4.891  | 4.475  | 4.820  | 46.135   | 28.594   | 21.316   | 27.140   |
| Psmb5      | 0.629 | 0.515 | 0.579 | 8.701  | 8.032  | 7.744  | 7.912  | 414.815  | 260.010  | 214.188  | 238.876  |
| Ppif       | 0.627 | 0.473 | 0.548 | 6.287  | 5.613  | 5.208  | 5.420  | 77.018   | 47.811   | 36.085   | 41.645   |
| Lap3       | 0.627 | 0.406 | 0.485 | 8.222  | 7.548  | 6.920  | 7.179  | 297.272  | 185.583  | 120.503  | 143.329  |
| Ahcy       | 0.626 | 0.439 | 0.557 | 6.648  | 5.973  | 5.461  | 5.804  | 99.222   | 61.655   | 43.212   | 54.674   |
| Smarcd3    | 0.626 | 0.559 | 0.510 | 5.324  | 4.648  | 4.485  | 4.353  | 39.036   | 24.007   | 21.462   | 19.356   |
| H2afz      | 0.625 | 0.411 | 0.533 | 10.534 | 9.855  | 9.251  | 9.626  | 1480.770 | 922.698  | 610.214  | 786.346  |
| Mars       | 0.624 | 0.620 | 0.662 | 6.856  | 6.176  | 6.168  | 6.262  | 114.770  | 71.089   | 71.143   | 75.447   |
| Tmem160    | 0.623 | 0.441 | 0.461 | 6.419  | 5.738  | 5.239  | 5.302  | 84.532   | 52.223   | 36.904   | 38.309   |
| Ube2m      | 0.623 | 0.372 | 0.494 | 7.757  | 7.075  | 6.329  | 6.740  | 215.187  | 133.472  | 79.693   | 105.474  |
| Mrto4      | 0.623 | 0.496 | 0.560 | 7.220  | 6.538  | 6.207  | 6.383  | 147.982  | 91.659   | 73.150   | 82.126   |
| Gadd45gip1 | 0.622 | 0.465 | 0.509 | 4.963  | 4.279  | 3.857  | 3.987  | 30.154   | 18.361   | 13.542   | 14.802   |
| Fiz1       | 0.621 | 0.412 | 0.532 | 5.983  | 5.296  | 4.703  | 5.073  | 62.194   | 38.192   | 25.131   | 32.538   |
| Samm50     | 0.621 | 0.481 | 0.568 | 8.275  | 7.588  | 7.219  | 7.460  | 308.476  | 190.947  | 148.481  | 174.397  |
| Mpnd       | 0.621 | 0.594 | 0.651 | 5.899  | 5.211  | 5.147  | 5.278  | 58.619   | 35.938   | 34.549   | 37.672   |
| Tfeb       | 0.621 | 0.407 | 0.558 | 5.441  | 4.753  | 4.145  | 4.598  | 42.392   | 25.888   | 16.751   | 23.126   |
| Cops6      | 0.620 | 0.433 | 0.464 | 8.454  | 7.765  | 7.245  | 7.345  | 349.283  | 215.892  | 151.182  | 160.969  |
| Rpl7a      | 0.620 | 0.475 | 0.573 | 11.805 | 11.116 | 10.731 | 11.001 | 3574.160 | 2211.820 | 1704.995 | 2040.590 |
| Pgls       | 0.620 | 0.630 | 0.557 | 6.911  | 6.221  | 6.244  | 6.066  | 119.257  | 73.375   | 75.052   | 65.773   |
| Acat2      | 0.619 | 0.490 | 0.499 | 6.495  | 5.803  | 5.464  | 5.492  | 89.092   | 54.678   | 43.304   | 43.827   |
| Gpa33      | 0.619 | 0.521 | 0.521 | 5.533  | 4.841  | 4.592  | 4.594  | 45.275   | 27.586   | 23.208   | 23.063   |
| Dkc1       | 0.617 | 0.487 | 0.551 | 7.685  | 6.989  | 6.647  | 6.826  | 204.649  | 125.719  | 99.551   | 112.001  |
| Rpl18a     | 0.617 | 0.500 | 0.551 | 10.421 | 9.724  | 9.422  | 9.561  | 1368.930 | 842.674  | 687.363  | 751.442  |
| Prmt6      | 0.616 | 0.486 | 0.618 | 4.018  | 3.319  | 2.979  | 3.325  | 15.193   | 8.957    | 6.908    | 8.985    |
| Uxt        | 0.615 | 0.605 | 0.641 | 5.023  | 4.322  | 4.297  | 4.380  | 31.478   | 18.953   | 18.721   | 19.752   |
| Hist2h2bb  | 0.615 | 0.448 | 0.596 | 6.497  | 5.796  | 5.338  | 5.752  | 89.271   | 54.433   | 39.588   | 52.696   |
| Tubb3      | 0.615 | 0.551 | 0.545 | 4.096  | 3.395  | 3.236  | 3.221  | 16.092   | 9.492    | 8.454    | 8.290    |
| Dph3       | 0.615 | 0.508 | 0.590 | 4.381  | 3.679  | 3.404  | 3.620  | 19.810   | 11.776   | 9.618    | 11.252   |
| Tmem11     | 0.615 | 0.486 | 0.592 | 6.207  | 5.506  | 5.166  | 5.452  | 72.828   | 44.316   | 35.028   | 42.614   |
| Agpat2     | 0.615 | 0.598 | 0.614 | 5.044  | 4.342  | 4.302  | 4.340  | 31.968   | 19.230   | 18.792   | 19.177   |
| Nudt8      | 0.613 | 0.500 | 0.510 | 4.708  | 4.003  | 3.707  | 3.737  | 25.122   | 14.990   | 12.107   | 12.288   |

|               |       |       |       |       |       |       |       |         |         |         |         |
|---------------|-------|-------|-------|-------|-------|-------|-------|---------|---------|---------|---------|
| Cyc1          | 0.609 | 0.505 | 0.583 | 8.375 | 7.660 | 7.390 | 7.596 | 330.646 | 200.667 | 167.307 | 191.766 |
| Tars          | 0.605 | 0.550 | 0.600 | 6.918 | 6.194 | 6.056 | 6.181 | 119.827 | 71.997  | 65.752  | 71.302  |
| 2810428115Rik | 0.605 | 0.517 | 0.612 | 6.856 | 6.132 | 5.903 | 6.148 | 114.765 | 68.934  | 59.058  | 69.634  |
| Snx17         | 0.605 | 0.532 | 0.562 | 6.014 | 5.289 | 5.103 | 5.183 | 63.560  | 37.983  | 33.490  | 35.187  |
| Phb2          | 0.605 | 0.431 | 0.493 | 9.153 | 8.428 | 7.937 | 8.133 | 567.823 | 342.390 | 244.942 | 278.677 |
| Tmem234       | 0.605 | 0.512 | 0.568 | 6.959 | 6.233 | 5.993 | 6.143 | 123.278 | 74.012  | 62.902  | 69.396  |
| Plp2          | 0.604 | 0.521 | 0.533 | 6.923 | 6.197 | 5.982 | 6.015 | 120.247 | 72.162  | 62.434  | 63.445  |
| Mvk           | 0.604 | 0.489 | 0.509 | 5.320 | 4.592 | 4.287 | 4.347 | 38.918  | 23.059  | 18.585  | 19.270  |
| Tuba1b        | 0.604 | 0.400 | 0.473 | 9.581 | 8.853 | 8.258 | 8.502 | 764.021 | 460.191 | 306.256 | 360.066 |
| Nsun5         | 0.604 | 0.413 | 0.510 | 4.418 | 3.689 | 3.140 | 3.445 | 20.356  | 11.867  | 7.847   | 9.849   |
| Slc25a1       | 0.602 | 0.442 | 0.517 | 6.398 | 5.666 | 5.218 | 5.447 | 83.234  | 49.623  | 36.361  | 42.452  |
| Mepce         | 0.601 | 0.476 | 0.571 | 4.798 | 4.064 | 3.728 | 3.989 | 26.798  | 15.681  | 12.299  | 14.821  |
| Fdft1         | 0.600 | 0.541 | 0.524 | 5.838 | 5.101 | 4.951 | 4.904 | 56.142  | 33.236  | 30.043  | 28.834  |
| Abhd17a       | 0.598 | 0.493 | 0.566 | 6.501 | 5.759 | 5.479 | 5.679 | 89.484  | 53.008  | 43.759  | 50.051  |
| Tomm40        | 0.597 | 0.403 | 0.508 | 7.951 | 7.207 | 6.638 | 6.973 | 246.229 | 146.365 | 98.968  | 124.119 |
| Tpm3          | 0.597 | 0.439 | 0.577 | 8.633 | 7.888 | 7.446 | 7.838 | 395.607 | 235.285 | 173.955 | 226.975 |
| Hax1          | 0.597 | 0.515 | 0.556 | 7.349 | 6.604 | 6.392 | 6.503 | 161.927 | 96.033  | 83.267  | 89.383  |
| Arhgdia       | 0.596 | 0.477 | 0.561 | 7.777 | 7.031 | 6.709 | 6.944 | 218.143 | 129.434 | 103.982 | 121.616 |
| Thap11        | 0.594 | 0.469 | 0.584 | 5.350 | 4.600 | 4.257 | 4.575 | 39.762  | 23.188  | 18.193  | 22.746  |
| Timm13        | 0.594 | 0.427 | 0.481 | 6.782 | 6.030 | 5.556 | 5.727 | 108.945 | 64.182  | 46.200  | 51.774  |
| Naa10         | 0.592 | 0.340 | 0.451 | 7.361 | 6.604 | 5.804 | 6.211 | 163.239 | 96.029  | 55.079  | 72.798  |
| Pycr2         | 0.592 | 0.408 | 0.575 | 6.884 | 6.126 | 5.590 | 6.085 | 116.997 | 68.672  | 47.334  | 66.638  |
| Rsph1         | 0.591 | 0.387 | 0.466 | 4.401 | 3.643 | 3.031 | 3.299 | 20.106  | 11.460  | 7.201   | 8.804   |
| Mybl2         | 0.589 | 0.420 | 0.495 | 9.296 | 8.534 | 8.043 | 8.283 | 627.187 | 368.617 | 263.740 | 309.243 |
| Ccdc22        | 0.587 | 0.526 | 0.611 | 4.432 | 3.664 | 3.505 | 3.721 | 20.567  | 11.641  | 10.388  | 12.140  |
| Nelfe         | 0.587 | 0.402 | 0.530 | 6.550 | 5.781 | 5.235 | 5.633 | 92.606  | 53.855  | 36.804  | 48.440  |
| Tsta3         | 0.586 | 0.417 | 0.513 | 6.041 | 5.271 | 4.778 | 5.079 | 64.805  | 37.503  | 26.536  | 32.667  |
| Ak2           | 0.586 | 0.553 | 0.625 | 7.831 | 7.060 | 6.977 | 7.152 | 226.431 | 132.068 | 125.387 | 140.717 |
| Cenpb         | 0.586 | 0.421 | 0.459 | 6.127 | 5.355 | 4.879 | 5.004 | 68.815  | 39.811  | 28.521  | 30.979  |
| Tuba1a        | 0.585 | 0.429 | 0.449 | 6.876 | 6.103 | 5.654 | 5.720 | 116.301 | 67.535  | 49.540  | 51.495  |
| Fam213b       | 0.584 | 0.546 | 0.510 | 5.488 | 4.713 | 4.613 | 4.518 | 43.838  | 25.150  | 23.560  | 21.821  |
| Inhbb         | 0.584 | 0.498 | 0.500 | 6.290 | 5.514 | 5.283 | 5.290 | 77.168  | 44.568  | 38.075  | 37.976  |
| Map2k2        | 0.583 | 0.416 | 0.526 | 6.484 | 5.707 | 5.217 | 5.557 | 88.452  | 51.094  | 36.335  | 45.902  |
| Fkbp4         | 0.583 | 0.375 | 0.437 | 9.390 | 8.611 | 7.976 | 8.196 | 669.276 | 389.026 | 251.562 | 291.218 |
| Cisd3         | 0.582 | 0.417 | 0.450 | 7.779 | 6.999 | 6.519 | 6.629 | 218.458 | 126.607 | 91.025  | 97.591  |
| Mrpl12        | 0.582 | 0.344 | 0.469 | 8.081 | 7.300 | 6.542 | 6.988 | 269.539 | 156.166 | 92.484  | 125.425 |
| Hist1h4i      | 0.582 | 0.530 | 0.511 | 5.130 | 4.349 | 4.215 | 4.162 | 34.011  | 19.327  | 17.634  | 16.832  |
| Galk1         | 0.581 | 0.495 | 0.548 | 7.490 | 6.707 | 6.475 | 6.621 | 178.600 | 103.226 | 88.275  | 97.082  |
| Epb4.1l4a     | 0.580 | 0.418 | 0.505 | 5.716 | 4.930 | 4.459 | 4.729 | 51.527  | 29.396  | 21.074  | 25.429  |
| Eif6          | 0.579 | 0.357 | 0.453 | 8.329 | 7.541 | 6.841 | 7.185 | 320.224 | 184.761 | 114.038 | 143.972 |
| Gdf3          | 0.577 | 0.435 | 0.607 | 5.529 | 4.736 | 4.328 | 4.809 | 45.132  | 25.586  | 19.159  | 26.937  |
| Mvb12a        | 0.577 | 0.372 | 0.475 | 6.157 | 5.363 | 4.731 | 5.083 | 70.277  | 40.034  | 25.659  | 32.764  |
| Alkbh7        | 0.576 | 0.552 | 0.478 | 5.439 | 4.643 | 4.583 | 4.374 | 42.367  | 23.918  | 23.049  | 19.660  |
| Hist1h4k      | 0.575 | 0.397 | 0.543 | 5.840 | 5.042 | 4.507 | 4.958 | 56.222  | 31.860  | 21.822  | 29.974  |
| Ufc1          | 0.575 | 0.507 | 0.542 | 7.206 | 6.406 | 6.227 | 6.321 | 146.517 | 83.591  | 74.143  | 78.674  |
| Qdpr          | 0.570 | 0.529 | 0.539 | 7.046 | 6.236 | 6.126 | 6.155 | 130.997 | 74.174  | 69.100  | 69.981  |
| Mical1        | 0.565 | 0.529 | 0.644 | 4.262 | 3.439 | 3.342 | 3.628 | 18.175  | 9.814   | 9.177   | 11.320  |
| Ctu2          | 0.565 | 0.455 | 0.558 | 4.445 | 3.621 | 3.308 | 3.604 | 20.768  | 11.268  | 8.937   | 11.113  |
| Exosc5        | 0.562 | 0.464 | 0.555 | 7.768 | 6.936 | 6.659 | 6.919 | 216.727 | 121.097 | 100.373 | 119.565 |
| Lgals3        | 0.558 | 0.336 | 0.476 | 6.016 | 5.175 | 4.442 | 4.945 | 63.647  | 35.029  | 20.815  | 29.692  |
| Eif4e2        | 0.558 | 0.376 | 0.470 | 8.059 | 7.218 | 6.649 | 6.971 | 265.480 | 147.491 | 99.685  | 123.949 |
| Psat1         | 0.558 | 0.562 | 0.547 | 7.511 | 6.669 | 6.679 | 6.641 | 181.252 | 100.509 | 101.852 | 98.438  |
| Hist1h4h      | 0.557 | 0.390 | 0.508 | 4.587 | 3.743 | 3.228 | 3.609 | 23.006  | 12.354  | 8.405   | 11.155  |
| Sars          | 0.550 | 0.485 | 0.526 | 6.941 | 6.078 | 5.899 | 6.015 | 121.788 | 66.355  | 58.860  | 63.422  |
| Use1          | 0.549 | 0.372 | 0.468 | 6.902 | 6.036 | 5.476 | 5.806 | 118.538 | 64.460  | 43.680  | 54.724  |
| Rpp25         | 0.547 | 0.406 | 0.433 | 7.000 | 6.129 | 5.699 | 5.791 | 126.907 | 68.787  | 51.115  | 54.189  |
| Tmem238       | 0.544 | 0.442 | 0.562 | 4.048 | 3.169 | 2.869 | 3.217 | 15.526  | 7.971   | 6.328   | 8.267   |
| Mvd           | 0.544 | 0.456 | 0.469 | 5.674 | 4.795 | 4.542 | 4.581 | 50.005  | 26.680  | 22.379  | 22.840  |
| Cnpy2         | 0.540 | 0.483 | 0.570 | 7.106 | 6.217 | 6.055 | 6.293 | 136.604 | 73.191  | 65.695  | 77.162  |
| Ptpmt1        | 0.530 | 0.585 | 0.565 | 4.814 | 3.898 | 4.040 | 3.991 | 27.106  | 13.865  | 15.501  | 14.843  |
| Yars          | 0.524 | 0.593 | 0.629 | 6.896 | 5.963 | 6.142 | 6.227 | 118.022 | 61.224  | 69.865  | 73.665  |
| Rdm1          | 0.521 | 0.381 | 0.464 | 6.767 | 5.826 | 5.375 | 5.660 | 107.839 | 55.570  | 40.635  | 49.371  |
| Ldlr          | 0.516 | 0.527 | 0.556 | 5.542 | 4.587 | 4.619 | 4.696 | 45.549  | 22.962  | 23.649  | 24.814  |
| Gcat          | 0.508 | 0.410 | 0.474 | 5.811 | 4.835 | 4.525 | 4.733 | 55.091  | 27.459  | 22.103  | 25.491  |
| March9        | 0.501 | 0.463 | 0.562 | 4.201 | 3.203 | 3.092 | 3.370 | 17.388  | 8.186   | 7.555   | 9.304   |
| Pgp           | 0.498 | 0.313 | 0.416 | 6.355 | 5.349 | 4.680 | 5.090 | 80.811  | 39.647  | 24.728  | 32.938  |
| Mrps34        | 0.493 | 0.308 | 0.465 | 6.659 | 5.639 | 4.961 | 5.555 | 99.932  | 48.716  | 30.266  | 45.821  |
| Nsdhl         | 0.491 | 0.531 | 0.522 | 5.027 | 4.000 | 4.115 | 4.089 | 31.581  | 14.962  | 16.381  | 15.955  |
| Fdps          | 0.453 | 0.421 | 0.416 | 8.185 | 7.044 | 6.937 | 6.921 | 289.726 | 130.611 | 121.929 | 119.673 |
| Usf2          | 0.396 | 0.533 | 0.621 | 4.931 | 3.594 | 4.024 | 4.244 | 29.478  | 11.045  | 15.323  | 17.887  |
| Vax2          | 0.343 | 0.272 | 0.323 | 5.501 | 3.959 | 3.626 | 3.871 | 44.264  | 14.512  | 11.388  | 13.581  |