

Table S1 - The 158 early stage biomarkers

| Order | Name | mRMR Score |
|-------|--------------|------------|
| 1 | CASP1 | 0.107 |
| 2 | ZNF552 | 0.086 |
| 3 | WDYHV1 | 0.082 |
| 4 | MAVS | 0.082 |
| 5 | MBNL2 | 0.074 |
| 6 | CHRNA3 | 0.069 |
| 7 | PACS2 | 0.069 |
| 8 | SLC11A1 | 0.065 |
| 9 | SOX11 | 0.064 |
| 10 | ZC3H12A | 0.063 |
| 11 | LGALS8 | 0.06 |
| 12 | SYK | 0.06 |
| 13 | TTC7B | 0.059 |
| 14 | CHST2 | 0.057 |
| 15 | FAM12B | 0.055 |
| 16 | MBTD1 | 0.056 |
| 17 | MMP8 | 0.052 |
| 18 | PRKCDBP | 0.052 |
| 19 | NTRK1 | 0.051 |
| 20 | CDKN2A | 0.05 |
| 21 | PQBP1 | 0.049 |
| 22 | SERPINB2 | 0.049 |
| 23 | C18orf1 | 0.049 |
| 24 | SLC17A7 | 0.047 |
| 25 | LRP4 | 0.046 |
| 26 | METTL8 | 0.045 |
| 27 | RB1CC1 | 0.045 |
| 28 | TET3 | 0.045 |
| 29 | SALL2 | 0.045 |
| 30 | DDX47 | 0.044 |
| 31 | SLC22A5 | 0.044 |
| 32 | FAM20B | 0.045 |
| 33 | CDON | 0.044 |
| 34 | SRBD1 | 0.045 |
| 35 | CCL20 | 0.045 |
| 36 | NKAIN2 | 0.043 |
| 37 | LOC100130175 | 0.043 |
| 38 | SAV1 | 0.043 |
| 39 | ANKS4B | 0.043 |

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| 40 | SART3 | 0.043 |
| 41 | TSPYL4 | 0.042 |
| 42 | C4orf29 | 0.043 |
| 43 | PSMB9 | 0.043 |
| 44 | CCDC83 | 0.042 |
| 45 | CPA2 | 0.042 |
| 46 | TMPRSS6 | 0.042 |
| 47 | GPR177 | 0.042 |
| 48 | UBE2CBP | 0.041 |
| 49 | SNAPC3 | 0.041 |
| 50 | BAX | 0.041 |
| 51 | FCRL5 | 0.041 |
| 52 | BEND6 | 0.04 |
| 53 | PRF1 | 0.04 |
| 54 | LEPRE1 | 0.041 |
| 55 | SLC22A18 | 0.041 |
| 56 | KRCC1 | 0.04 |
| 57 | CCL7 | 0.04 |
| 58 | GADD45GIP1 | 0.04 |
| 59 | DIRAS3 | 0.04 |
| 60 | TTC17 | 0.039 |
| 61 | KDM4B | 0.039 |
| 62 | SCEL | 0.038 |
| 63 | LGI1 | 0.038 |
| 64 | C4orf31 | 0.037 |
| 65 | EBI3 | 0.037 |
| 66 | TXNRD3 | 0.037 |
| 67 | GAS1 | 0.037 |
| 68 | GRIN3A | 0.037 |
| 69 | RFXAP | 0.036 |
| 70 | AKR1C3 | 0.036 |
| 71 | RNF43 | 0.037 |
| 72 | MRPL51 | 0.036 |
| 73 | HIATL1 | 0.036 |
| 74 | PIGR | 0.036 |
| 75 | DIS3L2 | 0.036 |
| 76 | ZPBP | 0.036 |
| 77 | LOC90925 | 0.035 |
| 78 | RPS2 | 0.036 |
| 79 | LOC100129502 | 0.035 |
| 80 | IL26 | 0.035 |

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|-----|----------|-------|
| 81 | UAP1L1 | 0.034 |
| 82 | HSPB1 | 0.035 |
| 83 | IGKC | 0.035 |
| 84 | SAMD11 | 0.034 |
| 85 | VIP | 0.034 |
| 86 | KIAA0562 | 0.034 |
| 87 | MAGT1 | 0.034 |
| 88 | UBXN7 | 0.033 |
| 89 | PTGER1 | 0.033 |
| 90 | CRB3 | 0.033 |
| 91 | ATL3 | 0.033 |
| 92 | IGLV4-60 | 0.033 |
| 93 | OLIG1 | 0.033 |
| 94 | C6orf211 | 0.033 |
| 95 | COL8A1 | 0.033 |
| 96 | MEG3 | 0.033 |
| 97 | ANGPTL4 | 0.033 |
| 98 | IGHD | 0.032 |
| 99 | ADAMTS16 | 0.032 |
| 100 | OCA2 | 0.032 |
| 101 | FASTKD1 | 0.032 |
| 102 | CXCL14 | 0.032 |
| 103 | SPATS2 | 0.032 |
| 104 | TRAV8-3 | 0.032 |
| 105 | BTBD3 | 0.032 |
| 106 | JHDM1D | 0.032 |
| 107 | RABGEF1 | 0.032 |
| 108 | PARVA | 0.032 |
| 109 | CCDC102B | 0.032 |
| 110 | IGJ | 0.032 |
| 111 | DYDC1 | 0.032 |
| 112 | SLC2A3 | 0.032 |
| 113 | GLTPD1 | 0.032 |
| 114 | OXA1L | 0.031 |
| 115 | PRKAA2 | 0.031 |
| 116 | C19orf61 | 0.031 |
| 117 | TATDN2 | 0.031 |
| 118 | KATNAL1 | 0.031 |
| 119 | ZNF91 | 0.031 |
| 120 | FAM53B | 0.031 |
| 121 | CYP4F2 | 0.031 |

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| 122 | ATP2B4 | 0.031 |
| 123 | C6orf154 | 0.031 |
| 124 | CD79A | 0.031 |
| 125 | EEF1DP3 | 0.031 |
| 126 | COL4A5 | 0.03 |
| 127 | PARG | 0.03 |
| 128 | RNF4 | 0.03 |
| 129 | NS3BP | 0.03 |
| 130 | PLEKHB1 | 0.03 |
| 131 | MAP7D1 | 0.03 |
| 132 | COBLL1 | 0.03 |
| 133 | GPR85 | 0.029 |
| 134 | HLA-DQB2 | 0.029 |
| 135 | PITX1 | 0.029 |
| 136 | ALKBH6 | 0.029 |
| 137 | C2orf61 | 0.029 |
| 138 | SATB2 | 0.029 |
| 139 | GMCL1 | 0.029 |
| 140 | APOBEC1 | 0.029 |
| 141 | NOP10 | 0.028 |
| 142 | PLXNB3 | 0.028 |
| 143 | PTGER3 | 0.028 |
| 144 | WBSCR27 | 0.028 |
| 145 | LOC339290 | 0.028 |
| 146 | ZNF551 | 0.028 |
| 147 | EEF1B2 | 0.028 |
| 148 | LPXN | 0.028 |
| 149 | UBQLN2 | 0.028 |
| 150 | ACSF2 | 0.028 |
| 151 | CEACAM1 | 0.028 |
| 152 | NFIB | 0.028 |
| 153 | PIKFYVE | 0.028 |
| 154 | SPATA12 | 0.028 |
| 155 | DYNLRB2 | 0.028 |
| 156 | PGRMC1 | 0.028 |
| 157 | C3orf58 | 0.028 |
| 158 | ZNF485 | 0.028 |

Table S2 - The 284 late stage biomarkers

| Order | Name | mRMR Score |
|-------|-------------|------------|
| 1 | GFPT1 | 0.116 |
| 2 | LOC402778 | 0.082 |
| 3 | ANP32E | 0.077 |
| 4 | IKBKE | 0.058 |
| 5 | LOC400654 | 0.062 |
| 6 | FCGR3B | 0.06 |
| 7 | FLJ14107 | 0.056 |
| 8 | HOMEZ | 0.056 |
| 9 | FZD8 | 0.057 |
| 10 | KCNQ2 | 0.05 |
| 11 | PIK3AP1 | 0.048 |
| 12 | TMCC3 | 0.046 |
| 13 | STAG3 | 0.047 |
| 14 | CRLS1 | 0.047 |
| 15 | LYRM5 | 0.047 |
| 16 | C14orf159 | 0.047 |
| 17 | hCG_1820661 | 0.047 |
| 18 | SNAPIN | 0.046 |
| 19 | CCDC68 | 0.047 |
| 20 | SSR1 | 0.044 |
| 21 | ALPK3 | 0.044 |
| 22 | TMEM99 | 0.045 |
| 23 | LRCH3 | 0.044 |
| 24 | ZNF827 | 0.041 |
| 25 | C9orf152 | 0.041 |
| 26 | FBR3 | 0.04 |
| 27 | ASF1A | 0.04 |
| 28 | VNN2 | 0.042 |
| 29 | AQP10 | 0.04 |
| 30 | GDPD3 | 0.041 |
| 31 | MPPED1 | 0.039 |
| 32 | MTERFD2 | 0.037 |
| 33 | SAA3P | 0.037 |
| 34 | SOCS7 | 0.038 |
| 35 | SMAD7 | 0.037 |
| 36 | UQCC | 0.037 |
| 37 | ZZZ3 | 0.036 |
| 38 | TAP2 | 0.036 |
| 39 | LMTK3 | 0.035 |

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| 40 | ANKRD29 | 0.035 |
| 41 | PPP1R3A | 0.035 |
| 42 | COPA | 0.035 |
| 43 | MTMR12 | 0.035 |
| 44 | MID1 | 0.035 |
| 45 | MARCKS | 0.035 |
| 46 | CABP5 | 0.034 |
| 47 | CD55 | 0.034 |
| 48 | ABHD15 | 0.034 |
| 49 | KIAA0182 | 0.034 |
| 50 | SPINK5 | 0.033 |
| 51 | ITGA6 | 0.033 |
| 52 | EPPK1 | 0.033 |
| 53 | KIF1A | 0.032 |
| 54 | ZFHX3 | 0.033 |
| 55 | PQLC1 | 0.032 |
| 56 | CTSA | 0.033 |
| 57 | RNF138 | 0.032 |
| 58 | GSDMD | 0.031 |
| 59 | FPR1 | 0.031 |
| 60 | ATP6V1E2 | 0.031 |
| 61 | CAMK2B | 0.031 |
| 62 | ZMYM4 | 0.031 |
| 63 | GPR19 | 0.031 |
| 64 | ZNF818P | 0.031 |
| 65 | TBCKL | 0.03 |
| 66 | TM2D2 | 0.03 |
| 67 | SHANK2 | 0.03 |
| 68 | RUNDC3A | 0.03 |
| 69 | CLEC2D | 0.03 |
| 70 | C1orf14 | 0.03 |
| 71 | AMMECR1L | 0.03 |
| 72 | DEFA5 | 0.03 |
| 73 | C17orf76 | 0.029 |
| 74 | TMC2 | 0.029 |
| 75 | SERPINB4 | 0.029 |
| 76 | KLRD1 | 0.029 |
| 77 | SLC38A9 | 0.029 |
| 78 | SOS2 | 0.029 |
| 79 | CXXC4 | 0.029 |
| 80 | ADAM9 | 0.029 |

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| 81 | ARHGEF19 | 0.029 |
| 82 | AVPI1 | 0.029 |
| 83 | NSUN7 | 0.029 |
| 84 | MBNL3 | 0.029 |
| 85 | APBB1IP | 0.028 |
| 86 | MMGT1 | 0.028 |
| 87 | HAVCR1 | 0.028 |
| 88 | VPS4B | 0.028 |
| 89 | C8orf48 | 0.028 |
| 90 | SLC16A6 | 0.028 |
| 91 | TOX2 | 0.028 |
| 92 | CYP2J2 | 0.028 |
| 93 | ABCB1 | 0.028 |
| 94 | DYNC1I2 | 0.028 |
| 95 | SYTL3 | 0.027 |
| 96 | CGGBP1 | 0.027 |
| 97 | ORC3L | 0.027 |
| 98 | HMOX1 | 0.027 |
| 99 | TFCP2 | 0.026 |
| 100 | C20orf62 | 0.027 |
| 101 | LOC730184 | 0.027 |
| 102 | C9orf4 | 0.027 |
| 103 | A1CF | 0.027 |
| 104 | IRF1 | 0.027 |
| 105 | ARHGEF1 | 0.026 |
| 106 | C20orf7 | 0.026 |
| 107 | TREML1 | 0.026 |
| 108 | TNFRSF18 | 0.026 |
| 109 | MTMR3 | 0.026 |
| 110 | FAIM3 | 0.026 |
| 111 | NEB | 0.026 |
| 112 | TNFRSF1B | 0.026 |
| 113 | RNFT1 | 0.026 |
| 114 | SUV420H1 | 0.026 |
| 115 | AARSD1 | 0.026 |
| 116 | RXRB | 0.026 |
| 117 | ASB6 | 0.025 |
| 118 | PRO2012 | 0.025 |
| 119 | SCML1 | 0.026 |
| 120 | PREPL | 0.026 |
| 121 | RPRM | 0.025 |

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| 122 | LOC100130460 | 0.025 |
| 123 | PKP2 | 0.025 |
| 124 | EDN3 | 0.025 |
| 125 | ASS1 | 0.025 |
| 126 | ITGAD | 0.025 |
| 127 | C6orf217 | 0.025 |
| 128 | GFER | 0.025 |
| 129 | SLC39A14 | 0.025 |
| 130 | TLL7 | 0.024 |
| 131 | UPP1 | 0.025 |
| 132 | LYSMD2 | 0.024 |
| 133 | CD177 | 0.024 |
| 134 | TUBGCP4 | 0.024 |
| 135 | RNF215 | 0.024 |
| 136 | ACCN2 | 0.024 |
| 137 | GRSF1 | 0.024 |
| 138 | SLA | 0.024 |
| 139 | SOX8 | 0.024 |
| 140 | CCDC127 | 0.024 |
| 141 | ZCCHC2 | 0.024 |
| 142 | KANK4 | 0.023 |
| 143 | THADA | 0.024 |
| 144 | FREM1 | 0.024 |
| 145 | C18orf10 | 0.023 |
| 146 | ETV6 | 0.023 |
| 147 | MYCN | 0.023 |
| 148 | PITPNA | 0.023 |
| 149 | RASGEF1B | 0.023 |
| 150 | SLCO1A2 | 0.023 |
| 151 | TAX1BP3 | 0.023 |
| 152 | CPA6 | 0.023 |
| 153 | FAM181A | 0.023 |
| 154 | C8G | 0.022 |
| 155 | LOC100130522 | 0.022 |
| 156 | PLUNC | 0.022 |
| 157 | RBM39 | 0.022 |
| 158 | ZAP70 | 0.022 |
| 159 | LOC339539 | 0.022 |
| 160 | NAMPT | 0.022 |
| 161 | NGB | 0.022 |
| 162 | ATP6V1E1 | 0.022 |

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| 163 | LOC729991 | 0.022 |
| 164 | RNF4 | 0.022 |
| 165 | PPAPDC1B | 0.022 |
| 166 | LOC388210 | 0.022 |
| 167 | CCL18 | 0.022 |
| 168 | HRAS | 0.022 |
| 169 | MORC4 | 0.021 |
| 170 | C9orf169 | 0.021 |
| 171 | AADA2L2 | 0.021 |
| 172 | SCFD2 | 0.021 |
| 173 | LOC283731 | 0.021 |
| 174 | C14orf53 | 0.021 |
| 175 | PKIB | 0.021 |
| 176 | THEMIS | 0.021 |
| 177 | SLC25A11 | 0.021 |
| 178 | LTF | 0.021 |
| 179 | LOC153577 | 0.021 |
| 180 | ATAD1 | 0.021 |
| 181 | F2 | 0.021 |
| 182 | HCN1 | 0.021 |
| 183 | ST3GAL1 | 0.021 |
| 184 | KIAA0947 | 0.021 |
| 185 | LOC84740 | 0.021 |
| 186 | BRAF | 0.021 |
| 187 | ENPP3 | 0.02 |
| 188 | LOC100130275 | 0.02 |
| 189 | ESRRG | 0.02 |
| 190 | SLC4A9 | 0.02 |
| 191 | RASGRP2 | 0.02 |
| 192 | NAT15 | 0.02 |
| 193 | DNAJB8 | 0.02 |
| 194 | LOC441242 | 0.02 |
| 195 | PSMB3 | 0.02 |
| 196 | SLC39A2 | 0.02 |
| 197 | TRIM47 | 0.02 |
| 198 | CRYZ | 0.02 |
| 199 | C15orf33 | 0.02 |
| 200 | C2orf64 | 0.02 |
| 201 | CD2 | 0.02 |
| 202 | CEP57 | 0.02 |
| 203 | POLR2C | 0.02 |

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| 204 | MCM3APAS | 0.02 |
| 205 | MYEF2 | 0.02 |
| 206 | TTC15 | 0.02 |
| 207 | B3GNT7 | 0.02 |
| 208 | LOC100130744 | 0.02 |
| 209 | DACH2 | 0.02 |
| 210 | SLC22A15 | 0.02 |
| 211 | GALNT1 | 0.019 |
| 212 | SEMA6C | 0.02 |
| 213 | BEX1 | 0.019 |
| 214 | MTMR8 | 0.019 |
| 215 | RBM41 | 0.019 |
| 216 | GDNF | 0.019 |
| 217 | C1orf103 | 0.019 |
| 218 | C1orf161 | 0.019 |
| 219 | MMD | 0.019 |
| 220 | PURB | 0.019 |
| 221 | SEMA4B | 0.019 |
| 222 | ANKRD28 | 0.019 |
| 223 | MYCL1 | 0.019 |
| 224 | HLA-DRA | 0.019 |
| 225 | CCDC136 | 0.019 |
| 226 | ZNF10 | 0.019 |
| 227 | HPS5 | 0.019 |
| 228 | ESX1 | 0.019 |
| 229 | C7orf13 | 0.019 |
| 230 | NECAB1 | 0.019 |
| 231 | SEC31B | 0.019 |
| 232 | SP5 | 0.019 |
| 233 | ZC3H15 | 0.019 |
| 234 | CCDC153 | 0.019 |
| 235 | LOC401913 | 0.019 |
| 236 | SLC25A3 | 0.019 |
| 237 | LPHN2 | 0.018 |
| 238 | LMBR1L | 0.018 |
| 239 | C19orf45 | 0.018 |
| 240 | HAS2 | 0.018 |
| 241 | OGDHL | 0.018 |
| 242 | ZSWIM1 | 0.019 |
| 243 | ZFP14 | 0.019 |
| 244 | LOC284801 | 0.018 |

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| 245 | AMELY | 0.018 |
| 246 | SERPINA4 | 0.018 |
| 247 | MED23 | 0.018 |
| 248 | CXCL13 | 0.018 |
| 249 | SFRS15 | 0.018 |
| 250 | GATA3 | 0.018 |
| 251 | MTERFD3 | 0.018 |
| 252 | LOC283177 | 0.018 |
| 253 | CAV3 | 0.018 |
| 254 | GNA11 | 0.018 |
| 255 | LOC338758 | 0.018 |
| 256 | OCEL1 | 0.018 |
| 257 | YLPM1 | 0.018 |
| 258 | NCOA7 | 0.018 |
| 259 | CLEC4E | 0.018 |
| 260 | RNF135 | 0.018 |
| 261 | EIF1 | 0.018 |
| 262 | FATE1 | 0.018 |
| 263 | ZFYVE9 | 0.018 |
| 264 | NUPR1 | 0.018 |
| 265 | JAK2 | 0.018 |
| 266 | IDH2 | 0.017 |
| 267 | EGFL7 | 0.017 |
| 268 | CRIM1 | 0.017 |
| 269 | PTCH2 | 0.017 |
| 270 | CASP9 | 0.017 |
| 271 | CPSF7 | 0.017 |
| 272 | NT5E | 0.017 |
| 273 | EGF | 0.017 |
| 274 | DRD1 | 0.017 |
| 275 | DDX3Y | 0.017 |
| 276 | CD69 | 0.017 |
| 277 | GCLC | 0.017 |
| 278 | UGDH | 0.017 |
| 279 | PIK3CG | 0.017 |
| 280 | SLITRK6 | 0.017 |
| 281 | PTPRH | 0.017 |
| 282 | BCL11A | 0.017 |
| 283 | FMN2 | 0.017 |
| 284 | CYTH2 | 0.017 |

Table S3 - The 632 signal propagation paths from early stage biomarkers to late stage biomarkers

| Early stage biomarker | Late stage biomarker | Pearson correlation test p value | Pearson correlation test FDR | Pearson correlation coefficient | Shortest path | Path length (sum of edge weights) | Permutation FDR |
|-----------------------|----------------------|----------------------------------|------------------------------|---------------------------------|--|-----------------------------------|-----------------|
| SLC2A3 | CD69 | 0 | 0 | 0.626900758 | SLC2A3->SP1->EP300->STAT3->IL2->CD69 | 204 | 0 |
| EBI3 | ZAP70 | 1.28E-06 | 6.86E-05 | 0.347236703 | EBI3->IL27RA->STAT1->JAK2->SHC1->ZAP70 | 7 | 0 |
| CD79A | CD2 | 1.74E-09 | 2.91E-07 | 0.424410472 | CD79A->SYK->LCK->CD2 | 6 | 0 |
| CD79A | ZAP70 | 3.46E-10 | 7.52E-08 | 0.440624965 | CD79A->SYK->CBL->ZAP70 | 5 | 0 |
| RNF4 | RNF4 | 0 | 0 | 1 | RNF4->RNF4 | 0 | 0 |
| PRF1 | IRF1 | 6.68E-13 | 3.94E-10 | 0.496402019 | PRF1->CD8A->IL2->STAT1->IRF1 | 9 | 0 |
| PRF1 | CD2 | 1.55E-15 | 2.70E-12 | 0.542713938 | PRF1->CD8A->LCK->CD2 | 8 | 0 |
| PSMB9 | IRF1 | 2.22E-16 | 4.96E-13 | 0.557080516 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->STAT1->IRF1 | 8 | 0 |
| PSMB9 | CD2 | 0 | 0 | 0.570225364 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->GRB2->LCP2->LCK->CD2 | 10 | 0 |
| PSMB9 | ZAP70 | 1.19E-06 | 6.44E-05 | 0.34825263 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->SHC1->ZAP70 | 7 | 0 |
| SYK | SMAD7 | 3.38E-06 | 0.000149401 | 0.334015718 | SYK->CBL->GRB2->ERBB2->CTNNB1->SMAD7 | 7 | 0 |
| RNF43 | BCL11A | 0 | 0 | 0.585197535 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->SP1->ESR1->NCOA2->BCL11A | 176 | 0 |
| CASP1 | IRF1 | 2.22E-16 | 4.96E-13 | 0.554916623 | CASP1->IL18->IFNG->IFNGR1->STAT1->IRF1 | 6 | 0 |
| CASP1 | JAK2 | 7.44E-08 | 6.59E-06 | 0.382973243 | CASP1->IL18->IFNG->IL2->STAT3->JAK2 | 6 | 0 |
| CASP1 | CD2 | 4.44E-15 | 6.04E-12 | 0.534985329 | CASP1->IL18->IFNG->CD4->LCK->CD2 | 7 | 0 |
| CASP1 | ZAP70 | 1.77E-06 | 8.90E-05 | 0.342930182 | CASP1->IL18->IFNG->CD4->ZAP70 | 7 | 0 |
| CASP1 | EGF | 3.63E-06 | 0.000157382 | 0.332993074 | CASP1->IL18->IFNG->IL2->STAT3->EGFR->EGF | 7 | 0 |
| SATB2 | BCL11A | 0 | 0 | 0.609237465 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->EP300->ESR1->NCOA2->BCL11A | 141 | 0 |
| CD79A | CXCL13 | 4.37E-13 | 2.74E-10 | 0.499846556 | CD79A->SYK->LCK->CD4->CXCR4->CXCL13 | 16 | 5.00E-05 |
| PRF1 | TNFRSF1B | 1.12E-13 | 8.37E-11 | 0.510627682 | PRF1->CD8A->LCK->NFKBIA->CHUK->TRAF2->TNFRSF1B | 12 | 5.00E-05 |
| CD79A | CD69 | 1.10E-13 | 8.37E-11 | 0.510820388 | CD79A->SYK->LCK->IL2->CD69 | 23 | 1.00E-04 |
| PRF1 | JAK2 | 5.10E-08 | 4.89E-06 | 0.387412908 | PRF1->CD8A->IL2->STAT3->JAK2 | 8 | 1.00E-04 |
| PRF1 | ZAP70 | 1.83E-06 | 9.14E-05 | 0.342458478 | PRF1->CD8A->LCK->ZAP70 | 8 | 1.00E-04 |
| PSMB9 | TNFRSF1B | 1.61E-06 | 8.20E-05 | 0.344206323 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->RIPK1->TRAF2->TNFRSF1B | 8 | 1.00E-04 |
| EBI3 | TNFRSF1B | 1.52E-06 | 7.89E-05 | 0.344934855 | EBI3->IL27RA->STAT1->EP300->RELA->CHUK->TRAF2->TNFRSF1B | 9 | 0.00015 |
| PRF1 | KLRD1 | 8.00E-13 | 4.47E-10 | 0.494931163 | PRF1->CD8A->LCK->SYK->TYROBP->KLRD1 | 37 | 0.00015 |
| PARVA | MARCKS | 1.50E-08 | 1.77E-06 | 0.401323009 | PARVA->ILK->PXN->GIT1->ARHGEF7->CDC42->PLD1->PRKCA->MARCKS | 10 | 0.00015 |
| PSMB9 | HLA-DRA | 7.76E-13 | 4.41E-10 | 0.495176944 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->TP53->EP300->CREB1->CIITA->HLA-DRA | 26 | 0.00015 |
| EBI3 | CD2 | 1.64E-05 | 0.000531378 | 0.310977657 | EBI3->IL27RA->STAT1->JAK2->PTPN6->LCK->CD2 | 10 | 2.00E-04 |
| PARVA | FZD8 | 9.84E-07 | 5.56E-05 | 0.350758246 | PARVA->ILK->AKT1->GSK3B->LRP6->FZD8 | 10 | 2.00E-04 |
| PSMB9 | ITGA6 | 2.30E-09 | 3.67E-07 | -0.421521154 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->SRC->PTK2->PXN->ITGA4->ITGB1->ITGA6 | 11 | 2.00E-04 |
| CD79A | PIK3CG | 2.33E-08 | 2.53E-06 | 0.396401296 | CD79A->SYK->VAV1->RAC1->AKT1->PIK3CG | 11 | 0.00025 |
| GAS1 | A1CF | 1.96E-13 | 1.36E-10 | -0.506257527 | GAS1->SHH->GLI2->BTRC->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 46 | 0.00025 |
| IGKC | CXCL13 | 4.88E-15 | 6.37E-12 | 0.534296591 | IGKC->ERBB4->EGF->GRB2->LCP2->LCK->CD4->CXCR4->CXCL13 | 43 | 0.00025 |

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| IGKC | CD2 | 5.38E-12 | 2.21E-09 | 0.478890918 | IGKC->ERBB4->EGF->GRB2->LCP2->LCK->CD2 | 33 | 0.00025 |
| IGHD | CD69 | 4.44E-15 | 6.04E-12 | 0.534666347 | IGHD->GHRH->GCG->LEP->STAT3->IL2->CD69 | 58 | 0.00025 |
| IGHD | CXCL13 | 1.75E-14 | 1.79E-11 | 0.524769287 | IGHD->GHRH->GCG->LEP->STAT3->IL2->IFNG->CD4->CXCR4->CXCL13 | 54 | 0.00025 |
| IGHD | CD2 | 4.44E-16 | 8.68E-13 | 0.549783195 | IGHD->GHRH->GCG->LEP->STAT3->IL2->LCK->CD2 | 45 | 0.00025 |
| MAVS | HMOX1 | 6.75E-08 | 6.12E-06 | -0.384127112 | MAVS->IRF3->CREBBP->HIF1A->HMOX1 | 11 | 0.00025 |
| CCL7 | HMOX1 | 1.06E-08 | 1.32E-06 | 0.405126767 | CCL7->CCR5->CD4->IFNG->IFNGR1->STAT1->EP300->HIF1A->HMOX1 | 13 | 0.00035 |
| EBI3 | HMOX1 | 2.55E-05 | 0.000750363 | 0.304270806 | EBI3->IL27RA->STAT1->EP300->HIF1A->HMOX1 | 11 | 0.00035 |
| RABGEF1 | SOS2 | 7.78E-06 | 0.000289707 | 0.322112893 | RABGEF1->RABEP1->RAB5A->EGFR->GRB2->SOS2 | 11 | 0.00035 |
| SERPINB2 | HMOX1 | 5.44E-08 | 5.17E-06 | 0.386653364 | SERPINB2->PLAU->JUN->EP300->HIF1A->HMOX1 | 13 | 0.00035 |
| PRF1 | HMOX1 | 8.10E-08 | 7.01E-06 | 0.381961889 | PRF1->CD8A->IL2->STAT3->EP300->HIF1A->HMOX1 | 14 | 0.00035 |
| PRF1 | CXCL13 | 2.23E-10 | 5.13E-08 | 0.444897138 | PRF1->CD8A->CD4->CXCR4->CXCL13 | 17 | 0.00035 |
| CASP1 | CXCL13 | 5.01E-09 | 7.13E-07 | 0.413284923 | CASP1->IL18->IFNG->CD4->CXCR4->CXCL13 | 15 | 0.00035 |
| CEACAM1 | GNA11 | 6.66E-11 | 1.93E-08 | 0.456335057 | CEACAM1->PTPN11->GRB2->RET->GDNF->EDNRB->GNA11 | 36 | 4.00E-04 |
| GAS1 | LPHN2 | 1.29E-13 | 9.37E-11 | 0.509556943 | GAS1->SHH->BMP4->BMPR1A->SMAD1->SMAD4->TGFB1->FKBP1A->RYR1->HOMER1->SHANK2->LPHN2 | 86 | 4.00E-04 |
| PRF1 | HLA-DRA | 1.40E-10 | 3.56E-08 | 0.449362216 | PRF1->CD8A->IL2->STAT3->EP300->CREB1->CIITA->HLA-DRA | 28 | 4.00E-04 |
| PSMB9 | CXCL13 | 1.52E-09 | 2.59E-07 | 0.425762805 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->GRB2->LCP2->LCK->CD4->CXCR4->CXCL13 | 20 | 4.00E-04 |
| EBI3 | PIK3CG | 2.14E-06 | 0.000102784 | 0.340293436 | EBI3->IL27RA->STAT1->EP300->CREB1->AKT1->PIK3CG | 14 | 0.00045 |
| APOBEC1 | A1CF | 4.37E-07 | 2.86E-05 | 0.361276568 | APOBEC1->A1CF | 15 | 0.00045 |
| PRF1 | BEX1 | 6.52E-07 | 3.94E-05 | 0.356126438 | PRF1->CD8A->IL2->SHC1->NGFR->BEX1 | 15 | 0.00045 |
| ATP2B4 | MARCKS | 9.07E-10 | 1.67E-07 | 0.431045457 | ATP2B4->CALM1->IQGAP1->CDC42->PLD1->PRKCA->MARCKS | 24 | 0.00045 |
| FCRL5 | CXCL13 | 1.73E-14 | 1.79E-11 | 0.52490935 | FCRL5->BCL9->CTNNB1->ERBB2->GRB2->LCP2->LCK->CD4->CXCR4->CXCL13 | 100 | 0.00045 |
| IGJ | CD69 | 1.21E-12 | 6.26E-10 | 0.491541404 | IGJ->IL2->CD69 | 74 | 0.00045 |
| SLC11A1 | HMOX1 | 1.36E-06 | 7.21E-05 | 0.34642529 | SLC11A1->ZBTB17->MYC->EP300->HIF1A->HMOX1 | 15 | 5.00E-04 |
| HSPB1 | TFCP2 | 2.56E-05 | 0.000754145 | -0.304177992 | HSPB1->MAPKAPK2->MAPK14->CREB1->EP300->YY1->TFCP2 | 12 | 5.00E-04 |
| PTGER1 | NCOA7 | 3.10E-13 | 2.02E-10 | -0.502611276 | PTGER1->BDKRB2->KNG1->EGF->SRC->ESR1->NCOA7 | 103 | 5.00E-04 |
| SLC22A18 | PTPRH | 9.68E-14 | 7.76E-11 | 0.511791911 | SLC22A18->CDKN1C->MYO1D->SRF->PTPRH | 108 | 5.00E-04 |
| PSMB9 | FCGR3B | 1.21E-11 | 4.33E-09 | 0.471831178 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->CBL->SYK->FCER1G->FCGR3B | 56 | 5.00E-04 |
| AKR1C3 | A1CF | 2.61E-12 | 1.22E-09 | 0.485060376 | AKR1C3->PTGDS->PTGS2->IL6->STAT3->SRC->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 71 | 5.00E-04 |
| IGKC | CD69 | 3.33E-11 | 1.05E-08 | 0.462707233 | IGKC->ERBB4->EGF->SRC->STAT3->IL2->CD69 | 47 | 5.00E-04 |
| CASP1 | HLA-DRA | 9.05E-10 | 1.67E-07 | 0.431075723 | CASP1->IL18->IFNG->IL2->STAT3->EP300->CREB1->CIITA->HLA-DRA | 26 | 5.00E-04 |
| IGJ | CXCL13 | 2.55E-12 | 1.21E-09 | 0.485272077 | IGJ->IL2->CD8A->CD4->CXCR4->CXCL13 | 70 | 5.00E-04 |
| ANGPTL4 | CYP2J2 | 5.22E-13 | 3.18E-10 | -0.498411954 | ANGPTL4->LPL->APOE->APP->APBB1->KAT5->PLA2G4A->CYP2J2 | 103 | 0.00055 |
| ATP2B4 | LPHN2 | 1.22E-12 | 6.26E-10 | 0.491446424 | ATP2B4->CALM1->IQGAP1->RAC1->AKT1->MTOR->FKBP1A->RYR1->HOMER1->SHANK2->LPHN2 | 93 | 0.00055 |
| CASP1 | PIK3CG | 6.19E-06 | 0.000243487 | 0.325421407 | CASP1->IL18->IFNG->IL2->STAT3->RAC1->AKT1->PIK3CG | 14 | 0.00055 |
| EBI3 | HLA-DRA | 4.63E-09 | 6.67E-07 | 0.414140884 | EBI3->IL27RA->STAT1->EP300->CREB1->CIITA->HLA-DRA | 25 | 6.00E-04 |
| GAS1 | KLRD1 | 1.27E-10 | 3.31E-08 | 0.450263555 | GAS1->SHH->FGF8->FGFR1->PLCG1->CBL->SYK->TYROBP->KLRD1 | 42 | 6.00E-04 |
| PRF1 | FCGR3B | 7.83E-11 | 2.19E-08 | 0.454834104 | PRF1->CD8A->LCK->SYK->FCER1G->FCGR3B | 57 | 6.00E-04 |

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| CASP1 | CD69 | 6.10E-08 | 5.70E-06 | 0.385308469 | CASP1->IL18->IFNG->IL2->CD69 | 21 | 6.00E-04 |
| SATB2 | RBM39 | 1.44E-12 | 7.15E-10 | 0.490071558 | SATB2->HOXA2->CD1D->B2M->CD8A->LCK->CD2->CD2BP2->SF3A2->RBM39 | 110 | 6.00E-04 |
| CEACAM1 | A1CF | 1.71E-10 | 4.18E-08 | 0.447449775 | CEACAM1->PTPN11->GRB2->ERBB2->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 47 | 0.00065 |
| CEACAM1 | EDN3 | 7.12E-08 | 6.40E-06 | 0.383483001 | CEACAM1->PTPN11->GRB2->RET->GDNF->EDNRB->EDN3 | 22 | 0.00065 |
| PTGER1 | KCNQ2 | 4.81E-12 | 2.01E-09 | 0.47984446 | PTGER1->BDKRB2->KNG1->EGF->SRC->ESR1->EP300->CREB1->CAMK2B->CALM1->KCNQ2 | 100 | 0.00065 |
| SERPINB2 | BCL11A | 6.83E-12 | 2.70E-09 | -0.476817364 | SERPINB2->PLAU->JUN->EP300->ESR1->NCOA2->BCL11A | 73 | 0.00065 |
| MAVS | SHANK2 | 2.13E-08 | 2.36E-06 | 0.397403786 | MAVS->IRF3->CREBBP->CREB1->AKT1->MTOR->FKBP1A->RYR1->HOMER1->SHANK2 | 25 | 0.00065 |
| CASP1 | ASS1 | 3.31E-08 | 3.38E-06 | 0.392393444 | CASP1->IL18->IFNG->IL2->STAT3->RAC1->AKT1->NOS3->ARG2->OTC->ASS1 | 24 | 0.00065 |
| CD79A | HLA-DRA | 1.17E-08 | 1.42E-06 | 0.404109604 | CD79A->SYK->VAV1->RAC1->AKT1->CREB1->CIITA->HLA-DRA | 26 | 7.00E-04 |
| APOBEC1 | TFCP2 | 8.41E-09 | 1.08E-06 | 0.407701882 | APOBEC1->APOB->LDLR->APOE->APP->PSEN1->CTNNB1->GSK3B->TP53->YY1->TFCP2 | 28 | 7.00E-04 |
| PSMB9 | CD69 | 6.75E-08 | 6.12E-06 | 0.384113473 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->STAT3->IL2->CD69 | 24 | 7.00E-04 |
| RNF43 | ABCB1 | 4.44E-16 | 8.68E-13 | 0.552683482 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->ABCB1 | 150 | 7.00E-04 |
| CEACAM1 | CYP2J2 | 3.70E-11 | 1.15E-08 | 0.461755841 | CEACAM1->PTPN11->EGFR->UBC->TP53->KAT5->PLA2G4A->CYP2J2 | 75 | 0.00075 |
| CCL7 | FCGR3B | 1.93E-10 | 4.56E-08 | 0.446269883 | CCL7->CCR5->CD4->LCK->SYK->FCER1G->FCGR3B | 55 | 0.00075 |
| GAS1 | HMOX1 | 4.55E-07 | 2.97E-05 | 0.360744181 | GAS1->SHH->FGF8->FGFR1->PLCG1->EGFR->UBC->HIF1A->HMOX1 | 19 | 0.00075 |
| GAS1 | KANK4 | 3.07E-12 | 1.37E-09 | 0.483685968 | GAS1->SHH->FGF8->FGFR1->PLCG1->EGFR->UBC->TP53->TBP->POLR2A->POLR2H->POLR3D->POLR3F->POLR3C->KANK4 | 136 | 0.00075 |
| MAVS | CRLS1 | 2.09E-13 | 1.41E-10 | 0.505753936 | MAVS->IRF3->CREBBP->TP53->BCL2->BNIP2->CDC42->PLD1->CDS2->CRLS1 | 156 | 0.00075 |
| SATB2 | ENPP3 | 9.77E-15 | 1.13E-11 | 0.529167499 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->IL5->IL3->ENPP3 | 172 | 0.00075 |
| SLC2A3 | FCGR3B | 2.44E-15 | 4.02E-12 | 0.539204886 | SLC2A3->SP1->ESR1->SRC->CBL->SYK->FCER1G->FCGR3B | 238 | 8.00E-04 |
| SLC2A3 | FPR1 | 2.22E-16 | 4.96E-13 | 0.557121839 | SLC2A3->SP1->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 222 | 8.00E-04 |
| SLC2A3 | KLRD1 | 6.20E-14 | 5.10E-11 | 0.515223784 | SLC2A3->SP1->ESR1->SRC->CBL->SYK->TYROBP->KLRD1 | 218 | 8.00E-04 |
| SLC2A3 | HLA-DRA | 2.89E-15 | 4.51E-12 | 0.537670168 | SLC2A3->SP1->EP300->CREB1->CIITA->HLA-DRA | 205 | 8.00E-04 |
| SLC11A1 | FCGR3B | 8.34E-11 | 2.31E-08 | 0.454237845 | SLC11A1->ZBTB17->MYC->EP300->STAT3->EGFR->CBL->SYK->FCER1G->FCGR3B | 62 | 8.00E-04 |
| RNF43 | SCML1 | 6.06E-14 | 5.10E-11 | 0.515391773 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->HDAC1->SIN3A->MECP2->CDKL5->NHS->SCML1 | 234 | 8.00E-04 |
| NOP10 | TFCP2 | 1.50E-05 | 0.000495833 | -0.312373076 | NOP10->DKC1->RUVBL1->KAT5->TP53->YY1->TFCP2 | 16 | 0.00085 |
| IGHD | PIK3CG | 3.56E-10 | 7.68E-08 | 0.440345527 | IGHD->GHRH->POMC->NR4A1->AKT1->PIK3CG | 49 | 0.00085 |
| CEACAM1 | CLEC4E | 5.95E-14 | 5.10E-11 | -0.515541273 | CEACAM1->PTPN11->EGFR->UBC->IKBK->BCL10->CARD9->CLEC4E | 275 | 9.00E-04 |
| SLC11A1 | PIK3AP1 | 1.82E-10 | 4.37E-08 | 0.446858197 | SLC11A1->ZBTB17->MYC->MAPK1->GRB2->PIK3R1->PIK3AP1 | 66 | 9.00E-04 |
| CHST2 | CD69 | 1.33E-15 | 2.45E-12 | 0.543287197 | CHST2->SELL->CD34->MYB->CREBBP->TP53->EP300->STAT3->IL2->CD69 | 272 | 9.00E-04 |
| CHST2 | HLA-DRA | 7.99E-15 | 9.62E-12 | 0.530515724 | CHST2->SELL->CD34->MYB->CREBBP->CREB1->CIITA->HLA-DRA | 271 | 9.00E-04 |
| NOP10 | A1CF | 1.22E-08 | 1.47E-06 | -0.403588966 | NOP10->DKC1->RUVBL1->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 40 | 9.00E-04 |
| NOP10 | TNFRSF18 | 2.68E-06 | 0.000123487 | 0.337245108 | NOP10->DKC1->TERT->AKT1->RAC1->STAT3->IL2->TNFRSF18 | 18 | 9.00E-04 |
| NOP10 | KLRD1 | 1.26E-08 | 1.50E-06 | 0.40328604 | NOP10->DKC1->TERT->AKT1->RAC1->VAV1->SYK->TYROBP->KLRD1 | 39 | 9.00E-04 |
| IGHD | HLA-DRA | 1.94E-10 | 4.56E-08 | 0.446233583 | IGHD->GHRH->GCG->LEP->STAT3->EP300->CREB1->CIITA->HLA-DRA | 61 | 9.00E-04 |

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| CCL7 | CD69 | 1.08E-06 | 5.95E-05 | 0.349554402 | CCL7->CCR5->CD4->CD8A->IL2->CD69 | 22 | 0.00095 |
| ANGPTL4 | HMOX1 | 1.00E-09 | 1.82E-07 | 0.430022593 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->GSK3B->TP53->HIF1A->HMOX1 | 49 | 0.00095 |
| PRF1 | CD69 | 1.38E-06 | 7.27E-05 | 0.346294404 | PRF1->CD8A->IL2->CD69 | 23 | 0.00095 |
| PRF1 | SLA | 1.76E-11 | 6.05E-09 | 0.468446673 | PRF1->CD8A->IL2->STAT3->EP300->MYOD1->TCF3->TAL1->LMO2->LDB1->LHX3->IFT172->SLA | 127 | 0.00095 |
| NOP10 | UPP1 | 5.71E-10 | 1.14E-07 | 0.435678467 | NOP10->DKC1->RUVBL1->KAT5->TP53->RRM2B->RRM1->RRM2->TYMS->TK1->CDA->TYMP->UPP1 | 51 | 0.00095 |
| GAS1 | CCL18 | 1.07E-10 | 2.83E-08 | 0.451902229 | GAS1->SHH->FGF8->FGFR1->FRS2->GRB2->LCP2->LCK->CD4->CCR5->CCL13->CCR3->CCL18 | 81 | 0.001 |
| GAS1 | SLA | 3.48E-11 | 1.09E-08 | 0.462315159 | GAS1->SHH->GLI2->IFT172->SLA | 129 | 0.001 |
| SERPINB2 | A1CF | 4.39E-09 | 6.45E-07 | -0.414694299 | SERPINB2->PLAU->NFKB1->NFKBIA->BTRC->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 42 | 0.001 |
| PARVA | LPHN2 | 1.22E-10 | 3.20E-08 | 0.450682714 | PARVA->ILK->AKT1->MTOR->FKBP1A->RYR1->HOMER1->SHANK2->LPHN2 | 76 | 0.001 |
| MAVS | A1CF | 1.17E-08 | 1.42E-06 | 0.404054378 | MAVS->IRF3->CREBBP->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 41 | 0.001 |
| SATB2 | CD55 | 3.90E-11 | 1.20E-08 | -0.461266693 | SATB2->HOXA2->CD1D->B2M->CD8A->LCK->SYK->CD19->CR2->C3->CD55 | 120 | 0.001 |
| SLC2A3 | CCL18 | 5.29E-13 | 3.18E-10 | 0.498301001 | SLC2A3->SP1->EP300->RELA->NFKB1->CCL5->CCR3->CCL18 | 256 | 0.00105 |
| CEACAM1 | HMOX1 | 3.52E-06 | 0.000153605 | -0.333450511 | CEACAM1->PTPN11->EGFR->UBC->HIF1A->HMOX1 | 19 | 0.00105 |
| SLC22A18 | GNA11 | 1.86E-10 | 4.45E-08 | 0.446614204 | SLC22A18->CDKN1C->MYOD1->EP300->JUN->EDN1->EDNRB->GNA11 | 81 | 0.00105 |
| CRB3 | MARCKS | 5.51E-07 | 3.46E-05 | -0.358311949 | CRB3->PARD6A->CDC42->PLD1->PRKCA->MARCKS | 26 | 0.00105 |
| PSMB9 | KLRD1 | 7.99E-08 | 6.96E-06 | 0.382130458 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->CBL->SYK->TYROBP->KLRD1 | 36 | 0.00105 |
| RNF43 | CXCL13 | 4.84E-11 | 1.46E-08 | -0.459284305 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->CD4->CXCR4->CXCL13 | 119 | 0.00105 |
| CASP1 | ZFH3 | 2.27E-09 | 3.63E-07 | -0.421664979 | CASP1->IL18->IL1B->IL8->RELA->CREBBP->MYB->ZFH3 | 48 | 0.00105 |
| SLC2A3 | APBB1IP | 3.31E-12 | 1.46E-09 | 0.48305194 | SLC2A3->SP1->ESR1->SRC->PTK2->TLN1->APBB1IP | 234 | 0.0011 |
| PGRMC1 | SCML1 | 2.83E-12 | 1.28E-09 | 0.484389946 | PGRMC1->M6PR->IGF1->IGF1R->ESR1->SP1->HDAC1->SIN3A->MECP2->CDKL5->NHS->SCML1 | 208 | 0.0011 |
| PIGR | CXCL13 | 4.18E-06 | 0.000176829 | 0.331031366 | PIGR->CD79A->SYK->LCK->CD4->CXCR4->CXCL13 | 20 | 0.0011 |
| SATB2 | MID1 | 6.95E-12 | 2.72E-09 | 0.476658864 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->EP300->SP1->SMAD3->RUNX2->SP7->MID1 | 146 | 0.0011 |
| CCL7 | CCL18 | 1.11E-09 | 1.96E-07 | 0.429045553 | CCL7->CCR3->CCL18 | 67 | 0.00115 |
| EBI3 | SNAPIN | 4.17E-07 | 2.75E-05 | 0.361854206 | EBI3->IL27RA->STAT1->JAK2->GRB2->PDGFRB->SLC9A3R1->CFTR->STX1A->SNAP25->SNAPIN | 29 | 0.00115 |
| ANGPTL4 | FPR1 | 2.80E-10 | 6.22E-08 | 0.442678475 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->GSK3B->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 80 | 0.00115 |
| CHRNA3 | MARCKS | 2.56E-08 | 2.72E-06 | 0.395326163 | CHRNA3->PSMA4->UCHL5->PSMD4->UBC->EGFR->CBL->ARHGEF7->CDC42->PLD1->PRKCA->MARCKS | 46 | 0.00115 |
| PRF1 | PIK3AP1 | 9.26E-10 | 1.69E-07 | 0.430843795 | PRF1->CD8A->LCK->LCP2->GRB2->PIK3R1->PIK3AP1 | 63 | 0.00115 |
| NOP10 | RBM39 | 2.11E-08 | 2.34E-06 | -0.397538201 | NOP10->DKC1->RUVBL1->KAT5->TP53->YBX1->SF3A2->RBM39 | 47 | 0.00115 |
| PTGER3 | FZD8 | 2.93E-09 | 4.52E-07 | 0.418971416 | PTGER3->KNG1->EGF->ERBB2->CTNNB1->AXIN1->LRP6->FZD8 | 58 | 0.00115 |
| RNF43 | A1CF | 1.01E-11 | 3.75E-09 | 0.47342889 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->LCP2->GRB2->ERBB2->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 144 | 0.00115 |
| MAVS | GNA11 | 4.24E-07 | 2.78E-05 | 0.361661435 | MAVS->IRF3->CREBBP->CREB1->FOS->EDN1->EDNRB->GNA11 | 29 | 0.00115 |
| IGJ | CD2 | 1.35E-09 | 2.32E-07 | 0.427009846 | IGJ->IL2->LCK->CD2 | 61 | 0.00115 |
| PTGER3 | LPHN2 | 6.98E-11 | 2.00E-08 | 0.45589728 | PTGER3->KNG1->KLB1->A2M->TGFB1->TGFB1R1->FKBP1A->RYR1->HOMER1->SHANK2->LPHN2 | 128 | 0.0012 |
| SYK | ESRRG | 8.08E-07 | 4.72E-05 | 0.353344265 | SYK->CBL->EGFR->UBC->TP53->SIRT1->PPARGCIA->ESRRG | 29 | 0.0012 |
| MAP7D1 | SLA | 5.59E-12 | 2.27E-09 | 0.478558607 | MAP7D1->ARTN->GFRA1->RET->SHC1->IGF1R->ESR1- | 229 | 0.00125 |

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|---------|----------|----------|-------------|--------------|--|-----|---------|
| | | | | | >BRCA1->RBBP8->LMO4->LDB1->LHX3->IFT172->SLA | | |
| ANGPTL4 | SNAPIN | 2.13E-09 | 3.43E-07 | 0.422310071 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->ERBB2->GRB2->PDGFRB->SLC9A3R1->CFTR->STX1A->SNAP25->SNAPIN | 66 | 0.0013 |
| SAV1 | A1CF | 2.07E-10 | 4.79E-08 | -0.445614751 | SAV1->RASSF1->HRAS->SOS1->GRB2->ERBB2->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 95 | 0.0013 |
| NOP10 | CXCL13 | 4.41E-06 | 0.000185849 | 0.330264623 | NOP10->DKC1->TERT->AKT1->RAC1->VAV1->LCP2->LCK->CD4->CXCR4->CXCL13 | 23 | 0.0013 |
| ATP2B4 | HRAS | 4.63E-06 | 0.000192648 | -0.329565653 | ATP2B4->CALM1->IQGAP1->RAC1->AKT1->PIK3CA->HRAS | 23 | 0.0013 |
| ATP2B4 | SMAD7 | 5.69E-06 | 0.000227805 | 0.326633752 | ATP2B4->CALM1->CAMK2B->CREB1->EP300->SMAD2->TGFBF1->SMAD7 | 23 | 0.0013 |
| RNF43 | UPP1 | 3.13E-11 | 1.01E-08 | -0.463292255 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->RRM2B->RRM1->RRM2->TYMS->TK1->CDA->TYMP->UPP1 | 152 | 0.0013 |
| RB1CC1 | RBM39 | 2.37E-09 | 3.76E-07 | 0.421196345 | RB1CC1->PTK2->GRB2->LCP2->LCK->CD2->CD2BP2->SF3A2->RBM39 | 65 | 0.00135 |
| GAS1 | CD69 | 1.45E-06 | 7.59E-05 | 0.345563219 | GAS1->SHH->FGF8->FGFR1->PLCG1->EGFR->STAT3->IL2->CD69 | 31 | 0.00135 |
| NOP10 | SHANK2 | 4.69E-06 | 0.000194667 | -0.329379909 | NOP10->DKC1->TERT->AKT1->MTOR->FKBP1A->RYR1->HOMER1->SHANK2 | 24 | 0.00135 |
| CEACAM1 | FCGR3B | 5.48E-09 | 7.59E-07 | -0.412330378 | CEACAM1->PTPN11->GRB2->BLNK->SYK->FCER1G->FCGR3B | 63 | 0.0014 |
| SLC11A1 | FPR1 | 7.79E-08 | 6.82E-06 | 0.382421258 | SLC11A1->ZBTB17->MYC->EP300->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 47 | 0.0014 |
| SAV1 | JAK2 | 4.78E-09 | 6.86E-07 | 0.413792328 | SAV1->RASSF1->HRAS->SOS1->PTPN11->JAK2 | 61 | 0.0014 |
| PSMB9 | ZFH3 | 7.79E-08 | 6.82E-06 | -0.382427639 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->TP53->CREBBP->MYB->ZFH3 | 47 | 0.0014 |
| MAVS | FCGR3B | 8.55E-09 | 1.10E-06 | -0.407523127 | MAVS->IRF3->CREBBP->HIF1A->UBC->EGFR->CBL->SYK->FCER1G->FCGR3B | 59 | 0.0014 |
| MAVS | FPR1 | 1.42E-07 | 1.11E-05 | -0.37523462 | MAVS->IRF3->CREBBP->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 43 | 0.0014 |
| PTGER1 | CRIM1 | 5.45E-11 | 1.61E-08 | -0.458196402 | PTGER1->BDKRB2->KNG1->EGF->SRC->ESR1->EP300->SMAD2->SMAD4->SMAD1->BMPR1A->BMP4->CRIM1 | 163 | 0.00145 |
| PRF1 | CCL18 | 2.68E-09 | 4.20E-07 | 0.419904779 | PRF1->CD8A->CD4->CCR5->CCL5->CCR3->CCL18 | 73 | 0.00145 |
| CXCL14 | DYNC1I2 | 1.33E-11 | 4.67E-09 | 0.470969799 | CXCL14->CXCR4->CD4->IFNG->IL2->STAT3->EP300->TP53->CHEK1->CLSPN->PLK1->NUDC->PAFAH1B1->DCTN1->DCTN2->DYNC1I2 | 210 | 0.00145 |
| SYK | A1CF | 8.91E-07 | 5.11E-05 | 0.352061463 | SYK->CBL->GRB2->ERBB2->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 37 | 0.00145 |
| RNF43 | PIK3AP1 | 5.03E-11 | 1.50E-08 | -0.458935032 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->LCP2->GRB2->PIK3R1->PIK3AP1 | 164 | 0.00145 |
| SATB2 | A1CF | 1.67E-10 | 4.12E-08 | 0.447647641 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->SRC->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 110 | 0.00145 |
| CEACAM1 | KLRD1 | 2.79E-07 | 1.98E-05 | -0.36693184 | CEACAM1->PTPN11->GRB2->BLNK->SYK->TYROBP->KLRD1 | 43 | 0.0015 |
| EBI3 | RASGRP2 | 7.66E-09 | 1.01E-06 | 0.408712815 | EBI3->IL27RA->STAT1->EP300->HIF1A->HSP90AA1->RAF1->KRAS->RASGRP2 | 68 | 0.0015 |
| ANGPTL4 | FCGR3B | 6.29E-10 | 1.21E-07 | 0.434716752 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->ERBB2->GRB2->VAV1->SYK->FCER1G->FCGR3B | 94 | 0.0015 |
| NOP10 | CD69 | 3.43E-06 | 0.000151157 | 0.333793133 | NOP10->DKC1->TERT->AKT1->RAC1->STAT3->IL2->CD69 | 28 | 0.0015 |
| RFXAP | TAX1BP3 | 1.63E-07 | 1.23E-05 | -0.373578738 | RFXAP->RFXANK->CIITA->CREB1->AKT1->RAC1->ARHGDI1A->RHOA->RTKN->TAX1BP3 | 44 | 0.0015 |
| GAS1 | SHANK2 | 2.64E-06 | 0.00012232 | -0.337455104 | GAS1->SHH->BMP4->BMPR1A->SMAD1->SMAD4->TGFBF1->FKBP1A->RYR1->HOMER1->SHANK2 | 30 | 0.00155 |
| PRF1 | SHANK2 | 8.46E-06 | 0.000310627 | -0.320876781 | PRF1->CD8A->IL2->STAT3->EP300->SMAD2->TGFBF1->FKBP1A->RYR1->HOMER1->SHANK2 | 26 | 0.00155 |
| SLC2A3 | NAMPT | 3.28E-11 | 1.05E-08 | 0.462864705 | SLC2A3->SP1->EP300->STAT3->IL6->NAMPT | 223 | 0.0016 |
| SLC11A1 | ARHGEF19 | 8.34E-07 | 4.84E-05 | -0.352930061 | SLC11A1->ZBTB17->MYC->CTNNB1->DVL1->DAAM1->ARHGEF19 | 41 | 0.0016 |
| ANGPTL4 | A1CF | 2.19E-08 | 2.40E-06 | -0.397076744 | ANGPTL4->LPL->APOB->APOBEC1->A1CF | 65 | 0.0016 |

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| CHST2 | HMOX1 | 2.05E-11 | 6.88E-09 | 0.467114629 | CHST2->SELL->CD34->MYB->CREBBP->HIF1A->HMOX1 | 257 | 0.0016 |
| FCRL5 | CD2 | 7.81E-10 | 1.47E-07 | 0.432559934 | FCRL5->BCL9->CTNNB1->ERBB2->GRB2->LCP2->LCK->CD2 | 90 | 0.0016 |
| CASP1 | NAMPT | 5.44E-07 | 3.42E-05 | 0.358474195 | CASP1->IL18->IL1B->IL6->NAMPT | 42 | 0.0016 |
| CEACAM1 | PTPRH | 4.12E-08 | 4.08E-06 | 0.389871708 | CEACAM1->PTPN11->MAPK3->ELK1->SRF->PTPRH | 64 | 0.00165 |
| CD79A | SNAPIN | 1.26E-05 | 0.000426426 | 0.315016403 | CD79A->BLNK->GRB2->PDGFRB->SLC9A3R1->CFTR->STX1A->SNAP25->SNAPIN | 26 | 0.00165 |
| LEPRE1 | LPHN2 | 1.30E-09 | 2.24E-07 | 0.427430999 | LEPRE1->PPIB->BSG->MMP1->TIMP1->TGFB1->TGFB1->FKBP1A->RYR1->HOMER1->SHANK2->LPHN2 | 96 | 0.00165 |
| GAS1 | TAX1BP3 | 7.21E-07 | 4.30E-05 | 0.354818627 | GAS1->SHH->FGF8->FGFR1->FRS2->GRB2->VAV1->RAC1->ARHGDI1->RHOA->RTKN->TAX1BP3 | 43 | 0.00165 |
| FCRL5 | CD69 | 5.88E-10 | 1.16E-07 | 0.435388774 | FCRL5->BCL9->CTNNB1->CCND1->STAT3->IL2->CD69 | 105 | 0.00165 |
| IGKC | ZAP70 | 7.56E-06 | 0.000285698 | 0.322517626 | IGKC->ERBB4->EGF->EGFR->SHC1->ZAP70 | 30 | 0.00165 |
| RNF43 | VNN2 | 2.30E-11 | 7.57E-09 | -0.466073286 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->NFKB1A->NFKB1->ICAM1->ITGB2->VNN2 | 271 | 0.00165 |
| CEACAM1 | SHANK2 | 4.58E-06 | 0.000190817 | 0.329720073 | CEACAM1->PTPN11->JAK2->STAT3->EP300->SMAD2->TGFB1->FKBP1A->RYR1->HOMER1->SHANK2 | 32 | 0.0017 |
| EBI3 | KCNQ2 | 1.57E-06 | 8.07E-05 | 0.344487725 | EBI3->IL27RA->STAT1->EP300->CREB1->CAMK2B->CALM1->KCNQ2 | 40 | 0.0017 |
| RNF43 | JAK2 | 5.14E-10 | 1.05E-07 | -0.436723353 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->PTPN6->JAK2 | 110 | 0.0017 |
| CCL7 | HLA-DRA | 1.15E-05 | 0.000395266 | 0.316383976 | CCL7->CCR5->CD4->IFNG->IFNGR1->STAT1->EP300->CREB1->CIITA->HLA-DRA | 27 | 0.00175 |
| CEACAM1 | CCL18 | 3.78E-09 | 5.73E-07 | -0.416306236 | CEACAM1->PTPN11->GRB2->LCP2->LCK->CD4->CCR5->CCL13->CCR3->CCL18 | 82 | 0.0018 |
| CD79A | SLA | 6.60E-10 | 1.26E-07 | 0.434235739 | CD79A->BLNK->GRB2->ERBB2->CTNNB1->TCF4->TAL1->LMO2->LDB1->LHX3->IFT172->SLA | 124 | 0.0018 |
| SERPINB2 | ABCB1 | 2.09E-07 | 1.53E-05 | -0.370475021 | SERPINB2->PLAU->JUN->MAPK8->TP53->ABCB1 | 48 | 0.0018 |
| IGHD | KLRD1 | 2.94E-08 | 3.06E-06 | 0.393740885 | IGHD->GHRH->GCG->LEP->STAT3->EGFR->CBL->SYK->TYROBP->KLRD1 | 72 | 0.0018 |
| GAS1 | HLA-DRA | 6.78E-06 | 0.000261642 | 0.324095318 | GAS1->SHH->FGF8->FGFR1->FRS2->PTPN11->STAT1->EP300->CREB1->CIITA->HLA-DRA | 34 | 0.00185 |
| SERPINB2 | RBM39 | 2.78E-07 | 1.98E-05 | -0.366963937 | SERPINB2->PLAU->JUN->MAPK8->TP53->YBX1->SF3A2->RBM39 | 46 | 0.00185 |
| NFIB | CRIM1 | 1.56E-10 | 3.88E-08 | 0.448308638 | NFIB->HNF1A->HNF4A->SMAD4->SMAD1->BMP1A->BMP4->CRIM1 | 146 | 0.00185 |
| IGHD | ZAP70 | 1.23E-06 | 6.63E-05 | 0.347791003 | IGHD->GHRH->GCG->LEP->STAT3->JAK2->SHC1->ZAP70 | 43 | 0.00185 |
| RB1CC1 | SLC25A11 | 5.46E-10 | 1.09E-07 | -0.436130536 | RB1CC1->PTK2->PTEN->TP53->BCL2->BNIP3->BCKDHB->DLD->OGDH->SLC25A11 | 134 | 0.0019 |
| SAV1 | CD55 | 1.42E-09 | 2.43E-07 | 0.426475735 | SAV1->RASSF1->HRAS->SOS1->GRB2->VAV1->CD19->CR2->C3->CD55 | 106 | 0.00195 |
| PTGER1 | ARHGEF19 | 3.82E-09 | 5.78E-07 | -0.416171277 | PTGER1->BDKRB2->KNG1->EGF->ERBB2->CTNNB1->DVL1->DAAM1->ARHGEF19 | 95 | 0.002 |
| MAP7D1 | ST3GAL1 | 7.25E-11 | 2.06E-08 | 0.455550461 | MAP7D1->ARTN->GFRA1->RET->GRB2->LCP2->LCK->CD2->CD2BP2->SF3A2->SNRPE->LSM4->EXOSC10->CHPF->B4GALNT1->ST8SIA1->ST3GAL1 | 250 | 0.002 |
| IGKC | PIK3CG | 9.12E-06 | 0.000327379 | 0.319785463 | IGKC->ERBB4->EGF->EGFR->SOS1->HRAS->PIK3CG | 37 | 0.00215 |
| CCL7 | ARHGEF19 | 8.79E-06 | 0.000319499 | -0.320318201 | CCL7->CCR5->CD4->LCK->LCP2->GRB2->ERBB2->CTNNB1->DVL1->DAAM1->ARHGEF19 | 39 | 0.0022 |
| CCL7 | A1CF | 7.26E-06 | 0.000276534 | -0.32311507 | CCL7->CCR5->CD4->LCK->LCP2->GRB2->ERBB2->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 41 | 0.0022 |
| NOP10 | ABCB1 | 6.02E-07 | 3.70E-05 | -0.357159241 | NOP10->DKC1->RUVBL1->KAT5->TP53->ABCB1 | 49 | 0.0022 |
| MAP7D1 | LPHN2 | 1.05E-10 | 2.81E-08 | 0.452064977 | MAP7D1->ARTN->GFRA1->RET->GRB2->VAV1->RAC1->AKT1->MTOR->FKBP1A->RYR1->HOMER1->SHANK2->LPHN2 | 184 | 0.0022 |
| SATB2 | CTSA | 4.22E-09 | 6.22E-07 | 0.415136146 | SATB2->HOXA2->CD1D->CTSA | 104 | 0.0022 |
| SATB2 | ABCB1 | 1.85E-09 | 3.06E-07 | 0.423765915 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->EP300->TP53->ABCB1 | 117 | 0.0022 |
| LEPRE1 | PKP2 | 2.52E-06 | 0.00011848 | -0.338104154 | LEPRE1->PPIB->BSG->MMP1->JUN->MAPK8->TP53- | 44 | 0.00225 |

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| | | | | | >GSK3B->CTNNB1->CDH2->JUP->DSP->PKP2 | | |
| SAV1 | ENPP3 | 2.89E-10 | 6.38E-08 | -0.442365609 | SAV1->RASSF1->HRAS->SOS1->PTPN11->JAK2->CSF2RB->IL3->ENPP3 | 160 | 0.00225 |
| RNF43 | NT5E | 5.38E-10 | 1.09E-07 | -0.43627473 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->USP7->GMPS->IMPDH2->NT5E | 154 | 0.00225 |
| SLC11A1 | KLRD1 | 6.82E-06 | 0.000262725 | 0.3240177 | SLC11A1->ZBTB17->MYC->EP300->STAT3->EGFR->CBL->SYK->TYROBP->KLRD1 | 42 | 0.0023 |
| PRF1 | CLEC4E | 8.79E-11 | 2.39E-08 | 0.45374436 | PRF1->CD8A->LCK->NFKBIA->IKBK->BCL10->CARD9->CLEC4E | 269 | 0.0023 |
| IGHD | THEMIS | 1.05E-10 | 2.81E-08 | 0.452093266 | IGHD->GHRH->GCG->LEP->STAT3->IL2->THEMIS | 225 | 0.0023 |
| PRKAA2 | MYEF2 | 1.50E-06 | 7.76E-05 | 0.34516758 | PRKAA2->MTOR->AKT1->MDM2->RB1->RBBP4->SIN3A->HDAC9->MYEF2 | 46 | 0.0023 |
| PSMB9 | THEMIS | 1.75E-10 | 4.26E-08 | 0.447195217 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->STAT3->IL2->THEMIS | 191 | 0.00235 |
| CASP1 | THEMIS | 1.54E-10 | 3.86E-08 | 0.448427637 | CASP1->IL18->IFNG->IL2->THEMIS | 188 | 0.00235 |
| IGJ | PIK3CG | 1.59E-07 | 1.21E-05 | 0.373867805 | IGJ->IL2->STAT3->RAC1->AKT1->PIK3CG | 67 | 0.00235 |
| SLC11A1 | ABCB1 | 8.83E-07 | 5.08E-05 | -0.352176089 | SLC11A1->ZBTB17->MYC->EP300->TP53->ABCB1 | 51 | 0.0024 |
| PSMB9 | KCNQ2 | 9.45E-06 | 0.000336822 | 0.319258234 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->MDM2->AKT1->RAC1->IQGAP1->CALM1->KCNQ2 | 41 | 0.0024 |
| PGRMC1 | BCL11A | 9.48E-10 | 1.72E-07 | 0.430607002 | PGRMC1->M6PR->IGF1->IGF1R->ESR1->NCOA2->BCL11A | 147 | 0.00245 |
| CRB3 | TFCP2 | 2.49E-05 | 0.000738693 | -0.304602375 | CRB3->PARD6A->CDC42->BNIP2->BCL2->TP53->YY1->TFCP2 | 33 | 0.00245 |
| MAP7D1 | HMOX1 | 5.14E-09 | 7.21E-07 | 0.413019615 | MAP7D1->ARTN->GFRA1->RET->SHC1->EGFR->UBC->HIF1A->HMOX1 | 116 | 0.00245 |
| SERPINB2 | CD55 | 9.15E-07 | 5.21E-05 | 0.351710447 | SERPINB2->PLAU->JUN->MAPK1->GRB2->VAV1->CD19->CR2->C3->CD55 | 54 | 0.0025 |
| ANGPTL4 | UPP1 | 4.40E-08 | 4.34E-06 | 0.389126254 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->GSK3B->TP53->RRM2B->RRM1->RRM2->TYMS->TK1->CDA->TYMP->UPP1 | 86 | 0.0025 |
| MAP7D1 | FPR1 | 1.15E-09 | 2.02E-07 | 0.428654767 | MAP7D1->ARTN->GFRA1->RET->SHC1->EGFR->UBC->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 148 | 0.0025 |
| IGKC | TFCP2 | 1.39E-05 | 0.000465252 | -0.313508073 | IGKC->ERBB4->EGF->SRC->ESR1->EP300->YY1->TFCP2 | 37 | 0.0025 |
| CDON | KCNQ2 | 1.46E-06 | 7.62E-05 | 0.345484108 | CDON->CDH2->CTNNB1->IQGAP1->CALM1->KCNQ2 | 49 | 0.0025 |
| CD79A | LTF | 1.02E-05 | 0.000358462 | 0.31814697 | CD79A->BLNK->GRB2->ERBB2->CTNNB1->PSEN1->APP->A2M->LYZ->LTF | 43 | 0.00255 |
| RNF43 | GALNT1 | 2.90E-09 | 4.49E-07 | -0.41909189 | RNF43->AKAP8L->DHX9->SF3A2->SNRPD3->LSM7->EXOSC6->CHPF->GALNT1 | 138 | 0.00255 |
| CDON | ARHGEF19 | 8.30E-06 | 0.000306123 | -0.321161988 | CDON->CDH2->CTNNB1->DVL1->DAAM1->ARHGEF19 | 44 | 0.00255 |
| COL4A5 | CGGBP1 | 6.29E-09 | 8.60E-07 | 0.410847353 | COL4A5->COL4A3->COL4A4->IGBP1->PPP2CA->SGOL1->PLK1->CDC25C->CHEK2->TP53->MDM2->AKT1->RAC1->NCKAP1->CYFIP1->FMR1->CGGBP1 | 123 | 0.0026 |
| PIGR | SPINK5 | 2.69E-10 | 6.05E-08 | 0.443085473 | PIGR->CD79A->BLNK->GRB2->ERBB2->CTNNB1->CTNNA1->JUP->DSG1->KLK5->SPINK5 | 187 | 0.0026 |
| PSMB9 | CCL18 | 1.50E-07 | 1.15E-05 | 0.37454081 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->GRB2->LCP2->LCK->CD4->CCR5->CCL13->CCR3->CCL18 | 76 | 0.0026 |
| IGKC | CD177 | 2.50E-08 | 2.68E-06 | 0.395614534 | IGKC->ERBB4->EGF->SRC->ESR1->NCOA3->CREBBP->MYB->PRTN3->CD177 | 101 | 0.0026 |
| RNF43 | RBM39 | 3.98E-09 | 5.96E-07 | 0.41573387 | RNF43->AKAP8L->DHX9->SF3A2->RBM39 | 130 | 0.0026 |
| SLC11A1 | ESRRG | 2.24E-05 | 0.000677176 | -0.306259285 | SLC11A1->ZBTB17->MYC->EP300->SIRT1->PPARGC1A->ESRRG | 35 | 0.00265 |
| SLC11A1 | CCL18 | 1.36E-07 | 1.07E-05 | 0.375794268 | SLC11A1->ZBTB17->MYC->EP300->RELA->NFKB1->CCL5->CCR3->CCL18 | 80 | 0.0027 |
| PQBP1 | SCML1 | 8.83E-10 | 1.65E-07 | 0.43132396 | PQBP1->TXNL4A->CD2BP2->CD2->LCK->NFKBIA->RELA->HDAC1->SIN3A->MECP2->CDKL5->NHS->SCML1 | 163 | 0.0027 |
| MAVS | BCL11A | 2.23E-07 | 1.62E-05 | 0.369694606 | MAVS->IRF3->CREBBP->NCOA3->AR->NCOA2->BCL11A | 72 | 0.0027 |
| CCL7 | UPP1 | 1.88E-06 | 9.30E-05 | 0.342072139 | CCL7->CCR5->CD4->IFNG->IFNGR1->STAT1->EP300->TP53->RRM2B->RRM1->RRM2->TYMS->TK1->CDA->TYMP->UPP1 | 51 | 0.00275 |

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| CCL7 | PIK3AP1 | 5.54E-07 | 3.47E-05 | 0.35823459 | CCL7->CCR5->CD4->IFNG->CD80->CD28->PIK3R1->PIK3AP1 | 61 | 0.00275 |
| PIGR | CYP2J2 | 2.93E-07 | 2.06E-05 | 0.366304832 | PIGR->CD79A->BLNK->GRB2->ERBB2->CTNNB1->RUVBL1->KAT5->PLA2G4A->CYP2J2 | 71 | 0.00275 |
| RNF43 | MID1 | 6.00E-10 | 1.18E-07 | 0.43518324 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->SP1->SMAD3->RUNX2->SP7->MID1 | 180 | 0.00275 |
| RNF43 | SLA | 2.77E-10 | 6.19E-08 | -0.442797377 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->BRCA1->RBBP8->LMO4->LDB1->LHX3->IFT172->SLA | 228 | 0.00275 |
| IGJ | HLA-DRA | 1.68E-07 | 1.26E-05 | 0.37319543 | IGJ->IL2->STAT3->EP300->CREB1->CIITA->HLA-DRA | 79 | 0.00275 |
| PRF1 | FPR1 | 7.83E-06 | 0.000290868 | 0.322012145 | PRF1->CD8A->IL2->STAT3->EP300->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 46 | 0.0028 |
| HLA-DQB2 | TNFRSF1B | 2.71E-08 | 2.85E-06 | 0.394700674 | HLA-DQB2->ZFYVE9->SMAD2->EP300->RELA->CHUK->TRAF2->TNFRSF1B | 107 | 0.0028 |
| IGJ | ZAP70 | 7.88E-07 | 4.63E-05 | 0.353659269 | IGJ->IL2->LCK->ZAP70 | 61 | 0.0028 |
| PSMB9 | SLA | 1.74E-08 | 1.99E-06 | 0.39965776 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->TP53->BRCA1->RBBP8->LMO4->LDB1->LHX3->IFT172->SLA | 124 | 0.00285 |
| SYK | ABC1 | 8.79E-06 | 0.000319499 | 0.320312739 | SYK->CBL->EGFR->UBC->TP53->ABC1 | 45 | 0.00285 |
| SLC2A3 | A1CF | 6.63E-10 | 1.26E-07 | -0.434194713 | SLC2A3->SP1->MYC->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 220 | 0.0029 |
| PTGER1 | MTMR3 | 5.36E-10 | 1.09E-07 | -0.436316723 | PTGER1->BDKRB2->KNG1->EGF->SRC->PTK2->PTEN->INPP4B->MTMR3 | 205 | 0.0029 |
| SLC22A18 | CYP2J2 | 2.03E-08 | 2.27E-06 | 0.397960612 | SLC22A18->CDKN1C->CDK4->RB1->TP53->KAT5->PLA2G4A->CYP2J2 | 118 | 0.0029 |
| SAV1 | BCL11A | 1.55E-08 | 1.82E-06 | -0.400935861 | SAV1->RASSF1->HRAS->RAF1->HSP90AA1->ESR1->NCOA2->BCL11A | 127 | 0.0029 |
| PTGER1 | SOS2 | 8.16E-07 | 4.76E-05 | -0.353205254 | PTGER1->BDKRB2->KNG1->EGF->GRB2->SOS2 | 65 | 0.00295 |
| CHST2 | CD2 | 2.63E-10 | 5.97E-08 | 0.443282043 | CHST2->SELL->CD34->MYB->CREBBP->RELA->NFKBIA->LCK->CD2 | 258 | 0.00295 |
| NOP10 | C18orf10 | 6.35E-09 | 8.63E-07 | 0.410752447 | NOP10->DKC1->RUVBL1->CTNNB1->BTRC->NFKBIA->NFKB1->C18orf10 | 141 | 0.00295 |
| RNF43 | CD55 | 2.57E-09 | 4.04E-07 | -0.420360281 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->SYK->CD19->CR2->C3->CD55 | 154 | 0.00295 |
| SERPIN2 | PIK3AP1 | 9.96E-07 | 5.60E-05 | 0.350590435 | SERPIN2->PLAU->JUN->MAPK8->IRS1->PIK3R1->PIK3AP1 | 62 | 0.003 |
| RNF43 | KLRD1 | 1.22E-08 | 1.47E-06 | -0.40361282 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->SYK->TYROBP->KLRD1 | 138 | 0.003 |
| SATB2 | PIK3AP1 | 1.65E-08 | 1.90E-06 | -0.400284705 | SATB2->HOXA2->CD1D->B2M->CD8A->LCK->LCP2->GRB2->PIK3R1->PIK3AP1 | 130 | 0.003 |
| SERPIN2 | UPP1 | 5.59E-06 | 0.000224908 | 0.32687245 | SERPIN2->PLAU->JUN->MAPK8->TP53->RRM2B->RRM1->RRM2->TYMS->TK1->CDA->TYMP->UPP1 | 50 | 0.00305 |
| PRF1 | ZFH3 | 3.18E-06 | 0.000142113 | -0.334872349 | PRF1->GZMB->CASP3->BCL2->MYB->ZFH3 | 51 | 0.00305 |
| SLC2A3 | HMOX1 | 9.07E-10 | 1.67E-07 | 0.431046743 | SLC2A3->SP1->HIF1A->HMOX1 | 191 | 0.0031 |
| SATB2 | CRYZ | 9.28E-09 | 1.18E-06 | -0.406633202 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->RAC1->NCF2->DECR1->CRYZ | 142 | 0.0031 |
| CEACAM1 | ARHGEF19 | 1.31E-05 | 0.000440523 | 0.314456561 | CEACAM1->PTPN11->GRB2->ERBB2->CTNNB1->DVL1->DAAM1->ARHGEF19 | 45 | 0.00315 |
| GAS1 | FPR1 | 4.54E-06 | 0.000190213 | 0.329840769 | GAS1->SHH->FGF8->FGFR1->PLCG1->EGFR->UBC->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 51 | 0.00315 |
| PRF1 | THEMIS | 1.10E-09 | 1.96E-07 | 0.429092498 | PRF1->CD8A->IL2->THEMIS | 190 | 0.00315 |
| NOP10 | BCL11A | 6.51E-07 | 3.94E-05 | -0.356140856 | NOP10->DKC1->RUVBL1->CTNNB1->AR->NCOA2->BCL11A | 73 | 0.00315 |
| PSMB9 | APBB1IP | 3.49E-06 | 0.000152772 | 0.33354619 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->SRC->PTK2->TLN1->APBB1IP | 54 | 0.00315 |
| SYK | ETV6 | 1.86E-05 | 0.000585892 | 0.309072401 | SYK->CBL->SHC1->JAK2->ETV6 | 43 | 0.00315 |
| RNF43 | CD69 | 3.01E-08 | 3.10E-06 | -0.393472713 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->IL2->CD69 | 126 | 0.00315 |
| SLC11A1 | BCL11A | 6.72E-07 | 4.03E-05 | -0.355745355 | SLC11A1->ZBTB17->MYC->ESR1->NCOA2->BCL11A | 75 | 0.0032 |
| GAS1 | CYP2J2 | 6.39E-07 | 3.88E-05 | -0.356383733 | GAS1->SHH->FGF8->FGFR1->PLCG1->EGFR->UBC->TP53->KAT5->PLA2G4A->CYP2J2 | 75 | 0.0032 |
| IGHD | SLA | 4.56E-09 | 6.63E-07 | 0.414302207 | IGHD->GHRH->GCG->LEP->STAT3->EP300->MYOD1->TCF3->TAL1->LMO2->LDB1->LHX3->IFT172->SLA | 160 | 0.0032 |

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|----------|----------|----------|-------------|--------------|--|-----|---------|
| CEACAM1 | FPR1 | 7.88E-06 | 0.000292549 | -0.321910795 | CEACAM1->PTPN11->EGFR->UBC->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 51 | 0.00325 |
| GAS1 | HAS2 | 1.91E-08 | 2.17E-06 | 0.398608935 | GAS1->SHH->NOG->BMP2->HAS2 | 140 | 0.00325 |
| SERPINB2 | ARHGEF19 | 2.75E-05 | 0.000796636 | -0.30309113 | SERPINB2->PLAU->NFKB1->NFKBIA->BTRC->CTNNB1->DVL1->DAAM1->ARHGEF19 | 40 | 0.00325 |
| SERPINB2 | NT5E | 6.61E-06 | 0.00025608 | 0.324477614 | SERPINB2->PLAU->JUN->MAPK8->TP53->USP7->GMPS->IMPDH2->NT5E | 52 | 0.00325 |
| MAP7D1 | CD69 | 3.52E-08 | 3.56E-06 | 0.391681182 | MAP7D1->ARTN->GFRA1->RET->SHC1->IL2->CD69 | 128 | 0.00325 |
| MMP8 | CCL18 | 5.34E-09 | 7.43E-07 | 0.412604679 | MMP8->TIMP2->MMP2->JUN->IL2->CD8A->CD4->CCR5->CCL13->CCR3->CCL18 | 166 | 0.0033 |
| ANGPTL4 | GNA11 | 1.53E-06 | 7.90E-05 | -0.344863457 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->ERBB2->GRB2->RET->GDNF->EDNRB->GNA11 | 67 | 0.0033 |
| ANGPTL4 | SHANK2 | 2.31E-06 | 0.000109451 | -0.339297883 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->CCND1->CDKN1B->AKT1->MTOR->FKBP1A->RYR1->HOMER1->SHANK2 | 61 | 0.0033 |
| SALL2 | SMAD7 | 3.58E-05 | 0.000979496 | 0.298906045 | SALL2->NGFR->SHC1->ERBB2->CTNNB1->SMAD7 | 39 | 0.0033 |
| GAS1 | GALNT1 | 5.58E-06 | 0.000224569 | 0.326912518 | GAS1->SHH->FGF8->FGFR1->FRS2->GRB2->LCP2->LCK->CD2->CD2BP2->SF3A2->SNRPE->LSM4->EXOSC10->CHPF->GALNT1 | 58 | 0.00335 |
| GAS1 | SCML1 | 3.30E-08 | 3.38E-06 | -0.392415629 | GAS1->SHH->FGF8->FGFR1->PLCG1->EGFR->UBC->TP53->HDAC1->SIN3A->MECP2->CDKL5->NHS->SCML1 | 139 | 0.00335 |
| ANGPTL4 | FZD8 | 1.55E-05 | 0.000509266 | -0.311829266 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->AXIN1->LRP6->FZD8 | 45 | 0.00335 |
| MAP7D1 | A1CF | 2.19E-08 | 2.40E-06 | -0.397108707 | MAP7D1->ARTN->GFRA1->RET->GRB2->ERBB2->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 143 | 0.00335 |
| CASP1 | IDH2 | 7.48E-06 | 0.00028325 | 0.322678021 | CASP1->IL18->IFNG->IL2->STAT3->SRC->CTNNB1->PITX2->SUCLG1->SDHB->FH->MDH2->CS->ACO2->IDH2 | 54 | 0.00335 |
| SALL2 | HMOX1 | 2.93E-05 | 0.000841524 | 0.302060706 | SALL2->NGFR->SHC1->EGFR->UBC->HIF1A->HMOX1 | 41 | 0.0034 |
| SLC2A3 | PIK3AP1 | 1.15E-09 | 2.02E-07 | 0.428643966 | SLC2A3->SP1->ESR1->IGF1R->PIK3R1->PIK3AP1 | 242 | 0.00345 |
| APOBEC1 | KLRD1 | 1.05E-05 | 0.00036853 | -0.317637598 | APOBEC1->APOB->LDLR->APOE->APP->PSEN1->CTNNB1->ERBB2->GRB2->VAV1->SYK->TYROBP->KLRD1 | 51 | 0.00345 |
| PIGR | PTPRH | 4.08E-06 | 0.000173089 | 0.331365798 | PIGR->CD79A->BLNK->GRB2->MAPK1->ELK1->SRF->PTPRH | 60 | 0.00345 |
| C18orf1 | SMAD7 | 6.32E-08 | 5.81E-06 | 0.384899701 | C18orf1->TGFB1->FN1->TGFB1->TGFB1->SMAD7 | 118 | 0.00345 |
| SERPINB2 | FCGR3B | 4.57E-06 | 0.000190801 | 0.329740185 | SERPINB2->PLAU->JUN->MAPK8->IRS1->PIK3R1->CBL->SYK->FCER1G->FCGR3B | 59 | 0.0035 |
| PTGER3 | MARCKS | 3.39E-06 | 0.000149655 | 0.333972228 | PTGER3->KNG1->EGF->SRC->GJA1->PRKCA->MARCKS | 61 | 0.0035 |
| PSMB9 | PIK3AP1 | 3.05E-06 | 0.000137774 | 0.335429183 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->GRB2->PIK3R1->PIK3AP1 | 61 | 0.0035 |
| HSPB1 | ATP6V1E1 | 1.56E-07 | 1.19E-05 | 0.374080781 | HSPB1->MAPKAPK2->MAPK14->CREB1->EP300->RELA->CHUK->TRAF2->TNFRSF11A->TNFSF11->TCIRG1->ATP6V1B1->ATP6V1D->ATP6V1A->ATP6V1E1 | 97 | 0.00355 |
| SERPINB2 | MID1 | 1.06E-06 | 5.86E-05 | -0.34978638 | SERPINB2->PLAU->JUN->RUNX2->SP7->MID1 | 77 | 0.00355 |
| NOP10 | FCGR3B | 6.15E-06 | 0.000242377 | 0.325505349 | NOP10->DKC1->TERT->AKT1->RAC1->VAV1->SYK->FCER1G->FCGR3B | 59 | 0.00355 |
| NOP10 | SUV420H1 | 8.79E-08 | 7.45E-06 | -0.380994186 | NOP10->DKC1->RUVBL1->CTNNB1->AR->NCOA2->SUV420H1 | 110 | 0.0036 |
| FCRL5 | HLA-DRA | 1.14E-07 | 9.20E-06 | 0.377903932 | FCRL5->BCL9->CTNNB1->CCND1->CREB1->CIITA->HLA-DRA | 106 | 0.0036 |
| MAP7D1 | GFPT1 | 6.72E-09 | 9.02E-07 | -0.410142671 | MAP7D1->ARTN->GFRA1->RET->SHC1->EGFR->UBC->TP53->ATF3->ATF4->ASNS->GLUL->GFPT1 | 169 | 0.0036 |
| SLC11A1 | SLA | 6.49E-08 | 5.92E-06 | 0.384574921 | SLC11A1->ZBTB17->MYC->SP1->HDAC1->TAL1->LMO2->LDB1->LHX3->IFT172->SLA | 128 | 0.00365 |
| GAS1 | ABCB1 | 1.03E-05 | 0.000361709 | -0.317964492 | GAS1->SHH->FGF8->FGFR1->PLCG1->EGFR->UBC->TP53->ABCB1 | 55 | 0.00365 |
| ANGPTL4 | BCL11A | 1.16E-07 | 9.36E-06 | -0.377625227 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->AR->NCOA2->BCL11A | 107 | 0.00365 |
| PITX1 | LPHN2 | 5.90E-08 | 5.53E-06 | -0.385694506 | PITX1->LHB->LHCGR->ARRB2->MAPK1->MYC->EP300->SMAD2->TGFB1->FKBP1A->RYR1->HOMER1->SHANK2->LPHN2 | 132 | 0.00365 |

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| EEF1B2 | KCNQ2 | 3.38E-07 | 2.33E-05 | 0.36450214 | EEF1B2->RPL6->RPL5->MDM2->AKT1->RAC1->IQGAP1->CALM1->KCNQ2 | 88 | 0.0037 |
| NFIB | HMOX1 | 9.84E-06 | 0.000349017 | -0.318658126 | NFIB->HNF1A->HNF4A->SMAD4->SMAD2->EP300->HIF1A->HMOX1 | 58 | 0.0037 |
| SLC11A1 | SUV420H1 | 1.00E-07 | 8.31E-06 | -0.379434349 | SLC11A1->ZBTB17->MYC->ESR1->NCOA2->SUV420H1 | 112 | 0.00375 |
| IGHD | PIK3AP1 | 2.34E-07 | 1.69E-05 | 0.369109163 | IGHD->GHRH->GCG->LEP->STAT3->JAK2->SHC1->PIK3R1->PIK3AP1 | 97 | 0.00375 |
| RNF43 | SHANK2 | 8.01E-08 | 6.96E-06 | 0.382101602 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->LCP2->VAV1->RAC1->AKT1->MTOR->FKBP1A->RYR1->HOMER1->SHANK2 | 128 | 0.00375 |
| COL4A5 | CASP9 | 2.34E-05 | 0.00070028 | 0.305562692 | COL4A5->COL4A3->COL4A4->IGBP1->PPP2CA->SGOL1->PLK1->CDC25C->CHEK2->TP53->APAF1->CASP9 | 46 | 0.00385 |
| COL4A5 | KCNQ2 | 1.25E-06 | 6.75E-05 | 0.347534523 | COL4A5->COL4A3->COL4A4->IGBP1->PPP2CA->SGOL1->PLK1->CDC25C->CHEK2->TP53->EP300->CREB1->CAMK2B->CALM1->KCNQ2 | 79 | 0.00385 |
| MAVS | SLA | 9.12E-08 | 7.67E-06 | -0.380553125 | MAVS->IRF3->CREBBP->TP53->BRCA1->RBBP8->LMO4->LDB1->LHX3->IFT172->SLA | 125 | 0.0039 |
| CCL7 | SLA | 1.06E-07 | 8.66E-06 | 0.378714623 | CCL7->CCR1->CCL5->NFKB1->RELA->HDAC1->TAL1->LMO2->LDB1->LHX3->IFT172->SLA | 126 | 0.00395 |
| PTGER1 | RASGRP2 | 1.01E-07 | 8.33E-06 | 0.379316859 | PTGER1->BDKRB2->KNG1->EGF->EGFR->SOS1->HRAS->RAF1->KRAS->RASGRP2 | 126 | 0.00395 |
| CXCL14 | C18orf10 | 1.79E-09 | 2.97E-07 | -0.424136403 | CXCL14->CXCR4->CD4->LCK->NFKBIA->NFKB1->C18orf10 | 275 | 0.00395 |
| IGKC | HLA-DRA | 1.70E-05 | 0.000543441 | 0.31048081 | IGKC->ERBB4->EGF->SRC->ESR1->EP300->CREB1->CIITA->HLA-DRA | 50 | 0.00395 |
| PGRMC1 | UPP1 | 1.14E-07 | 9.20E-06 | -0.377935065 | PGRMC1->M6PR->IGF1->IRS1->MAPK8->TP53->RRM2B->RRM1->RRM2->TYMS->TK1->CDA->TYMP->UPP1 | 126 | 0.004 |
| CYP4F2 | JAK2 | 1.98E-06 | 9.70E-05 | -0.341347671 | CYP4F2->PTGS2->IL6->STAT3->JAK2 | 78 | 0.00405 |
| FCRL5 | THEMIS | 3.16E-09 | 4.83E-07 | 0.418170204 | FCRL5->BCL9->CTNNB1->CCND1->STAT3->IL2->THEMIS | 272 | 0.0041 |
| CASP1 | RASGEF1B | 9.27E-09 | 1.18E-06 | 0.406641905 | CASP1->IL18->IFNG->IL2->STAT3->RAC1->ARHGDI1->RHOA->ROCK2->PPP1R12A->PRKG1->MRV1->PRKG2->RASGEF1B | 179 | 0.0041 |
| SATB2 | SCML1 | 8.21E-09 | 1.07E-06 | 0.407971543 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->EP300->TP53->HDAC1->SIN3A->MECP2->CDKL5->NHS->SCML1 | 201 | 0.0041 |
| ANGPTL4 | CRIM1 | 7.71E-08 | 6.79E-06 | -0.382547341 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->SMAD4->SMAD1->BMPR1A->BMP4->CRIM1 | 141 | 0.00415 |
| NOP10 | CCL18 | 1.89E-06 | 9.33E-05 | 0.341987632 | NOP10->DKC1->RUVB1->CTNNB1->BTRC->NFKBIA->NFKB1->CCL5->CCR3->CCL18 | 79 | 0.00415 |
| RNF43 | ENPP3 | 7.10E-09 | 9.45E-07 | 0.40954811 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->IL2->IL5->IL3->ENPP3 | 208 | 0.00415 |
| NFIB | FCGR3B | 2.71E-07 | 1.94E-05 | -0.367260031 | NFIB->HNF1A->HNF4A->SMAD4->SMAD2->EP300->STAT3->EGFR->CBL->SYK->FCER1G->FCGR3B | 105 | 0.0042 |
| SLC2A3 | CXCL13 | 1.24E-08 | 1.48E-06 | 0.403423543 | SLC2A3->SP1->EP300->STAT1->CXCL9->CXCR3->CXCL13 | 199 | 0.00425 |
| CEACAM1 | SPINK5 | 1.76E-08 | 2.00E-06 | 0.399540856 | CEACAM1->PTPN11->GRB2->ERBB2->CTNNB1->CDH1->JUP->DSG1->KLK5->SPINK5 | 192 | 0.00425 |
| CCL7 | CRIM1 | 3.11E-07 | 2.17E-05 | -0.365556417 | CCL7->CCR5->CD4->IFNG->IFNGR1->STAT1->EP300->SMAD2->SMAD4->SMAD1->BMPR1A->BMP4->CRIM1 | 105 | 0.00425 |
| NOP10 | CTSA | 6.07E-06 | 0.000239818 | -0.325694638 | NOP10->DKC1->TERT->AKT1->TSC2->YWHAZ->GP1BA->F2->GLA->GLB1->CTSA | 68 | 0.00425 |
| PIGR | CD177 | 1.97E-06 | 9.62E-05 | 0.341483242 | PIGR->CD79A->BLNK->GRB2->MAPK1->JUN->SPI1->PRTN3->CD177 | 80 | 0.00425 |
| MAP7D1 | UPP1 | 5.75E-08 | 5.41E-06 | 0.385993048 | MAP7D1->ARTN->GFRA1->RET->SHC1->EGFR->UBC->TP53->RRM2B->RRM1->RRM2->TYMS->TK1->CDA->TYMP->UPP1 | 154 | 0.00425 |
| MAVS | GFPT1 | 1.09E-05 | 0.000378441 | 0.317161671 | MAVS->IRF3->CREBBP->TP53->ATF3->ATF4->ASNS->GLUL->GFPT1 | 64 | 0.00425 |
| SLC2A3 | PIK3CG | 1.93E-08 | 2.17E-06 | 0.398540596 | SLC2A3->SP1->ESR1->AKT1->PIK3CG | 193 | 0.0043 |
| PGRMC1 | FPR1 | 1.76E-07 | 1.31E-05 | -0.372632759 | PGRMC1->M6PR->IGF1->IRS1->MAPK8->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 120 | 0.0043 |
| PLEKHB1 | KCNQ2 | 4.06E-09 | 6.01E-07 | 0.415546597 | PLEKHB1->SELPLG->SELE->NFKB1->RELA->EP300->CREB1->CAMK2B->CALM1->KCNQ2 | 298 | 0.0043 |

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|------------|---------|----------|-------------|--------------|---|-----|---------|
| ZC3H12A | ASS1 | 3.68E-05 | 0.000997589 | 0.298463881 | ZC3H12A->CCL2->CCR5->CD4->LCK->LCP2->VAV1->RAC1->AKT1->NOS3->ARG2->OTC->ASS1 | 45 | 0.0043 |
| MAP7D1 | KANK4 | 7.75E-09 | 1.01E-06 | 0.408587537 | MAP7D1->ARTN->GFRA1->RET->SHC1->EGFR->UBC->TP53->TBP->POLR2A->POLR2H->POLR3D->POLR3F->POLR3C->KANK4 | 233 | 0.0043 |
| CDON | PURB | 1.15E-06 | 6.28E-05 | -0.348687667 | CDON->CDH2->CTNNB1->SRC->VCL->TPM1->TNNT2->MYBPC3->MYH6->PURB | 86 | 0.0043 |
| IGJ | CD177 | 1.49E-07 | 1.15E-05 | 0.37463569 | IGJ->IL2->JUN->SPI1->PRTN3->CD177 | 129 | 0.00435 |
| SERPINB2 | MYEF2 | 2.83E-05 | 0.000817135 | -0.302607847 | SERPINB2->PLAU->NFKB1->RELA->HDAC1->SIN3A->HDAC9->MYEF2 | 48 | 0.0044 |
| CXCL14 | JAK2 | 8.99E-08 | 7.58E-06 | -0.380728109 | CXCL14->CXCR4->CD4->LCK->PTPN6->JAK2 | 143 | 0.0044 |
| IGHD | ACCN2 | 2.00E-05 | 0.000618861 | -0.307975304 | IGHD->GHRH->GCG->LEP->STAT3->SRC->GJA1->PRKCA->PICK1->ACCN2 | 58 | 0.0044 |
| CEACAM1 | GFPT1 | 5.60E-06 | 0.000225004 | 0.326847894 | CEACAM1->PTPN11->IRS1->MAPK8->JUN->ATF3->ATF4->ASNS->GLUL->GFPT1 | 72 | 0.00445 |
| PTGER1 | RUNDC3A | 5.19E-08 | 4.96E-06 | -0.387202742 | PTGER1->BDKRB2->KNG1->EGF->EGFR->NCK1->TNIK->RAP2A->RUNDC3A | 165 | 0.00445 |
| RB1CC1 | UPP1 | 6.36E-06 | 0.000247997 | -0.325030505 | RB1CC1->PTK2->PTEN->TP53->RRM2B->RRM1->RRM2->TYMS->TK1->CDA->TYMP->UPP1 | 71 | 0.0045 |
| PTGER1 | HMOX1 | 7.42E-06 | 0.000281735 | 0.322791307 | PTGER1->BDKRB2->KNG1->EGF->EGFR->UBC->HIF1A->HMOX1 | 70 | 0.0045 |
| VIP | SPINK5 | 1.68E-08 | 1.93E-06 | 0.400085759 | VIP->VIPR1->ADCYAP1->ADCYAP1R1->GCG->LEP->STAT3->SRC->CTNNB1->CDH5->JUP->DSG1->KLF5->SPINK5 | 213 | 0.0045 |
| MAP7D1 | CCL18 | 3.36E-08 | 3.42E-06 | 0.392234765 | MAP7D1->ARTN->GFRA1->RET->GRB2->LCP2->LCK->CD4->CCR5->CCL13->CCR3->CCL18 | 178 | 0.00455 |
| MAP7D1 | KLRD1 | 1.39E-07 | 1.09E-05 | 0.3755209 | MAP7D1->ARTN->GFRA1->RET->GRB2->VAV1->SYK->TYROBP->KLRD1 | 139 | 0.00455 |
| APOBEC1 | ETV6 | 1.83E-05 | 0.000577808 | 0.309315233 | APOBEC1->APOB->LDLR->APOE->APP->PSEN1->CTNNB1->ERBB2->GRB2->JAK2->ETV6 | 61 | 0.0046 |
| EEF1B2 | MARCKS | 1.79E-05 | 0.000566706 | -0.309672663 | EEF1B2->RPL6->RPL5->MDM2->AKT1->RAC1->PAK1->CDC42->PLD1->PRKCA->MARCKS | 61 | 0.0046 |
| LEPRE1 | KANK4 | 1.01E-07 | 8.33E-06 | 0.379358448 | LEPRE1->PPIB->BSG->MMP1->JUN->MAPK8->TP53->TBP->POLR2A->POLR2H->POLR3D->POLR3F->POLR3C->KANK4 | 147 | 0.0046 |
| CHST2 | KLRD1 | 8.32E-09 | 1.08E-06 | 0.407819429 | CHST2->SELL->CD34->MYB->CREBBP->TP53->UBC->EGFR->CBL->SYK->TYROBP->KLRD1 | 285 | 0.0046 |
| GAS1 | ST3GAL1 | 9.29E-08 | 7.79E-06 | 0.380337648 | GAS1->SHH->FGF8->FGFR2->FGF23->GALNT3->GCNT1->ST3GAL1 | 152 | 0.00465 |
| GAS1 | GFPT1 | 7.76E-06 | 0.000289707 | -0.322147554 | GAS1->SHH->FGF8->FGFR1->PLCG1->EGFR->UBC->TP53->ATF3->ATF4->ASNS->GLUL->GFPT1 | 72 | 0.00465 |
| SERPINB2 | CCL18 | 5.67E-06 | 0.000227478 | 0.326672778 | SERPINB2->PLAU->NFKB1->CCL5->CCR3->CCL18 | 75 | 0.00465 |
| FCRL5 | ZAP70 | 1.28E-06 | 6.86E-05 | 0.347281181 | FCRL5->BCL9->CTNNB1->ERBB2->GRB2->LCP2->ZAP70 | 88 | 0.00465 |
| C19orf61 | MARCKS | 6.56E-06 | 0.000254633 | -0.324581454 | C19orf61->UPF1->UPF2->LSM1->LSM7->SNRPD3->SF3A2->CD2BP2->CD2->LCK->LCP2->GRB2->WASL->CDC42->PLD1->PRKCA->MARCKS | 74 | 0.0047 |
| LEPRE1 | FPR1 | 1.98E-05 | 0.000615484 | 0.308131483 | LEPRE1->PPIB->BSG->MMP1->JUN->MAPK8->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 62 | 0.00475 |
| CHST2 | CXCL13 | 9.29E-09 | 1.18E-06 | 0.406622037 | CHST2->SELL->CD34->MYB->CREBBP->RELA->NFKB1->CCL5->CCR3->CCL11->CXCR3->CXCL13 | 267 | 0.00475 |
| SLC11A1 | CLEC4E | 1.14E-08 | 1.39E-06 | 0.404334566 | SLC11A1->ZBTB17->MYC->EP300->RELA->IKKB->BCL10->CARD9->CLEC4E | 270 | 0.0048 |
| CXCL14 | A1CF | 4.62E-08 | 4.53E-06 | 0.388543355 | CXCL14->CXCR4->CD4->LCK->LCP2->GRB2->ERBB2->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 177 | 0.00485 |
| SLC11A1 | UPP1 | 3.24E-05 | 0.000903817 | 0.300500114 | SLC11A1->ZBTB17->MYC->EP300->TP53->RRM2B->RRM1->RRM2->TYMS->TK1->CDA->TYMP->UPP1 | 53 | 0.0049 |
| HSPB1 | IDH2 | 3.06E-05 | 0.000868814 | -0.301402532 | HSPB1->MAPKAPK2->MAPK14->CREB1->CCND1->CTNNB1->PITX2->SUCLG1->SDHB->FH->MDH2->CS->ACO2->IDH2 | 53 | 0.0049 |
| GADD45GIP1 | COPA | 2.76E-06 | 0.000126612 | -0.336797846 | GADD45GIP1->GADD45G->PCNA->CCND1->CTNNB1->SRC->GNB2L1->PRKCE->COPB2->COPB1->COPA | 83 | 0.0049 |
| PIGR | IDH2 | 2.72E-05 | 0.000791871 | 0.303228246 | PIGR->CD79A->BLNK->GRB2->ERBB2->CTNNB1->PITX2->SUCLG1->SDHB->FH->MDH2->CS->ACO2->IDH2 | 55 | 0.0049 |

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| CD79A | RASGRP2 | 1.73E-05 | 0.000549464 | 0.310220262 | CD79A->BLNK->GRB2->PIK3R1->PIK3CA->KRAS->RASGRP2 | 66 | 0.00505 |
| ANGPTL4 | GFPT1 | 1.14E-06 | 6.23E-05 | -0.348843917 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->GSK3B->TP53->ATF3->ATF4->ASNS->GLUL->GFPT1 | 101 | 0.00505 |
| AKR1C3 | ESRRG | 2.42E-05 | 0.000721475 | 0.305027128 | AKR1C3->PTGDS->PTGS2->IL6->STAT3->EP300->SIRT1->PPARGC1A->ESRRG | 62 | 0.00505 |
| SERPINB2 | CRIM1 | 9.84E-07 | 5.56E-05 | -0.350751563 | SERPINB2->PLAU->JUN->SMAD4->SMAD1->BMPR1A->BMP4->CRIM1 | 104 | 0.0051 |
| HLA-DQB2 | CD2 | 5.56E-07 | 3.48E-05 | 0.358177996 | HLA-DQB2->ZFYE9->SMAD2->EP300->STAT3->IL2->LCK->CD2 | 109 | 0.0051 |
| MAVS | CLEC4E | 2.27E-08 | 2.48E-06 | -0.39666576 | MAVS->IRF3->CREBBP->RELA->IKKBK->BCL10->CARD9->CLEC4E | 266 | 0.0051 |
| MAVS | PIK3AP1 | 2.06E-05 | 0.000632555 | -0.307548699 | MAVS->IRF3->CREBBP->TP53->MAPK8->IRS1->PIK3R1->PIK3AP1 | 63 | 0.0051 |
| RB1CC1 | SLITRK6 | 2.52E-08 | 2.69E-06 | -0.395527871 | RB1CC1->PTK2->GRB2->NTRK1->SLITRK6 | 259 | 0.00515 |
| PTGER1 | PURB | 2.84E-07 | 2.01E-05 | -0.366683023 | PTGER1->BDKRB2->KNG1->EGF->SRC->VCL->TPM1->TNNT2->MYBPC3->MYH6->PURB | 134 | 0.00515 |
| CXCL14 | SLC25A11 | 2.97E-08 | 3.08E-06 | -0.393633577 | CXCL14->CXCR4->CD4->IFNG->IL2->STAT3->EP300->TP53->BCL2->BNIP3->BCKDHB->DLD->OGDH->SLC25A11 | 250 | 0.00515 |
| FCRL5 | SLA | 4.50E-08 | 4.43E-06 | 0.388859956 | FCRL5->BCL9->CTNNB1->TCF4->TAL1->LMO2->LDB1->LHX3->IFT172->SLA | 203 | 0.00515 |
| IGKC | CLEC2D | 1.98E-08 | 2.22E-06 | 0.398235809 | IGKC->ERBB4->EGF->EGFR->UBC->RIPK1->TRAF2->TNFRSF11A->TNFSF11->CLEC2D | 294 | 0.00515 |
| NOP10 | VNN2 | 9.00E-08 | 7.58E-06 | 0.380717677 | NOP10->DKC1->RUVBL1->CTNNB1->BTRC->NFKBIA->NFKB1->ICAM1->ITGB2->VNN2 | 170 | 0.0052 |
| PARVA | KANK4 | 4.13E-07 | 2.73E-05 | 0.361977094 | PARVA->ILK->AKT1->MDM2->TP53->TBP->POLR2A->POLR2H->POLR3D->POLR3F->POLR3C->KANK4 | 127 | 0.0052 |
| RNF43 | HMOX1 | 4.81E-07 | 3.09E-05 | -0.360033968 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->HIF1A->HMOX1 | 115 | 0.0052 |
| CDON | RASGRP2 | 1.02E-05 | 0.000358379 | 0.318167154 | CDON->SHH->FGF8->FGFR1->FRS2->PTPN11->KRAS->RASGRP2 | 77 | 0.00525 |
| PITX1 | MARCKS | 2.49E-05 | 0.000738711 | -0.304587286 | PITX1->LHB->LHCGR->ARRB2->MAPK1->GRB2->WASL->CDC42->PLD1->PRKCA->MARCKS | 63 | 0.00525 |
| MAP7D1 | TFCP2 | 5.02E-07 | 3.20E-05 | -0.359506183 | MAP7D1->ARTN->GFRA1->RET->SHC1->EGFR->STAT3->EP300->YY1->TFCP2 | 118 | 0.0053 |
| HSPB1 | NUPR1 | 4.89E-06 | 0.000200576 | 0.328804581 | HSPB1->MAPKAPK2->MAPK14->ATF2->MAPK8->TP53->NUPR1 | 83 | 0.0054 |
| MAGT1 | FCGR3B | 6.22E-08 | 5.77E-06 | -0.385084259 | MAGT1->DDOST->SSR4->RPS5->RPL5->MDM2->AKT1->RAC1->VAV1->SYK->FCER1G->FCGR3B | 203 | 0.0054 |
| CD79A | CD177 | 1.29E-05 | 0.000435268 | 0.314652442 | CD79A->BLNK->GRB2->MAPK1->JUN->SPI1->PRTN3->CD177 | 76 | 0.0055 |
| ANGPTL4 | ESRRG | 2.09E-05 | 0.000638861 | -0.307321 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->GSK3B->TP53->SIRT1->PPARGC1A->ESRRG | 68 | 0.0055 |
| VIP | RPRM | 1.92E-06 | 9.43E-05 | 0.341771094 | VIP->VIPR1->ADCYAP1->POMC->NR4A1->BCL2->TP53->RPRM | 101 | 0.0055 |
| PSMB9 | CLEC4E | 3.90E-08 | 3.90E-06 | 0.390514114 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->IKBK->BCL10->CARD9->CLEC4E | 266 | 0.00555 |
| CD79A | CLEC2D | 4.10E-08 | 4.07E-06 | 0.389933614 | CD79A->BLNK->GRB2->EGFR->UBC->RIPK1->TRAF2->TNFRSF11A->TNFSF11->CLEC2D | 270 | 0.0056 |
| SATB2 | ARHGEF19 | 1.38E-06 | 7.30E-05 | 0.346225502 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->SRC->CTNNB1->DVL1->DAAM1->ARHGEF19 | 108 | 0.00565 |
| PTGER1 | SNAPIN | 3.77E-06 | 0.000161877 | 0.332481584 | PTGER1->BDKRB2->KNG1->EGF->EGFR->PLCG1->PDGFRB->SLC9A3R1->CFTR->STX1A->SNAP25->SNAPIN | 87 | 0.00575 |
| SERPINB2 | CRYZ | 1.55E-05 | 0.000509266 | 0.311826181 | SERPINB2->PLAU->JUN->IL2->STAT3->RAC1->NCF2->DECR1->CRYZ | 76 | 0.0058 |
| CHST2 | TNFRSF1B | 5.64E-08 | 5.33E-06 | 0.386232005 | CHST2->SELL->CD34->MYB->CREBBP->RELA->CHUK->TRAF2->TNFRSF1B | 255 | 0.00585 |
| MAP7D1 | FCGR3B | 2.35E-07 | 1.69E-05 | 0.369058127 | MAP7D1->ARTN->GFRA1->RET->GRB2->VAV1->SYK->FCER1G->FCGR3B | 159 | 0.00585 |
| MBNL2 | ITGA6 | 1.54E-06 | 7.93E-05 | 0.344796627 | MBNL2->CCT3->PPP2CA->SGOL1->PLK1->CDC25C->CHEK2->TP53->PTEN->PTK2->PXN->ITGA4->ITGB1->ITGA6 | 110 | 0.00585 |
| PGRMC1 | VNN2 | 6.43E-08 | 5.88E-06 | -0.384692931 | PGRMC1->M6PR->PLIN3->IGF2R->PLAUR->PLG->FN1->ITGB1->ITGA8->ITGB2->VNN2 | 243 | 0.0059 |
| PTGER1 | LMBR1L | 9.88E-07 | 5.57E-05 | 0.350691779 | PTGER1->BDKRB2->KNG1->KLBK1->A2M->LYZ->LCN1- | 114 | 0.0059 |

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| | | | | | >LMBR1L | | |
| CASP1 | CLEC2D | 5.48E-08 | 5.19E-06 | 0.386571791 | CASP1->IL18->IL1B->NFKB1->CHUK->TRAF2->TNFRSF11A->TNFSF11->CLEC2D | 270 | 0.0059 |
| IGKC | TOX2 | 7.24E-08 | 6.47E-06 | 0.383285204 | IGKC->ERBB4->EGF->EGFR->UBC->TP53->BCL2->NR4A1->ZNF461->TOX2 | 231 | 0.00595 |
| RPS2 | CTSA | 3.24E-05 | 0.000904596 | -0.300470286 | RPS2->RPS3->RPL5->MDM2->AKT1->TSC2->YWHAZ->GP1BA->F2->GLA->GLB1->CTSA | 68 | 0.006 |
| SLC2A3 | CYP2J2 | 7.52E-08 | 6.64E-06 | -0.382845305 | SLC2A3->SP1->TP53->KAT5->PLA2G4A->CYP2J2 | 246 | 0.00605 |
| PGRMC1 | TFCP2 | 3.81E-06 | 0.000163285 | 0.332340611 | PGRMC1->M6PR->IGF1->IGF1R->ESR1->EP300->YY1->TFCP2 | 90 | 0.00605 |
| RABGEF1 | RASGRP2 | 2.35E-05 | 0.000703186 | -0.305483827 | RABGEF1->RABEP1->RAB5A->EGFR->SOS1->HRAS->RAF1->KRAS->RASGRP2 | 72 | 0.0061 |
| SAV1 | MYEF2 | 2.69E-06 | 0.00012368 | -0.337162482 | SAV1->RASSF1->HRAS->PIK3CA->PTEN->TP53->HDAC1->SIN3A->HDAC9->MYEF2 | 103 | 0.0061 |
| SLC2A3 | JAK2 | 1.44E-07 | 1.12E-05 | 0.37507784 | SLC2A3->SP1->EP300->STAT1->JAK2 | 187 | 0.00615 |
| SOX11 | HMOX1 | 6.60E-07 | 3.97E-05 | 0.355964228 | SOX11->BNIP3->BCL2->TP53->HIF1A->HMOX1 | 136 | 0.00615 |
| SOX11 | KANK4 | 7.33E-08 | 6.53E-06 | 0.383146141 | SOX11->BNIP3->BCL2->TP53->TBP->POLR2A->POLR2H->POLR3D->POLR3F->POLR3C->KANK4 | 252 | 0.00615 |
| CRB3 | BCL11A | 4.97E-06 | 0.000203294 | -0.328575624 | CRB3->PARD6A->CDC42->IQGAP1->RAC1->AKT1->ESR1->NCOA2->BCL11A | 91 | 0.00615 |
| ATP2B4 | ATP6V1E2 | 1.21E-06 | 6.52E-05 | -0.348063834 | ATP2B4->CALM1->CAMK2B->CREB1->CREBBP->RELA->CHUK->TRAF2->TNFRSF11A->TNFSF11->TCIRG1->ATP6V1B1->ATP6V1D->ATP6V1A->ATP6V1E2 | 122 | 0.0062 |
| MAVS | SUV420H1 | 2.14E-06 | 0.000102784 | 0.340344408 | MAVS->IRF3->CREBBP->NCOA3->AR->NCOA2->SUV420H1 | 109 | 0.0062 |
| APOBEC1 | SP5 | 5.79E-06 | 0.000230376 | 0.32638113 | APOBEC1->APOB->LDLR->APOE->APP->PSEN1->CTNNB1->SP5 | 91 | 0.00625 |
| TET3 | SNAPIN | 3.35E-07 | 2.31E-05 | -0.364633868 | TET3->NANOG->KLF4->CTNNB1->ERBB2->GRB2->PDGFRB->SLC9A3R1->CFTR->STX1A->SNAP25->SNAPIN | 163 | 0.00625 |
| SATB2 | CRIM1 | 1.89E-07 | 1.40E-05 | 0.371727531 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->EP300->SMAD2->SMAD4->SMAD1->BMPRI1A->BMP4->CRIM1 | 173 | 0.00625 |
| CHRNA3 | ARHGEF19 | 2.70E-05 | 0.000788308 | 0.303342166 | CHRNA3->PSMA4->UCHL5->PSMD4->UBC->TP53->GSK3B->CTNNB1->DVL1->DAAM1->ARHGEF19 | 71 | 0.0063 |
| RNF43 | CCL18 | 2.06E-07 | 1.52E-05 | -0.37065317 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->CD4->CCR5->CCL5->CCR3->CCL18 | 175 | 0.0063 |
| CXCL14 | CRYZ | 1.35E-07 | 1.07E-05 | -0.375846494 | CXCL14->CXCR4->CD4->LCK->LCP2->VAV1->RAC1->NCF2->DECR1->CRYZ | 209 | 0.00635 |
| PGRMC1 | CD2 | 1.07E-05 | 0.000374305 | -0.317374151 | PGRMC1->M6PR->IGF1->IRS1->GRB2->LCP2->LCK->CD2 | 86 | 0.0064 |
| ANGPTL4 | CCL18 | 1.88E-06 | 9.30E-05 | 0.342080948 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->BTRC->NFKBIA->NFKB1->CCL5->CCR3->CCL18 | 113 | 0.0064 |
| NOP10 | DYNC1I2 | 2.54E-05 | 0.000749668 | -0.304312472 | NOP10->DKC1->RUVBL1->KAT5->TP53->CHEK1->CDC25C->PLK1->NUDC->PAFAH1B1->DCTN1->DCTN2->DYNC1I2 | 74 | 0.0064 |
| IGHD | APBB1IP | 8.33E-06 | 0.000306797 | 0.321112596 | IGHD->GHRH->GCG->LEP->STAT3->SRC->PTK2->TLN1->APBB1IP | 89 | 0.0064 |
| PQBP1 | BCL11A | 3.23E-06 | 0.000143955 | 0.334653023 | PQBP1->TXNL4A->CD2BP2->CD2->LCK->ZAP70->SHC1->IGF1R->ESR1->NCOA2->BCL11A | 104 | 0.00645 |
| PRF1 | CLEC2D | 8.31E-08 | 7.11E-06 | 0.381660275 | PRF1->CD8A->LCK->NFKBIA->CHUK->TRAF2->TNFRSF11A->TNFSF11->CLEC2D | 273 | 0.0065 |
| FCRL5 | KLRD1 | 1.74E-06 | 8.81E-05 | 0.343106475 | FCRL5->BCL9->CTNNB1->ERBB2->EGFR->CBL->SYK->TYROBP->KLRD1 | 117 | 0.0065 |
| GAS1 | NUPR1 | 7.82E-06 | 0.000290859 | 0.322029935 | GAS1->SHH->FGF8->FGFR1->PLCG1->EGFR->UBC->TP53->NUPR1 | 92 | 0.00655 |
| ANGPTL4 | SUV420H1 | 7.78E-07 | 4.58E-05 | -0.3538353 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->AR->NCOA2->SUV420H1 | 144 | 0.00665 |
| PRF1 | VNN2 | 3.64E-07 | 2.46E-05 | 0.363594006 | PRF1->CD8A->IL2->STAT3->IL6->ICAM1->ITGB2->VNN2 | 168 | 0.00665 |
| RNF43 | HLA-DRA | 1.49E-06 | 7.73E-05 | -0.345245597 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->EP300->CREB1->CIITA->HLA-DRA | 130 | 0.0067 |
| CD79A | THEMIS | 2.09E-07 | 1.53E-05 | 0.370493018 | CD79A->SYK->LCK->IL2->THEMIS | 190 | 0.00675 |
| ANGPTL4 | ABCB1 | 1.46E-05 | 0.000484768 | -0.312745377 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->GSK3B->TP53->ABCB1 | 84 | 0.00675 |

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| MAP7D1 | APBB1IP | 5.91E-07 | 3.65E-05 | 0.357403116 | MAP7D1->ARTN->GFRA1->RET->GRB2->PTK2->TLN1->APBB1IP | 156 | 0.00675 |
| NFIB | MID1 | 2.15E-06 | 0.000102784 | 0.340283992 | NFIB->HNF1A->HNF4A->SMAD4->SMAD1->RUNX2->SP7->MID1 | 119 | 0.00675 |
| IGKC | THEMIS | 1.73E-07 | 1.29E-05 | 0.372824575 | IGKC->ERBB4->EGF->SRC->STAT3->IL2->THEMIS | 214 | 0.00675 |
| SAV1 | RPRM | 1.66E-06 | 8.44E-05 | -0.343733166 | SAV1->RASSF1->HRAS->PIK3CA->PTEN->TP53->RPRM | 129 | 0.0068 |
| PGRMC1 | CD69 | 4.24E-06 | 0.000179068 | -0.330828944 | PGRMC1->M6PR->PLIN3->IGF2R->PLAUR->PLAU->JUN->IL2->CD69 | 101 | 0.00685 |
| PITX1 | LTF | 6.22E-06 | 0.000244543 | -0.325340954 | PITX1->LHB->LHCGR->ARRB2->MAPK1->GRB2->ERBB2->CTNNB1->PSEN1->APP->A2M->LYZ->LTF | 96 | 0.00685 |
| ANGPTL4 | MMD | 5.51E-06 | 0.000221918 | 0.327101039 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->CCND1->CDK2->CDC6->MCM2->MUT->MMD | 104 | 0.00695 |
| CYP4F2 | ACCN2 | 8.99E-06 | 0.000324246 | 0.319994328 | CYP4F2->PTGS2->IL1B->NFKB1->PRKCA->PICK1->ACCN2 | 94 | 0.00705 |
| IGHD | TOX2 | 1.68E-07 | 1.26E-05 | 0.373177976 | IGHD->GHRH->POMC->NR4A1->ZNF461->TOX2 | 238 | 0.00705 |
| PGRMC1 | FCGR3B | 1.78E-06 | 8.97E-05 | -0.342797047 | PGRMC1->M6PR->IGF1->IRS1->GRB2->VAV1->SYK->FCER1G->FCGR3B | 133 | 0.0071 |
| PSMB9 | VNN2 | 5.40E-07 | 3.40E-05 | 0.358566101 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->EGFR->STAT3->IL6->ICAM1->ITGB2->VNN2 | 167 | 0.00715 |
| PTGER1 | LTF | 1.09E-05 | 0.000379232 | -0.317114186 | PTGER1->BDKRB2->KNG1->KLBK1->A2M->LYZ->LTF | 93 | 0.0072 |
| LEPRE1 | CYP2J2 | 1.55E-05 | 0.000508928 | -0.311867916 | LEPRE1->PPIB->BSG->MMP1->JUN->MAPK8->TP53->KAT5->PLA2G4A->CYP2J2 | 86 | 0.0072 |
| PQBP1 | MID1 | 3.83E-06 | 0.000163927 | 0.33226614 | PQBP1->TXNL4A->CD2BP2->CD2->LCK->IL2->STAT3->EP300->SP1->SMAD3->RUNX2->SP7->MID1 | 109 | 0.00725 |
| CHRNA3 | ATP6V1E2 | 1.83E-06 | 9.14E-05 | -0.342459824 | CHRNA3->PSMA4->UCHL5->PSMD4->UBC->RIPK1->TRAF2->TNFRSF11A->TNFSF11->TCIRG1->ATP6V1B1->ATP6V1D->ATP6V1A->ATP6V1E2 | 139 | 0.0073 |
| PTGER3 | PTPRH | 6.31E-06 | 0.000247045 | -0.325139129 | PTGER3->KNG1->EGF->GRB2->MAPK1->ELK1->SRF->PTPRH | 107 | 0.0074 |
| RNF43 | APBB1IP | 1.05E-06 | 5.84E-05 | -0.349850518 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->LCP2->GRB2->PTK2->TLN1->APBB1IP | 157 | 0.0074 |
| PITX1 | CRIM1 | 1.00E-06 | 5.62E-05 | -0.350477646 | PITX1->LHB->LHCGR->ARRB2->MAPK1->JUN->SMAD4->SMAD1->BMPR1A->BMP4->CRIM1 | 156 | 0.0074 |
| UBQLN2 | MID1 | 1.33E-06 | 7.06E-05 | 0.346781172 | UBQLN2->PSMD4->UBC->TP53->SP1->SMAD3->RUNX2->SP7->MID1 | 152 | 0.00745 |
| ANGPTL4 | SLA | 1.11E-06 | 6.09E-05 | 0.349179838 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->TCF4->TAL1->LMO2->LDB1->LHX3->IFT172->SLA | 160 | 0.0075 |
| RNF43 | MYEF2 | 1.42E-06 | 7.46E-05 | 0.345839583 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->HDAC1->SIN3A->HDAC9->MYEF2 | 150 | 0.0075 |
| COL8A1 | LPHN2 | 1.91E-06 | 9.36E-05 | 0.34189212 | COL8A1->COL8A2->ZEB1->CDH1->CTNNB1->SMAD7->TGFB1->FKBP1A->RYR1->HOMER1->SHANK2->LPHN2 | 142 | 0.00755 |
| SLC22A18 | SNAPIN | 2.29E-05 | 0.000687347 | -0.305939789 | SLC22A18->CDKN1C->CDK4->RB1->TP53->PTEN->SLC9A3R1->CFTR->STX1A->SNAP25->SNAPIN | 82 | 0.0076 |
| RNF43 | TFCP2 | 3.44E-06 | 0.00015147 | 0.333744534 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->YY1->TFCP2 | 117 | 0.0076 |
| IGLV4-60 | HLA-DRA | 1.89E-06 | 9.30E-05 | 0.342044612 | IGLV4-60->C1S->SERPING1->PLG->SERPINE1->PLAU->FOS->CREB1->CIITA->HLA-DRA | 144 | 0.00765 |
| IGHD | VNN2 | 3.61E-07 | 2.45E-05 | 0.363691974 | IGHD->GHRH->GCG->LEP->STAT3->IL6->ICAM1->ITGB2->VNN2 | 201 | 0.00765 |
| SLC2A3 | LPHN2 | 2.10E-07 | 1.53E-05 | 0.370462482 | SLC2A3->SP1->SMAD3->TGFB1->FKBP1A->RYR1->HOMER1->SHANK2->LPHN2 | 259 | 0.0077 |
| CASP1 | VNN2 | 8.97E-07 | 5.13E-05 | 0.351964601 | CASP1->IL18->IL1B->NFKB1->ICAM1->ITGB2->VNN2 | 166 | 0.0077 |
| SATB2 | KLRD1 | 8.98E-06 | 0.00032424 | -0.320011549 | SATB2->HOXA2->CD1D->B2M->CD8A->LCK->SYK->TYROBP->KLRD1 | 104 | 0.0077 |
| SLC2A3 | NUPR1 | 1.85E-07 | 1.38E-05 | 0.371994379 | SLC2A3->SP1->TP53->NUPR1 | 263 | 0.00775 |
| SLC2A3 | SNAPIN | 3.53E-07 | 2.41E-05 | 0.363981086 | SLC2A3->SP1->TP53->PTEN->SLC9A3R1->CFTR->STX1A->SNAP25->SNAPIN | 210 | 0.0078 |
| ANGPTL4 | LMBR1L | 1.34E-05 | 0.000450004 | 0.314072817 | ANGPTL4->LPL->APOE->APP->A2M->LYZ->LCN1->LMBR1L | 96 | 0.008 |
| SERPINB2 | SLC25A11 | 5.87E-06 | 0.000233177 | 0.3261711 | SERPINB2->PLAU->JUN->MAPK8->TP53->BCL2->BNIP3->BCKDHB->DLD->OGDH->SLC25A11 | 113 | 0.00805 |
| CRB3 | DYNC1I2 | 1.90E-05 | 0.000594857 | -0.308794323 | CRB3->PARD6A->CDC42->IQGAP1->CLIP1->DCTN1- | 89 | 0.0081 |

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| | | | | | >DCTN2->DYNC1I2 | | |
| RNF43 | PIK3CG | 4.89E-06 | 0.000200576 | -0.3288067 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->LCP2->VAV1->RAC1->AKT1->PIK3CG | 117 | 0.0081 |
| TET3 | FPR1 | 8.25E-07 | 4.81E-05 | -0.353065607 | TET3->NANOG->KLF4->CTNNB1->GSK3B->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 177 | 0.00815 |
| NFIB | NCOA7 | 1.67E-05 | 0.000536682 | 0.310702013 | NFIB->HNF1A->HNF4A->SMAD4->SMAD3->SP1->ESR1->NCOA7 | 92 | 0.00815 |
| APOBEC1 | CCL18 | 1.92E-05 | 0.00059831 | -0.30864464 | APOBEC1->APOB->LDLR->APOE->APP->PSEN1->CTNNB1->BTRC->NFKBIA->NFKB1->CCL5->CCR3->CCL18 | 90 | 0.0082 |
| ANGPTL4 | MID1 | 5.77E-06 | 0.00023006 | -0.326419119 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->MYC->SP1->SMAD3->RUNX2->SP7->MID1 | 114 | 0.00825 |
| CXCL14 | MARCKS | 2.43E-06 | 0.000115125 | 0.338561971 | CXCL14->CXCR4->CD4->LCK->LCP2->GRB2->WASL->CDC42->PLD1->PRKCA->MARCKS | 149 | 0.00825 |
| MAP7D1 | HAS2 | 2.97E-07 | 2.09E-05 | 0.366116774 | MAP7D1->ARTN->GFRA1->RET->SHC1->EGFR->STAT3->EP300->SMAD2->SMAD4->SMAD1->BMPR1A->BMP2->HAS2 | 248 | 0.00825 |
| SAV1 | MID1 | 3.46E-06 | 0.000151981 | -0.333677718 | SAV1->RASSF1->HRAS->RAF1->HSP90AA1->HIF1A->SP1->SMAD3->RUNX2->SP7->MID1 | 133 | 0.0083 |
| TET3 | FCGR3B | 7.14E-07 | 4.26E-05 | -0.354951043 | TET3->NANOG->KLF4->CTNNB1->ERBB2->EGFR->CBL->SYK->FCER1G->FCGR3B | 191 | 0.00835 |
| UAP1L1 | A1CF | 3.12E-07 | 2.18E-05 | -0.365504754 | UAP1L1->PGM3->GLO1->AKR1B1->DECR1->NCF2->RAC1->CTNNB1->PSEN1->APP->APOE->LDLR->APOB->APOBEC1->A1CF | 250 | 0.00835 |
| RB1CC1 | CTSA | 2.18E-05 | 0.000662507 | 0.306671714 | RB1CC1->PTK2->GRB2->MAPK1->MAP2K1->RAF1->YWHAZ->GP1BA->F2->GLA->GLB1->CTSA | 89 | 0.0084 |
| PTGER1 | CGGBP1 | 2.80E-06 | 0.000127693 | 0.336645879 | PTGER1->BDKRB2->KNG1->EGF->EGFR->STAT3->RAC1->NCKAP1->CYFIP1->FMR1->CGGBP1 | 143 | 0.0084 |
| SERPINB2 | ST3GAL1 | 2.68E-06 | 0.000123488 | 0.337224585 | SERPINB2->PLAU->JUN->MAPK8->TP53->YBX1->SF3A2->SNRPE->LSM4->EXOSC10->CHPF->B4GALNT1->ST8SIA1->ST3GAL1 | 149 | 0.00845 |
| SERPINB2 | ENPP3 | 1.26E-05 | 0.000426426 | -0.315007984 | SERPINB2->PLAU->FOS->CSF2->CSF2RB->IL3->ENPP3 | 105 | 0.00845 |
| PGRMC1 | GFPT1 | 3.34E-06 | 0.000147893 | 0.33417722 | PGRMC1->M6PR->PLIN3->IGF2R->PLAUR->PLAU->JUN->ATF3->ATF4->ASNS->GLUL->GFPT1 | 140 | 0.0086 |
| SATB2 | SHANK2 | 2.07E-05 | 0.000633637 | 0.307492306 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->EP300->SMAD2->TGFBFR1->FKBP1A->RYR1->HOMER1->SHANK2 | 93 | 0.00865 |
| EEF1B2 | MTMR3 | 8.93E-07 | 5.11E-05 | -0.35203409 | EEF1B2->RPL6->RPL5->MDM2->TP53->PTEN->INPP4B->MTMR3 | 193 | 0.0087 |
| RPS2 | CRIM1 | 1.43E-05 | 0.000474091 | -0.313128764 | RPS2->RPS3->RPL5->MDM2->TP53->SP1->SMAD3->SMAD4->SMAD1->BMPR1A->BMP4->CRIM1 | 106 | 0.0087 |
| CASP1 | SLA | 5.77E-06 | 0.00023006 | 0.326432764 | CASP1->IL18->IL1B->IL8->RELA->HDAC1->TAL1->LMO2->LDB1->LHX3->IFT172->SLA | 125 | 0.0087 |
| IGLV4-60 | CD2 | 6.04E-06 | 0.000238992 | 0.325780519 | IGLV4-60->C1S->SERPING1->PLG->FN1->ITGA4->PXN->PTK2->GRB2->LCP2->LCK->CD2 | 127 | 0.00875 |
| SERPINB2 | SCML1 | 4.95E-06 | 0.000203068 | -0.328610097 | SERPINB2->PLAU->NFKB1->RELA->HDAC1->SIN3A->MECP2->CDKL5->NHS->SCML1 | 132 | 0.0088 |
| MAP7D1 | HLA-DRA | 5.42E-06 | 0.000219116 | 0.327330623 | MAP7D1->ARTN->GFRA1->RET->SHC1->EGFR->STAT3->EP300->CREB1->CIITA->HLA-DRA | 131 | 0.00885 |
| IGJ | THEMIS | 4.66E-07 | 3.02E-05 | 0.360452963 | IGJ->IL2->THEMIS | 241 | 0.00885 |
| SCEL | TAX1BP3 | 5.25E-07 | 3.32E-05 | 0.358918935 | SCEL->TXNIP->TXN->MAP3K5->TRAF2->CHUK->RELA->EP300->STAT3->RAC1->ARHGDI2->RHOA->RTKN->TAX1BP3 | 229 | 0.0089 |
| IGJ | TOX2 | 3.86E-07 | 2.57E-05 | 0.362851862 | IGJ->IL2->STAT3->EP300->TP53->BCL2->NR4A1->ZNF461->TOX2 | 261 | 0.0089 |
| FCRL5 | TNFRSF18 | 2.40E-05 | 0.000716063 | 0.30515857 | FCRL5->BCL9->CTNNB1->CCND1->STAT3->IL2->TNFRSF18 | 95 | 0.00895 |
| EBI3 | SLA | 8.06E-06 | 0.000298255 | 0.321594297 | EBI3->IL27RA->STAT1->EP300->MYOD1->TCF3->TAL1->LMO2->LDB1->LHX3->IFT172->SLA | 124 | 0.00905 |
| MAGT1 | SCML1 | 3.53E-07 | 2.41E-05 | 0.363954356 | MAGT1->DDOST->SSR4->RPS5->RPL5->MDM2->RB1->HDAC1->SIN3A->MECP2->CDKL5->NHS->SCML1 | 276 | 0.00905 |
| SLC2A3 | UPP1 | 6.21E-07 | 3.79E-05 | 0.35675818 | SLC2A3->SP1->TP53->RRM2B->RRM1->RRM2->TYMS->TK1->CDA->TYMP->UPP1 | 228 | 0.0091 |
| CHRNA3 | CRIM1 | 5.31E-06 | 0.000215753 | 0.327615152 | CHRNA3->PSMA4->UCHL5->PSMD4->UBC->HIF1A->EP300- | 137 | 0.0091 |

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|----------|----------|----------|-------------|--------------|--|-----|---------|
| | | | | | >SMAD2->SMAD4->SMAD1->BMMPR1A->BMP4->CRIM1 | | |
| EEF1B2 | LTF | 2.75E-05 | 0.000797609 | -0.303057591 | EEF1B2->RPL6->RPL5->MDM2->TP53->GSK3B->CTNNB1->PSEN1->APP->A2M->LYZ->LTF | 93 | 0.0092 |
| UAP1L1 | MID1 | 3.80E-07 | 2.55E-05 | -0.363024241 | UAP1L1->PGM3->GLO1->AKR1B1->DECR1->NCF2->RAC1->AKT1->ESR1->SP1->SMAD3->RUNX2->SP7->MID1 | 288 | 0.0092 |
| UAP1L1 | KLRD1 | 5.73E-07 | 3.55E-05 | 0.357802068 | UAP1L1->PGM3->GLO1->AKR1B1->DECR1->NCF2->RAC1->VAV1->SYK->TYROBP->KLRD1 | 245 | 0.0092 |
| CEACAM1 | SLA | 6.24E-06 | 0.000244812 | -0.325300362 | CEACAM1->PTPN11->GRB2->ERBB2->CTNNB1->TCF4->TAL1->LMO2->LDB1->LHX3->IFT172->SLA | 133 | 0.00925 |
| SATB2 | FPR1 | 1.23E-05 | 0.000419116 | -0.315331235 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->EP300->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 113 | 0.00925 |
| SLC2A3 | GNA11 | 1.16E-06 | 6.31E-05 | -0.348573118 | SLC2A3->SP1->EP300->JUN->EDN1->EDNRB->GNA11 | 209 | 0.0093 |
| CXCL14 | SHANK2 | 3.57E-06 | 0.000155049 | 0.333221948 | CXCL14->CXCR4->ITCH->RNF11->SMURF2->SMAD2->TGFBF1->FKBP1A->RZR1->HOMER1->SHANK2 | 160 | 0.00945 |
| IGLV4-60 | PIK3CG | 8.37E-06 | 0.000307709 | 0.321042564 | IGLV4-60->C1S->SERPING1->PLG->FN1->ITGA4->PXN->ILK->AKT1->PIK3CG | 130 | 0.00945 |
| SLC11A1 | ST3GAL1 | 3.76E-06 | 0.000161644 | 0.332521107 | SLC11A1->ZBTB17->MYC->EP300->TP53->YBX1->SF3A2->SNRPE->LSM4->EXOSC10->CHPF->B4GALNT1->ST8SIA1->ST3GAL1 | 152 | 0.00955 |
| GAS1 | CLEC4E | 4.93E-07 | 3.16E-05 | 0.359723428 | GAS1->SHH->GLI2->BTRC->NFKBIA->IKKBK->BCL10->CARD9->CLEC4E | 273 | 0.00955 |
| ZC3H12A | DYNC1I2 | 3.42E-05 | 0.000948334 | -0.299633206 | ZC3H12A->CCL2->IL8->RELA->EP300->TP53->CHEK1->CDC25C->PLK1->NUDC->PAFAH1B1->DCTN1->DCTN2->DYNC1I2 | 95 | 0.00955 |
| SOX11 | CCL18 | 1.44E-06 | 7.51E-05 | 0.345720175 | SOX11->BNIP3->BCL2->TP53->HDAC1->RELA->NFKB1->CCL5->CCR3->CCL18 | 202 | 0.0096 |
| OXA1L | SLC25A11 | 2.06E-06 | 9.96E-05 | 0.340871216 | OXA1L->BCL2->BNIP3->BCKDHB->DLD->OGDH->SLC25A11 | 180 | 0.00965 |
| MAVS | VNN2 | 2.96E-06 | 0.000134079 | -0.335862145 | MAVS->IRF3->CREBBP->RELA->NFKB1->ICAM1->ITGB2->VNN2 | 167 | 0.00965 |
| IGJ | SPINK5 | 8.56E-07 | 4.93E-05 | 0.352590004 | IGJ->IL2->STAT3->EGFR->PTPN1->CDH2->JUP->DSG1->KLK5->SPINK5 | 239 | 0.00975 |
| SAV1 | PIK3AP1 | 1.41E-05 | 0.000470655 | 0.313287011 | SAV1->RASSF1->HRAS->PIK3CA->PIK3R1->PIK3AP1 | 114 | 0.0098 |
| RNF43 | DYNC1I2 | 2.58E-06 | 0.000120616 | 0.337753757 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->CHEK2->CDC25C->PLK1->NUDC->PAFAH1B1->DCTN1->DCTN2->DYNC1I2 | 175 | 0.00985 |
| CHST2 | PIK3CG | 6.39E-07 | 3.88E-05 | 0.356393217 | CHST2->SELL->CD34->MYB->CREBBP->CREB1->AKT1->PIK3CG | 260 | 0.0099 |
| PITX1 | GRSF1 | 9.56E-06 | 0.000340026 | 0.319093149 | PITX1->LHB->LHCGR->ARRB2->MAPK1->FOS->PTGS2->ALOX5->GPX4->GRSF1 | 133 | 0.00995 |
| TET3 | KCNQ2 | 2.85E-06 | 0.000129474 | -0.336387206 | TET3->NANOG->KLF4->CTNNB1->IQGAP1->CALM1->KCNQ2 | 174 | 0.01 |
| NOP10 | SLA | 1.19E-05 | 0.000408111 | 0.315809627 | NOP10->DKC1->RUVBL1->CTNNB1->TCF4->TAL1->LMO2->LDB1->LHX3->IFT172->SLA | 126 | 0.01 |
| CXCL14 | BCL11A | 1.56E-06 | 8.02E-05 | 0.34462473 | CXCL14->CXCR4->CD4->IFNG->IL2->STAT3->SRC->ESR1->NCOA2->BCL11A | 209 | 0.01 |
| CEACAM1 | CRIM1 | 1.71E-05 | 0.000544834 | 0.310426382 | CEACAM1->PTPN11->JAK2->STAT3->EP300->SMAD2->SMAD4->SMAD1->BMMPR1A->BMP4->CRIM1 | 112 | 0.01005 |
| CRB3 | GRSF1 | 2.90E-05 | 0.000834534 | 0.302234537 | CRB3->PARD6A->CDC42->IQGAP1->RAC1->STAT3->IL6->PTGS2->ALOX5->GPX4->GRSF1 | 102 | 0.0101 |
| MAP7D1 | SHANK2 | 1.23E-05 | 0.000417408 | -0.315408476 | MAP7D1->ARTN->GFRA1->RET->GRB2->VAV1->RAC1->AKT1->MTOR->FKBP1A->RZR1->HOMER1->SHANK2 | 128 | 0.0101 |
| COL8A1 | ZFHX3 | 2.07E-05 | 0.000634868 | 0.307434746 | COL8A1->COL8A2->ZEB1->CDH1->CTNNB1->MYC->MYB->ZFHX3 | 110 | 0.0101 |
| SATB2 | FCGR3B | 1.42E-05 | 0.00047124 | -0.313235547 | SATB2->HOXA2->CD1D->B2M->CD8A->LCK->SYK->FCER1G->FCGR3B | 124 | 0.0103 |
| GAS1 | VNN2 | 3.42E-06 | 0.00015102 | 0.333825491 | GAS1->SHH->FGF8->FGFR1->FRS2->PTPN11->IL6ST->IL6->ICAM1->ITGB2->VNN2 | 173 | 0.01035 |
| RNF43 | ARHGEF19 | 8.49E-06 | 0.000310851 | 0.320834529 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->LCP2->GRB2->ERBB2->CTNNB1->DVL1->DAAM1->ARHGEF19 | 142 | 0.01035 |
| SATB2 | CCL18 | 8.76E-06 | 0.000318939 | -0.3203726 | SATB2->HOXA2->CD1D->B2M->CD8A->CD4->CCR5->CCL13->CCR3->CCL18 | 140 | 0.01035 |

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| PGRMC1 | A1CF | 1.61E-05 | 0.000523368 | 0.311270698 | PGRMC1->M6PR->IGF1->IRS1->GRB2->ERBB2->CTNNB1->PSEN1->APP->APOE->DLR->APOB->APOBEC1->A1CF | 117 | 0.0104 |
| SLC11A1 | VNN2 | 3.48E-06 | 0.000152609 | 0.333580729 | SLC11A1->ZBTB17->MYC->EP300->RELA->NFKB1->ICAM1->ITGB2->VNN2 | 171 | 0.0104 |
| RNF43 | SLC25A11 | 1.76E-06 | 8.89E-05 | -0.342962611 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->BCL2->BNIP3->BCKDHB->DLD->OGDH->SLC25A11 | 215 | 0.0104 |
| HLA-DQB2 | HLA-DRA | 1.53E-05 | 0.000503985 | 0.312031317 | HLA-DQB2->ZFYVE9->SMAD2->EP300->CREB1->CIITA->HLA-DRA | 123 | 0.01045 |
| UBXN7 | CD2 | 2.02E-06 | 9.81E-05 | -0.341135279 | UBXN7->CUL2->RBX1->CUL1->BTRC->NFKBIA->LCK->CD2 | 210 | 0.0105 |
| DDX47 | MARCKS | 7.59E-07 | 4.49E-05 | -0.354149614 | DDX47->DNAH8->VCP->ATXN3->UBC->EGFR->GRB2->WASL->CDC42->PLD1->PRKCA->MARCKS | 291 | 0.01055 |
| RB1CC1 | C18orf10 | 6.07E-06 | 0.000239818 | -0.325694458 | RB1CC1->PTK2->SRC->ESR1->EP300->RELA->NFKB1->C18orf10 | 161 | 0.0106 |
| NOP10 | CRIM1 | 3.55E-05 | 0.000974527 | -0.299056053 | NOP10->DKC1->RUVBL1->CTNNB1->SMAD4->SMAD1->BMPR1A->BMP4->CRIM1 | 107 | 0.0106 |
| RNF43 | VPS4B | 1.31E-05 | 0.000441317 | -0.314413427 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->UBC->HGS->VPS4A->CHMP2A->VPS4B | 133 | 0.01065 |
| PGRMC1 | MID1 | 7.62E-06 | 0.000287177 | 0.322407365 | PGRMC1->M6PR->IGF1->IGF1R->ESR1->SP1->SMAD3->RUNX2->SP7->MID1 | 153 | 0.0107 |
| MAGT1 | HMOX1 | 6.70E-06 | 0.00025921 | -0.324284042 | MAGT1->DDOST->SSR4->RPS5->RPL5->MDM2->TP53->HIF1A->HMOX1 | 157 | 0.0107 |
| UAP1L1 | SHANK2 | 1.58E-06 | 8.07E-05 | -0.344463882 | UAP1L1->PGM3->GLO1->AKR1B1->DECR1->NCF2->RAC1->AKT1->MTOR->FKBP1A->RYR1->HOMER1->SHANK2 | 232 | 0.0107 |
| CXCL14 | CTSA | 2.58E-06 | 0.000120616 | 0.33773377 | CXCL14->CXCR4->CD4->CD8A->B2M->CD1D->CTSA | 202 | 0.01075 |
| SLC2A3 | SOCS7 | 1.85E-06 | 9.17E-05 | -0.342321349 | SLC2A3->SP1->ESR1->SRC->VCL->SORBS3->SOCS7 | 230 | 0.01095 |
| SATB2 | UPP1 | 1.95E-05 | 0.000609315 | -0.308350407 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->EP300->TP53->RRM2B->RRM1->RRM2->TYMS->TK1->CDA->TYMP->UPP1 | 119 | 0.01095 |
| SOX11 | SMAD7 | 1.43E-05 | 0.000475369 | 0.313072249 | SOX11->BNIP3->BCL2->TP53->EP300->SMAD2->TGFB1->SMAD7 | 134 | 0.01105 |
| CRB3 | ZMYM4 | 3.73E-06 | 0.000160668 | -0.332625532 | CRB3->PARD6A->CDC42->WASL->GRB2->FRS2->FGFR1->ZMYM4 | 179 | 0.01105 |
| MAP7D1 | CYP2J2 | 4.18E-06 | 0.000176829 | -0.331025812 | MAP7D1->ARTN->GFRA1->RET->SHC1->EGFR->UBC->TP53->KAT5->PLA2G4A->CYP2J2 | 172 | 0.01105 |
| PGRMC1 | SLC25A11 | 3.47E-06 | 0.000152238 | -0.333634421 | PGRMC1->M6PR->IGF1->IRS1->MAPK8->TP53->BCL2->BNIP3->BCKDHB->DLD->OGDH->SLC25A11 | 189 | 0.0111 |
| MBNL2 | MED23 | 1.20E-05 | 0.000409891 | 0.315728469 | MBNL2->CCT3->PPP2CA->SGOL1->PLK1->CDC25C->CHEK2->BRCA1->ESR1->NCOA2->VDR->MED1->CDK8->MED23 | 140 | 0.0111 |
| SLC2A3 | MID1 | 1.40E-06 | 7.37E-05 | -0.346042473 | SLC2A3->SP1->SMAD3->RUNX2->SP7->MID1 | 254 | 0.0112 |
| RABGEF1 | ST3GAL1 | 9.85E-06 | 0.000349046 | -0.318640178 | RABGEF1->RABEP1->RAB5A->EGFR->GRB2->LCP2->LCK->CD2->CD2BP2->SF3A2->SNRPE->LSM4->EXOSC10->CHPF->B4GALNT1->ST8SIA1->ST3GAL1 | 152 | 0.01125 |
| CHRNA3 | RUNDC3A | 1.28E-05 | 0.000431672 | 0.314792733 | CHRNA3->PSMA4->UCHL5->PSMD4->UBC->EGFR->NCK1->TNK1->RAP2A->RUNDC3A | 140 | 0.01125 |
| SLC22A18 | SLA | 5.43E-06 | 0.000219116 | -0.327309623 | SLC22A18->CDKN1C->MYOD1->TCF3->TAL1->LMO2->LDB1->LHX3->IFT172->SLA | 174 | 0.0113 |
| MBNL2 | PREPL | 3.33E-06 | 0.000147688 | 0.334216387 | MBNL2->CCT3->PPP2CA->SGOL1->PLK1->CDC25C->CHEK2->TP53->HDAC1->RELA->IKBK->PPM1B->PREPL | 197 | 0.01135 |
| CD79A | VNN2 | 7.27E-06 | 0.000276801 | 0.323083366 | CD79A->BLNK->GRB2->EGFR->STAT3->IL6->ICAM1->ITGB2->VNN2 | 166 | 0.0114 |
| UBQLN2 | SCML1 | 3.09E-06 | 0.000138906 | 0.335250114 | UBQLN2->PSMD4->UBC->TP53->HDAC1->SIN3A->MECP2->CDK5->NHS->SCML1 | 206 | 0.01145 |
| IGLV4-60 | CD69 | 1.32E-05 | 0.00044404 | 0.314305129 | IGLV4-60->C1S->SERPING1->PLG->SERPINE1->PLAU->JUN->IL2->CD69 | 142 | 0.01145 |
| ANGPTL4 | ST3GAL1 | 4.71E-06 | 0.000195337 | 0.329312252 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->GSK3B->TP53->YBX1->SF3A2->SNRPE->LSM4->EXOSC10->CHPF->B4GALNT1->ST8SIA1->ST3GAL1 | 185 | 0.0116 |
| CXCL14 | GALNT1 | 4.80E-06 | 0.000197895 | -0.329052154 | CXCL14->CXCR4->CD4->LCK->CD2->CD2BP2->SF3A2->SNRPD3->LSM7->EXOSC6->CHPF->GALNT1 | 185 | 0.0116 |
| FCRL5 | APBB1IP | 1.61E-05 | 0.000523368 | 0.311289771 | FCRL5->BCL9->CTNNB1->SRC->PTK2->TLN1->APBB1IP | 134 | 0.01165 |
| MAP7D1 | SMAD7 | 3.13E-05 | 0.000880031 | 0.30105882 | MAP7D1->ARTN->GFRA1->RET->GRB2->ERBB2->CTNNB1- | 113 | 0.01165 |

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|----------|----------|----------|-------------|--------------|---|-----|---------|
| | | | | | >SMAD7 | | |
| RNF43 | FCGR3B | 9.87E-06 | 0.000349199 | -0.318616991 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->SYK->FCER1G->FCGR3B | 158 | 0.01165 |
| SATB2 | VNN2 | 2.39E-06 | 0.000113505 | -0.338777614 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->IL6->ICAM1->ITGB2->VNN2 | 235 | 0.01165 |
| RNF43 | CTSA | 7.02E-06 | 0.00026876 | 0.323599726 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->CD8A->B2M->CD1D->CTSA | 170 | 0.0117 |
| SLC22A18 | MMD | 2.73E-05 | 0.000792661 | -0.303183671 | SLC22A18->CDKN1C->CDK4->PCNA->CDT1->CDC6->MCM2->MUT->MMD | 118 | 0.0118 |
| RNF43 | ASS1 | 2.24E-05 | 0.000677548 | -0.306235905 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->LCP2->VAV1->RAC1->AKT1->NOS3->ARG2->OTC->ASS1 | 127 | 0.0118 |
| PTGER3 | NUPR1 | 1.90E-05 | 0.000594744 | 0.308812573 | PTGER3->KNG1->EGF->EGFR->UBC->TP53->NUPR1 | 133 | 0.0119 |
| CCL7 | CLEC4E | 1.82E-06 | 9.11E-05 | 0.34256347 | CCL7->CCR1->CCL5->NFKB1->IKKBK->BCL10->CARD9->CLEC4E | 266 | 0.01195 |
| MMP8 | FPR1 | 1.91E-05 | 0.00059831 | 0.308670801 | MMP8->TIMP2->MMP2->JUN->MAPK8->TP53->NPM1->NCL->S100A11->ANXA1->FPR1 | 134 | 0.01205 |
| EEF1B2 | CTSA | 3.65E-05 | 0.000993534 | -0.298597401 | EEF1B2->RPL6->RPL5->MDM2->AKT1->TSC2->YWHAZ->GP1BA->F2->GLA->GLB1->CTSA | 114 | 0.0121 |
| TET3 | GFPT1 | 4.52E-06 | 0.000189935 | 0.329899569 | TET3->NANOG->KLF4->CTNNB1->GSK3B->TP53->ATF3->ATF4->ASNS->GLUL->GFPT1 | 198 | 0.0121 |
| CHST2 | GATA3 | 2.03E-06 | 9.86E-05 | 0.341034993 | CHST2->SELL->CD34->MYB->CREBBP->TP53->EP300->STAT3->IL2->IL5->GATA3 | 260 | 0.01215 |
| MAP7D1 | GATA3 | 3.59E-05 | 0.00098161 | 0.29885108 | MAP7D1->ARTN->GFRA1->RET->SHC1->IL2->IL5->GATA3 | 116 | 0.01215 |
| IGKC | SLA | 1.52E-05 | 0.000499379 | 0.312185892 | IGKC->ERBB4->EGF->SRC->ESR1->BRCA1->RBBP8->LMO4->LDB1->LHX3->IFT172->SLA | 148 | 0.01225 |
| RNF4 | SLC25A3 | 2.60E-05 | 0.000763522 | 0.303956523 | RNF4->AR->NCOA3->EP300->TP53->APAF1->CYCS->CYC1->UQCRCF1->SLC25A3 | 127 | 0.01235 |
| SLC2A3 | ESRRG | 4.29E-06 | 0.000180974 | -0.330660142 | SLC2A3->SP1->TP53->SIRT1->PPARGC1A->ESRRG | 210 | 0.01255 |
| MMP8 | ESRRG | 3.42E-05 | 0.000948334 | -0.299626799 | MMP8->TIMP2->MMP2->JUN->MAPK8->TP53->SIRT1->PPARGC1A->ESRRG | 122 | 0.01265 |
| JHDM1D | SOS2 | 3.07E-06 | 0.000138454 | 0.335335458 | JHDM1D->MBD2->HDAC1->TP53->UBC->EGFR->GRB2->SOS2 | 248 | 0.0127 |
| PACS2 | GCLC | 8.47E-06 | 0.000310627 | 0.320862266 | PACS2->CANX->CFTR->SLC9A3R1->PDGFRB->PIK3R2->IRS1->MAPK8->GSTP1->GSS->GCLC | 184 | 0.0128 |
| PTGER1 | CYP2J2 | 3.06E-05 | 0.000869099 | -0.301383122 | PTGER1->BDKRB2->KNG1->EGF->EGFR->UBC->TP53->KAT5->PLA2G4A->CYP2J2 | 126 | 0.01285 |
| MAP7D1 | ATP6V1E1 | 6.97E-06 | 0.000267263 | 0.323698451 | MAP7D1->ARTN->GFRA1->RET->SHC1->EGFR->UBC->RIPK1->TRAF2->TNFRSF11A->TNFSF11->TCIRG1->ATP6V1B1->ATP6V1D->ATP6V1A->ATP6V1E1 | 202 | 0.01305 |
| SAV1 | CRYZ | 3.66E-05 | 0.000995043 | 0.298545733 | SAV1->RASSF1->HRAS->PIK3CA->AKT1->RAC1->NCF2->DECR1->CRYZ | 128 | 0.0132 |
| UAP1L1 | HMOX1 | 5.99E-06 | 0.000237453 | 0.325891643 | UAP1L1->PGM3->GLO1->AKR1B1->DECR1->NCF2->RAC1->AKT1->HIF1A->HMOX1 | 223 | 0.0132 |
| PARVA | MTMR3 | 2.38E-05 | 0.000710912 | 0.305285146 | PARVA->ILK->PXN->PTK2->PTEN->INPP4B->MTMR3 | 144 | 0.01345 |
| CXCL14 | RBM39 | 1.25E-05 | 0.00042623 | 0.315051436 | CXCL14->CXCR4->CD4->LCK->CD2->CD2BP2->SF3A2->RBM39 | 177 | 0.0136 |
| SLC22A18 | CGGBP1 | 3.25E-05 | 0.000905063 | -0.300448107 | SLC22A18->CDKN1C->CDK4->CDKN1B->AKT1->RAC1->NCKAP1->CYFIP1->FMR1->CGGBP1 | 135 | 0.01365 |
| EEF1B2 | CRIM1 | 2.05E-05 | 0.00063198 | -0.307577752 | EEF1B2->RPL6->RPL5->MDM2->TP53->SP1->SMAD3->SMAD4->SMAD1->BMPR1A->BMP4->CRIM1 | 152 | 0.0137 |
| IGLV4-60 | CXCL13 | 3.05E-05 | 0.000867406 | 0.301442273 | IGLV4-60->C1S->SERPING1->PLG->FN1->ITGA4->PXN->PTK2->GRB2->LCP2->LCK->CD4->CXCR4->CXCL13 | 137 | 0.01375 |
| RNF43 | ESRRG | 3.57E-05 | 0.000977869 | 0.298960131 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->SIRT1->PPARGC1A->ESRRG | 134 | 0.01385 |
| SLC2A3 | BCL11A | 4.54E-06 | 0.000190213 | -0.329840798 | SLC2A3->SP1->ESR1->NCOA2->BCL11A | 250 | 0.014 |
| SLC2A3 | SHANK2 | 9.33E-06 | 0.000333629 | -0.319439964 | SLC2A3->SP1->SMAD3->TGFB1->FKBP1A->RYR1->HOMER1->SHANK2 | 203 | 0.014 |
| LEPRE1 | SLA | 2.71E-05 | 0.00078953 | 0.303303481 | LEPRE1->PPIB->BSG->MMP1->JUN->MAPK8->TP53->BRCA1->RBBP8->LMO4->LDB1->LHX3->IFT172->SLA | 144 | 0.014 |
| CDON | HAS2 | 2.69E-05 | 0.000786562 | 0.30342045 | CDON->SHH->NOG->BMP2->HAS2 | 143 | 0.014 |

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|----------|----------|----------|-------------|--------------|--|-----|---------|
| MAP7D1 | VNN2 | 3.53E-06 | 0.000153911 | 0.333394025 | MAP7D1->ARTN->GFRA1->RET->SHC1->EGFR->STAT3->IL6->ICAM1->ITGB2->VNN2 | 271 | 0.01405 |
| ADAMTS16 | LPHN2 | 9.01E-06 | 0.000324573 | 0.319962598 | ADAMTS16->EGR1->FOS->JUN->EP300->SMAD2->TGFB1->FKBP1A->RYR1->HOMER1->SHANK2->LPHN2 | 206 | 0.0141 |
| RB1CC1 | SCML1 | 2.51E-05 | 0.000741594 | 0.304512115 | RB1CC1->PTK2->PTEN->TP53->HDAC1->SIN3A->MECP2->CDK5->NHS->SCML1 | 153 | 0.0142 |
| UAP1L1 | SNAPIN | 6.39E-06 | 0.000248793 | 0.324961151 | UAP1L1->PGM3->GNPNAT1->HK2->SLC2A4->STX4->SNAP25->SNAPIN | 236 | 0.0142 |
| CXCL14 | RNF135 | 8.92E-06 | 0.000322994 | 0.320102052 | CXCL14->CXCR4->CD4->IFNG->IL18->IL1B->MYD88->IRF7->TBK1->IRF3->MAVS->DDX58->RNF135 | 213 | 0.0143 |
| SATB2 | SUV420H1 | 1.51E-05 | 0.000496952 | 0.312307154 | SATB2->HOXA2->CD1D->B2M->CD8A->IL2->STAT3->EP300->ESR1->NCOA2->SUV420H1 | 178 | 0.01435 |
| UBXN7 | FCGR3B | 4.56E-06 | 0.000190696 | -0.329785835 | UBXN7->CUL2->VHL->HIF1A->UBC->EGFR->CBL->SYK->FCER1G->FCGR3B | 256 | 0.01445 |
| CHST2 | ITGA6 | 4.85E-06 | 0.00019956 | -0.328914288 | CHST2->SELL->CD34->MYB->CREBBP->TP53->PTEN->PTK2->PXN->ITGA4->ITGB1->ITGA6 | 259 | 0.01445 |
| PSMB9 | MTMR3 | 2.99E-05 | 0.000855046 | -0.301739051 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->TP53->PTEN->INPP4B->MTMR3 | 145 | 0.01445 |
| TET3 | CCL18 | 1.00E-05 | 0.000354731 | -0.318351538 | TET3->NANOG->KLF4->CTNNB1->BTRC->NFKBIA->NFKB1->CCL5->CCR3->CCL18 | 210 | 0.0145 |
| RNF43 | CRYZ | 1.67E-05 | 0.000534811 | -0.310786181 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->LCP2->VAV1->RAC1->NCF2->DECR1->CRYZ | 176 | 0.01475 |
| TET3 | RBM39 | 1.64E-05 | 0.000529655 | 0.311042587 | TET3->NANOG->KLF4->CTNNB1->GSK3B->TP53->YBX1->SF3A2->RBM39 | 179 | 0.0149 |
| RNF43 | RNF135 | 1.74E-05 | 0.000551754 | 0.310141543 | RNF43->AKAP8L->DHX9->SF3A2->YBX1->TP53->CREBBP->IRF3->MAVS->DDX58->RNF135 | 178 | 0.015 |
| SATB2 | C18orf10 | 1.20E-05 | 0.000410265 | -0.315698562 | SATB2->HOXA2->CD1D->B2M->CD8A->LCK->NFKBIA->NFKB1->C18orf10 | 208 | 0.015 |
| PSMB9 | CLEC2D | 5.37E-06 | 0.000217578 | 0.32746267 | PSMB9->PSMB7->UCHL5->PSMD4->UBC->RIPK1->TRAF2->TNFRSF11A->TNFSF11->CLEC2D | 269 | 0.01515 |
| CXCL14 | UPP1 | 1.59E-05 | 0.000518949 | -0.311477916 | CXCL14->CXCR4->CD4->IFNG->IL2->STAT3->EP300->TP53->RRM2B->RRM1->RRM2->TYMS->TK1->CDA->TYMP->UPP1 | 187 | 0.01525 |
| MAP7D1 | SCML1 | 9.45E-06 | 0.000336822 | -0.319249389 | MAP7D1->ARTN->GFRA1->RET->SHC1->EGFR->UBC->TP53->HDAC1->SIN3A->MECP2->CDK5->NHS->SCML1 | 236 | 0.01535 |
| UAP1L1 | BCL11A | 5.70E-06 | 0.000227841 | -0.326613138 | UAP1L1->PGM3->GLO1->AKR1B1->DECR1->NCF2->RAC1->AKT1->ESR1->NCOA2->BCL11A | 282 | 0.01555 |
| NOP10 | CLEC4E | 7.59E-06 | 0.000286296 | 0.322469636 | NOP10->DKC1->RUVBL1->CTNNB1->BTRC->NFKBIA->IKBK->BCL10->CARD9->CLEC4E | 269 | 0.016 |
| SCEL | MMD | 9.04E-06 | 0.000325423 | -0.319907275 | SCEL->TXNIP->TXN->MAP3K5->TRAF2->RIPK1->UBC->TP53->RPA1->RPA3->MCM2->MUT->MMD | 259 | 0.0162 |
| ANGPTL4 | SCML1 | 3.21E-05 | 0.000899085 | -0.300636938 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->GSK3B->TP53->HDAC1->SIN3A->MECP2->CDK5->NHS->SCML1 | 168 | 0.01625 |
| RNF43 | SEMA4B | 2.81E-05 | 0.000811673 | -0.30274118 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->PTPRC->FYN->GRIN2A->DLG4->SEMA4B | 172 | 0.0163 |
| SLC2A3 | CD2 | 2.28E-05 | 0.000687117 | 0.305959824 | SLC2A3->SP1->EP300->STAT3->IL2->LCK->CD2 | 191 | 0.01645 |
| TET3 | ARHGEF19 | 3.60E-05 | 0.00098161 | 0.298830361 | TET3->NANOG->KLF4->CTNNB1->DVL1->DAAM1->ARHGEF19 | 169 | 0.01665 |
| SCEL | CD55 | 1.33E-05 | 0.000446688 | 0.314199866 | SCEL->TXNIP->TXN->MAP3K5->TRAF2->RIPK1->UBC->EGFR->GRB2->VAV1->CD19->CR2->C3->CD55 | 244 | 0.0167 |
| CHST2 | KCNQ2 | 8.63E-06 | 0.000314975 | 0.320590117 | CHST2->SELL->CD34->MYB->CREBBP->CREB1->CAMK2B->CALM1->KCNQ2 | 286 | 0.0169 |
| PGRMC1 | SLA | 2.32E-05 | 0.00069471 | -0.305730601 | PGRMC1->M6PR->IGF1->IGF1R->ESR1->BRCA1->RBBP8->LMO4->LDB1->LHX3->IFT172->SLA | 201 | 0.01725 |
| UBXN7 | BEX1 | 2.37E-05 | 0.000708215 | -0.305358767 | UBXN7->CUL2->VHL->HIF1A->UBC->EGFR->SHC1->NGFR->BEX1 | 212 | 0.018 |
| SAV1 | SCML1 | 3.64E-05 | 0.000990471 | -0.298674015 | SAV1->RASSF1->HRAS->PIK3CA->PTEN->TP53->HDAC1->SIN3A->MECP2->CDK5->NHS->SCML1 | 187 | 0.018 |
| RNF43 | C18orf10 | 1.78E-05 | 0.000564015 | -0.309776023 | RNF43->AKAP8L->DHX9->SF3A2->CD2BP2->CD2->LCK->NFKBIA->NFKB1->C18orf10 | 242 | 0.01815 |
| ANGPTL4 | VNN2 | 2.64E-05 | 0.000774518 | 0.303719309 | ANGPTL4->LPL->APOE->APP->PSEN1->CTNNB1->BTRC->NFKBIA->NFKB1->ICAM1->ITGB2->VNN2 | 204 | 0.01825 |
| SLC2A3 | ABC1 | 2.22E-05 | 0.000672361 | -0.306414197 | SLC2A3->SP1->TP53->ABC1 | 226 | 0.01835 |

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|---------|---------|----------|-------------|--------------|--|-----|---------|
| PTGER1 | HAS2 | 3.07E-05 | 0.000869802 | 0.301356166 | PTGER1->BDKRB2->KNG1->EGF->SRC->ESR1->EP300->SMAD2->SMAD4->SMAD1->BMPR1A->BMP2->HAS2 | 202 | 0.01855 |
| CHST2 | SNAPIN | 1.40E-05 | 0.000466868 | 0.31343989 | CHST2->SELL->CD34->MYB->CREBBP->TP53->PTEN->SLC9A3R1->CFTR->STX1A->SNAP25->SNAPIN | 277 | 0.01865 |
| UBXN7 | HMOX1 | 3.56E-05 | 0.00097482 | -0.299023683 | UBXN7->CUL2->VHL->HIF1A->HMOX1 | 208 | 0.0193 |
| MMP8 | KANK4 | 3.26E-05 | 0.000908505 | 0.300374248 | MMP8->TIMP2->MMP2->JUN->MAPK8->TP53->TBP->POLR2A->POLR2H->POLR3D->POLR3F->POLR3C->KANK4 | 219 | 0.01955 |
| UAP1L1 | RBM39 | 2.05E-05 | 0.000629688 | -0.307648646 | UAP1L1->PGM3->GLO1->AKR1B1->DECR1->NCF2->RAC1->VAV1->LCP2->LCK->CD2->CD2BP2->SF3A2->RBM39 | 254 | 0.01955 |
| GAS1 | TOX2 | 3.53E-05 | 0.00097178 | 0.299149852 | GAS1->SHH->FGF8->FGFR1->FRS2->GRB2->VAV1->RAC1->AKT1->NR4A1->ZNF461->TOX2 | 215 | 0.0197 |
| EBI3 | CLEC2D | 1.96E-05 | 0.000611367 | 0.308283654 | EBI3->IL27RA->STAT1->EP300->RELA->CHUK->TRAF2->TNFRSF11A->TNFSF11->CLEC2D | 270 | 0.02025 |
| PITX1 | DNAJB8 | 3.04E-05 | 0.000865461 | 0.301491816 | PITX1->LHB->LHCGR->ARRB2->MAPK1->MYC->EP300->MEF2D->HDAC4->DNAJB8 | 240 | 0.0206 |
| UBE2CBP | SYTL3 | 3.48E-05 | 0.000962883 | 0.299344 | UBE2CBP->UBE2C->BUB1B->CCNB1->CDC25C->CHEK1->TP53->PTEN->SLC9A3R1->CFTR->STX1A->SYTL4->RAB27A->SYTL3 | 240 | 0.021 |
| EBI3 | SLC39A2 | 3.02E-05 | 0.00086087 | 0.301618215 | EBI3->IL27RA->STAT1->EP300->CREB1->CAMK2B->GRIN2B->DLG4->KCNA4->KCNA2->SLC39A2 | 266 | 0.0221 |
| APOBEC1 | CLEC4E | 2.83E-05 | 0.000817135 | -0.302593386 | APOBEC1->APOB->LDLR->APOE->APP->PSEN1->CTNNB1->BTRC->NFKBIA->IKBK->BCL10->CARD9->CLEC4E | 280 | 0.02225 |

Table S4 - The 473 transition genes and the number of signal propagation paths crossed it

| Transition gene name | Number of signal propagation paths crossed it |
|----------------------|---|
| TP53 | 139 |
| CTNNB1 | 100 |
| EP300 | 94 |
| GRB2 | 85 |
| STAT3 | 83 |
| LCK | 82 |
| IL2 | 79 |
| EGFR | 74 |
| UBC | 66 |
| SF3A2 | 53 |
| APP | 48 |
| AKT1 | 47 |
| CD8A | 47 |
| PSEN1 | 46 |
| APOE | 45 |
| CD4 | 45 |
| RAC1 | 44 |
| SYK | 43 |
| SP1 | 41 |
| AKAP8L | 38 |
| DHX9 | 38 |
| LCP2 | 37 |
| ESR1 | 36 |
| ERBB2 | 35 |
| JUN | 34 |
| CREB1 | 33 |
| CD2 | 32 |
| CD2BP2 | 32 |
| CREBBP | 31 |
| SRC | 31 |
| EGF | 30 |
| NFKB1 | 29 |
| PSMD4 | 28 |
| RET | 27 |
| CXCR4 | 26 |
| HIF1A | 26 |
| RELA | 26 |
| SHC1 | 26 |
| UCHL5 | 26 |

| | |
|--------|----|
| VAV1 | 26 |
| SHH | 25 |
| ARTN | 24 |
| CD1D | 24 |
| GFRA1 | 24 |
| IFNG | 24 |
| LPL | 24 |
| PLAU | 24 |
| APOB | 23 |
| B2M | 23 |
| MAPK8 | 23 |
| CBL | 22 |
| FKBP1A | 22 |
| HOMER1 | 22 |
| HOXA2 | 22 |
| LDLR | 22 |
| NFKBIA | 22 |
| PTPN11 | 22 |
| RYR1 | 22 |
| STAT1 | 22 |
| YBX1 | 22 |
| DKC1 | 21 |
| HDAC1 | 21 |
| KNG1 | 21 |
| MYC | 21 |
| PSMB7 | 21 |
| IFT172 | 20 |
| NCOA2 | 20 |
| PTK2 | 20 |
| SMAD2 | 20 |
| SMAD4 | 20 |
| IL18 | 19 |
| LDB1 | 19 |
| LHX3 | 19 |
| CCR3 | 18 |
| CCR5 | 18 |
| CIITA | 18 |
| FCER1G | 18 |
| FGF8 | 18 |
| FGFR1 | 18 |
| TRAF2 | 18 |

| | |
|---------|----|
| APOBEC1 | 17 |
| MYB | 17 |
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| RUVBL1 | 15 |
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| BTRC | 14 |
| CALM1 | 14 |
| GHRH | 14 |
| HRAS | 14 |
| ITGB2 | 14 |
| KAT5 | 14 |
| M6PR | 14 |
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| CCL5 | 13 |
| GCG | 13 |
| ICAM1 | 13 |
| IL6 | 13 |
| LEP | 13 |
| MAPK1 | 13 |
| NCL | 13 |
| NPM1 | 13 |
| PIK3R1 | 13 |
| S100A11 | 13 |
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| CDA | 12 |
| CDKL5 | 12 |
| DECR1 | 12 |

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| ERBB4 | 12 |
| IL27RA | 12 |
| LMO2 | 12 |
| MECP2 | 12 |
| NCF2 | 12 |
| NHS | 12 |
| PRKCA | 12 |
| RRM1 | 12 |
| RRM2 | 12 |
| RRM2B | 12 |
| SELL | 12 |
| TAL1 | 12 |
| TK1 | 12 |
| TYMP | 12 |
| TYMS | 12 |
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| IRS1 | 11 |
| PLCG1 | 11 |
| RASSF1 | 11 |
| RPL5 | 11 |
| RUNX2 | 11 |
| SP7 | 11 |
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| BNIP3 | 10 |
| CDC25C | 10 |
| CFTR | 10 |
| CHUK | 10 |
| DAAM1 | 10 |
| DVL1 | 10 |
| IQGAP1 | 10 |
| JAK2 | 10 |
| MTOR | 10 |
| PLD1 | 10 |
| PLK1 | 10 |
| SHANK2 | 10 |
| SLC9A3R1 | 10 |
| TNFRSF11A | 10 |
| TNFSF11 | 10 |
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| CARD9 | 9 |
| PLA2G4A | 9 |

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| SNAP25 | 9 |
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| CAMK2B | 8 |
| CCND1 | 8 |
| CHPF | 8 |
| FRS2 | 8 |
| IGF1R | 8 |
| KLF4 | 8 |
| NANOG | 8 |
| PGM3 | 8 |
| PXN | 8 |
| RIPK1 | 8 |
| YY1 | 8 |
| A2M | 7 |
| AKR1B1 | 7 |
| AR | 7 |
| ASNS | 7 |
| ATF3 | 7 |
| ATF4 | 7 |
| CDKN1C | 7 |
| CHEK2 | 7 |
| GLO1 | 7 |
| GLUL | 7 |
| IL1B | 7 |
| LMO4 | 7 |
| PIK3CA | 7 |
| PPARGC1A | 7 |
| RBBP8 | 7 |
| SIRT1 | 7 |
| SOS1 | 7 |
| TERT | 7 |
| ARRB2 | 6 |
| BCKDHB | 6 |
| BSG | 6 |
| CCL13 | 6 |
| CD79A | 6 |
| DLD | 6 |
| EDNRB | 6 |
| EXOSC10 | 6 |
| ILK | 6 |

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| ITGA4 | 6 |
| LHB | 6 |
| LHCGR | 6 |
| LSM4 | 6 |
| LYZ | 6 |
| MMP1 | 6 |
| MYOD1 | 6 |
| NR4A1 | 6 |
| OGDH | 6 |
| PARD6A | 6 |
| PDGFRB | 6 |
| PLG | 6 |
| POLR2A | 6 |
| POLR2H | 6 |
| POLR3C | 6 |
| POLR3D | 6 |
| POLR3F | 6 |
| PPIB | 6 |
| PPP2CA | 6 |
| PTGS2 | 6 |
| RAF1 | 6 |
| RPL6 | 6 |
| SGOL1 | 6 |
| SNRPE | 6 |
| TBP | 6 |
| TLN1 | 6 |
| B4GALNT1 | 5 |
| C1S | 5 |
| C3 | 5 |
| CD19 | 5 |
| CDH2 | 5 |
| CR2 | 5 |
| DCTN1 | 5 |
| DCTN2 | 5 |
| FN1 | 5 |
| FOS | 5 |
| HNF1A | 5 |
| HNF4A | 5 |
| IFNGR1 | 5 |
| IKBKB | 5 |
| IKBKG | 5 |

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| JUP | 5 |
| KRAS | 5 |
| PSMA4 | 5 |
| SERPING1 | 5 |
| ST8SIA1 | 5 |
| TCF4 | 5 |
| WASL | 5 |
| ARHGDI1 | 4 |
| ATP6V1A | 4 |
| ATP6V1B1 | 4 |
| ATP6V1D | 4 |
| BMP2 | 4 |
| CDK4 | 4 |
| CHEK1 | 4 |
| CUL2 | 4 |
| DSG1 | 4 |
| F2 | 4 |
| GLA | 4 |
| GLB1 | 4 |
| GP1BA | 4 |
| HDAC9 | 4 |
| IL3 | 4 |
| IL5 | 4 |
| INPP4B | 4 |
| ITGB1 | 4 |
| KLK5 | 4 |
| MAPK14 | 4 |
| MAPKAPK2 | 4 |
| MMP2 | 4 |
| NCOA3 | 4 |
| NGFR | 4 |
| NUDC | 4 |
| PAFAH1B1 | 4 |
| PRTN3 | 4 |
| RB1 | 4 |
| RHOA | 4 |
| SRF | 4 |
| TCF3 | 4 |
| TCIRG1 | 4 |
| TIMP2 | 4 |
| YWHAZ | 4 |

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| ZNF461 | 4 |
| ACO2 | 3 |
| ARG2 | 3 |
| CCT3 | 3 |
| CDH1 | 3 |
| COL4A3 | 3 |
| COL4A4 | 3 |
| CS | 3 |
| CYFIP1 | 3 |
| DDOST | 3 |
| EDN1 | 3 |
| ELK1 | 3 |
| FH | 3 |
| FMR1 | 3 |
| GDNF | 3 |
| GLI2 | 3 |
| HSP90AA1 | 3 |
| IGBP1 | 3 |
| IGF2R | 3 |
| IL8 | 3 |
| KLKB1 | 3 |
| LRP6 | 3 |
| LSM7 | 3 |
| MAP3K5 | 3 |
| MCM2 | 3 |
| MDH2 | 3 |
| MUT | 3 |
| NCKAP1 | 3 |
| NOS3 | 3 |
| OTC | 3 |
| PITX2 | 3 |
| PLAUR | 3 |
| PLIN3 | 3 |
| POMC | 3 |
| PTPN6 | 3 |
| RAB5A | 3 |
| RABEP1 | 3 |
| RPS5 | 3 |
| RTKN | 3 |
| SDHB | 3 |
| SNRPD3 | 3 |

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|---------|---|
| SPI1 | 3 |
| SSR4 | 3 |
| SUCLG1 | 3 |
| TGFB1 | 3 |
| TSC2 | 3 |
| TXN | 3 |
| TXNIP | 3 |
| TXNL4A | 3 |
| VCL | 3 |
| VHL | 3 |
| ZFYVE9 | 3 |
| ADCYAP1 | 2 |
| ALOX5 | 2 |
| APAF1 | 2 |
| ARHGEF7 | 2 |
| AXIN1 | 2 |
| BNIP2 | 2 |
| CCL2 | 2 |
| CCR1 | 2 |
| CDC6 | 2 |
| CDKN1B | 2 |
| COL8A2 | 2 |
| CSF2RB | 2 |
| CXCR3 | 2 |
| DDX58 | 2 |
| DLG4 | 2 |
| EXOSC6 | 2 |
| GJA1 | 2 |
| GMPS | 2 |
| GPX4 | 2 |
| IMPDH2 | 2 |
| LCN1 | 2 |
| MAVS | 2 |
| MYBPC3 | 2 |
| MYH6 | 2 |
| NCK1 | 2 |
| NOG | 2 |
| PCNA | 2 |
| PICK1 | 2 |
| PTGDS | 2 |
| RAP2A | 2 |

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| RPS3 | 2 |
| SERPINE1 | 2 |
| TNIK | 2 |
| TNNT2 | 2 |
| TPM1 | 2 |
| USP7 | 2 |
| VIPR1 | 2 |
| ZEB1 | 2 |
| ADCYAP1R1 | 1 |
| APBB1 | 1 |
| ATF2 | 1 |
| ATXN3 | 1 |
| BUB1B | 1 |
| CANX | 1 |
| CASP3 | 1 |
| CCL11 | 1 |
| CCNB1 | 1 |
| CD28 | 1 |
| CD80 | 1 |
| CDH5 | 1 |
| CDK2 | 1 |
| CDK8 | 1 |
| CDS2 | 1 |
| CDT1 | 1 |
| CHMP2A | 1 |
| CLIP1 | 1 |
| CLSPN | 1 |
| COPB1 | 1 |
| COPB2 | 1 |
| CSF2 | 1 |
| CTNNA1 | 1 |
| CUL1 | 1 |
| CXCL9 | 1 |
| CYC1 | 1 |
| CYCS | 1 |
| DNAH8 | 1 |
| DSP | 1 |
| EGR1 | 1 |
| FGF23 | 1 |
| FGFR2 | 1 |
| FYN | 1 |

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| GADD45G | 1 |
| GALNT3 | 1 |
| GCNT1 | 1 |
| GIT1 | 1 |
| GNB2L1 | 1 |
| GNPNAT1 | 1 |
| GRIN2A | 1 |
| GRIN2B | 1 |
| GSS | 1 |
| GSTP1 | 1 |
| GZMB | 1 |
| HDAC4 | 1 |
| HGS | 1 |
| HK2 | 1 |
| IL6ST | 1 |
| IRF7 | 1 |
| ITCH | 1 |
| ITGA8 | 1 |
| KCNA4 | 1 |
| KCNAB2 | 1 |
| LSM1 | 1 |
| MAP2K1 | 1 |
| MAPK3 | 1 |
| MBD2 | 1 |
| MED1 | 1 |
| MEF2D | 1 |
| MRVI1 | 1 |
| MYD88 | 1 |
| NTRK1 | 1 |
| PAK1 | 1 |
| PIK3R2 | 1 |
| PPM1B | 1 |
| PPP1R12A | 1 |
| PRKCE | 1 |
| PRKG1 | 1 |
| PRKG2 | 1 |
| PTPN1 | 1 |
| PTPRC | 1 |
| RAB27A | 1 |
| RBBP4 | 1 |
| RBX1 | 1 |

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| RFXANK | 1 |
| RNF11 | 1 |
| ROCK2 | 1 |
| RPA1 | 1 |
| RPA3 | 1 |
| SELE | 1 |
| SELPLG | 1 |
| SLC2A4 | 1 |
| SMAD7 | 1 |
| SMURF2 | 1 |
| SORBS3 | 1 |
| STX4 | 1 |
| SYTL4 | 1 |
| TBK1 | 1 |
| TGFBI | 1 |
| TIMP1 | 1 |
| UBE2C | 1 |
| UPF1 | 1 |
| UPF2 | 1 |
| UQCRCF1 | 1 |
| VCP | 1 |
| VDR | 1 |
| VPS4A | 1 |
| ZAP70 | 1 |