

Additional File 7. Functional groupings of QISPs based on Gene Ontology (GO) molecular function and biological process annotations. Genes are grouped according to zone of expression: deep (D, dark gray), middle (M, light gray), upper (U, white). Listed genes are ranked by fold up-regulation.

Transcription

| Fold | Gene | Zone | Gene# | Clust# |
|------|---------------|------|-------|--------|
| 4.1 | Neurod4 | D | 307 | 13 |
| 3.9 | Bcl6 | D U | 315 | 15 |
| 3.5 | D430015B01Rik | D U | 286 | 11 |
| 3.4 | Tanc2 | D U | 310 | 14 |
| 3.1 | Myt1 | D U | 299 | 12 |
| 72 | Neurod6 | M | 281 | 10 |
| 31 | Neurod1 | M | 260 | 9 |
| 12 | Nhlh1 | M | 246 | 9 |
| 7.3 | Neurod2 | M | 257 | 9 |
| 6.9 | Myt11 | M | 240 | 9 |
| 5.6 | Aff3 | M | 270 | 10 |
| 3.8 | Trp53inp1 | M | 262 | 9 |
| 3.4 | Lhx9 | M | 245 | 9 |
| 43 | Tbr1 | U | 87 | 3 |
| 19 | Bhlhb5 | U | 217 | 6 |
| 18 | Hivep2 | U | 6 | 2 |
| 13 | Prdm8 | U | 177 | 6 |
| 12 | Nr4a3 | U | 43 | 2 |
| 12 | Satb2 | U | 166 | 6 |
| 5.7 | Nfe2l3 | U | 143 | 6 |
| 5.2 | Sox5 | U | 122 | 6 |
| 4.8 | Ldb2 | U | 94 | 4 |
| 4.5 | Bcl11b | U | 80 | 3 |
| 4.1 | Id2 | U | 216 | 6 |
| 4.1 | Tcp11l2 | U | 132 | 6 |
| 4 | Ppp1r16b | U | 130 | 6 |
| 3.9 | St18 | U | 51 | 3 |
| 3.8 | Zfp238 | U | 226 | 6 |
| 3.8 | Scrt1 | U | 215 | 6 |
| 3.6 | Ier5 | U | 146 | 6 |
| 3.4 | Thra | U | 208 | 6 |
| 3.3 | Btbd11 | U | 174 | 6 |
| 3.3 | Asx3 | U | 35 | 2 |
| 3.1 | Nap1l2 | U | 50 | 3 |
| 3.1 | Zfpm2 | U | 107 | 4 |
| 3.1 | Mef2c | U | 97 | 4 |
| 3.1 | Nelf | U | 129 | 6 |

Adhesion

| Fold | Gene | Zone | Gene# | Clust# |
|------|---------------|------|-------|--------|
| 3.1 | Opclm1 | D U | 317 | 15 |
| 7.9 | L1cam | M | 268 | 10 |
| 3.1 | Pcdh20 | M | 276 | 10 |
| 2.9 | Cdh8 | M | 244 | 9 |
| 32.9 | Cntn2 | U | 210 | 6 |
| 10.8 | Cdh13 | U | 96 | 4 |
| 9.1 | Lrnf5 | U | 128 | 6 |
| 8.1 | 9030425E11Rik | U | 190 | 6 |
| 7.8 | Dscam | U | 209 | 6 |
| 7 | Nrxn1 | U | 74 | 3 |
| 5.7 | Nfasc | U | 90 | 3 |
| 5.2 | Tes | U | 205 | 6 |
| 5.1 | Clistn2 | U | 27 | 2 |
| 4.7 | Cdh12 | U | 15 | 2 |
| 4 | Flrt2 | U | 173 | 6 |
| 3.8 | Aplp1 | U | 71 | 3 |
| 3.8 | Cdh11 | U | 66 | 3 |
| 3.6 | Flrt1 | U | 49 | 3 |
| 3.3 | Cdk5r1 | U | 203 | 6 |
| 3.3 | Ctnna2 | U | 196 | 6 |
| 3 | Cadm3 | U | 147 | 6 |

Kinases and adaptors

| Fold | Gene | Zone | Gene# | Clust# |
|------|---------|------|-------|--------|
| 4.1 | Camk2b | D U | 292 | 12 |
| 3.5 | Dok4 | D U | 290 | 11 |
| 3.2 | Sh3bp5 | D U | 294 | 12 |
| 10.2 | Nuak1 | M | 259 | 9 |
| 3.4 | Pak7 | M | 272 | 10 |
| 3.4 | Itpk1 | M | 271 | 10 |
| 3 | Sh2d4b | M | 284 | 10 |
| 21.9 | Sla | U | 22 | 2 |
| 6.8 | Plk2 | U | 33 | 2 |
| 6 | Stk32b | U | 19 | 2 |
| 5.2 | Prkce | U | 100 | 4 |
| 5.2 | Camkv | U | 93 | 4 |
| 4.1 | Sphkap | U | 102 | 4 |
| 3.8 | Sh3kbp1 | U | 211 | 6 |
| 3.7 | Pfkb | U | 18 | 2 |
| 3.5 | Dclk1 | U | 222 | 6 |
| 3.5 | Prkcz | U | 47 | 3 |
| 3.3 | Shb | U | 121 | 6 |
| 3 | Prkar1b | U | 106 | 4 |
| 3 | Prkaa2 | U | 133 | 6 |

Receptors

| Fold | Gene | Zone | Gene# | Clust# |
|------|--------|-------|-------|--------|
| 9.7 | Sstr2 | D | 306 | 13 |
| 4.1 | Ryr3 | D M U | 1 | 1 |
| 4.1 | Gipr | D U | 234 | 7 |
| 14 | Plxna4 | M | 252 | 9 |
| 9.7 | Nrp1 | M | 243 | 9 |
| 5 | Unc5d | M | 253 | 9 |
| 4.9 | Sema7a | M | 275 | 10 |
| 4.5 | Chrn2 | M | 264 | 10 |
| 4.5 | Celsr3 | M | 279 | 10 |
| 4 | Sema6d | M | 242 | 9 |
| 4 | Plxna2 | M | 251 | 9 |
| 3.4 | Olfm1 | M | 283 | 10 |
| 3.1 | Robo2 | M | 249 | 9 |
| 14 | Mc4r | U | 25 | 2 |
| 11 | Kit | U | 200 | 6 |
| 11 | Gira2 | U | 82 | 3 |
| 11 | Cnr1 | U | 161 | 6 |
| 7.8 | Gpr85 | U | 191 | 6 |
| 7.1 | Abcc8 | U | 138 | 6 |
| 6.1 | Ifngr2 | U | 62 | 3 |
| 5.8 | Robo1 | U | 72 | 3 |
| 5.7 | Sez6l | U | 76 | 3 |
| 5.1 | Dcc | U | 149 | 6 |
| 4.6 | Gabrg2 | U | 125 | 6 |
| 4.2 | Npr2 | U | 182 | 6 |
| 4.1 | Ptpro | U | 92 | 4 |
| 3.9 | Gabbr2 | U | 118 | 6 |
| 3.9 | Sema4g | U | 70 | 3 |
| 3.8 | Plxnd1 | U | 16 | 2 |
| 3.7 | Sez6l2 | U | 165 | 6 |
| 3.5 | Gpr21 | U | 137 | 6 |
| 3.1 | Gpr22 | U | 101 | 4 |
| 3 | Chrm3 | U | 151 | 6 |
| 3 | Ephb1 | U | 108 | 4 |

Ion channels and solute carriers

| Fold | Gene | Zone | Gene# | Clust# |
|------|----------|------|-------|--------|
| 3.3 | Nkain3 | D U | 311 | 14 |
| 3 | Cacna1h | D U | 113 | 5 |
| 19.4 | Slc17a6 | M | 247 | 9 |
| 12 | Slc17a7 | U | 139 | 6 |
| 7.9 | Cacna1e | U | 23 | 2 |
| 7.3 | Kcnq3 | U | 120 | 6 |
| 6.5 | Cacna2d1 | U | 195 | 6 |
| 6.4 | Slc1a1 | U | 38 | 2 |
| 5.3 | Scn2a1 | U | 24 | 2 |
| 5 | Slc8a1 | U | 158 | 6 |
| 4.8 | Kcnj3 | U | 77 | 3 |
| 4.1 | Kcna1 | U | 60 | 3 |
| 4 | Kcna6 | U | 119 | 6 |
| 3.9 | Scn3b | U | 28 | 2 |
| 3.1 | Cacnb3 | U | 193 | 6 |

Extracellular

| Fold | Gene | Zone | Gene# | Clust# |
|------|---------------|------|-------|--------|
| 5.6 | Igfb2 | D | 308 | 13 |
| 6.4 | Chga | D U | 296 | 12 |
| 6.2 | Adamtsl3 | D U | 289 | 11 |
| 4 | Pcsk2 | D U | 316 | 15 |
| 3.8 | Cck | D U | 302 | 12 |
| 3 | C1q13 | D U | 231 | 7 |
| 6.1 | Serpini1 | M | 282 | 10 |
| 5.2 | Nxph4 | M | 238 | 9 |
| 4.6 | Sema3c | M | 241 | 9 |
| 4.5 | Sparcl1 | M | 263 | 10 |
| 3.7 | Mfap4 | M | 239 | 9 |
| 3 | Nptx1 | M | 254 | 9 |
| 11.1 | Rspo3 | U | 58 | 3 |
| 8.1 | Wnt7b | U | 214 | 6 |
| 7.4 | 6530402F18Rik | U | 218 | 6 |
| 5.5 | Reln | U | 169 | 6 |
| 5.3 | Efna3 | U | 39 | 2 |
| 5.2 | Igf1 | U | 2 | 2 |
| 5.2 | Edil3 | U | 197 | 6 |
| 4.6 | Scg3 | U | 224 | 6 |
| 4.4 | Lamb1-1 | U | 29 | 2 |
| 4.3 | Necab3 | U | 140 | 6 |
| 3.8 | Nell2 | U | 172 | 6 |
| 3.8 | Cnih3 | U | 131 | 6 |
| 3.7 | Slit1 | U | 103 | 4 |
| 3.5 | Spock1 | U | 109 | 4 |
| 3.3 | Kirrel3 | U | 134 | 6 |
| 3.1 | Nxph3 | U | 32 | 2 |

Small G-protein signaling

| Fold | Gene | Zone | Gene# | Clust# |
|------|----------|------|-------|--------|
| 6.5 | Rasgef1b | D U | 300 | 12 |
| 5.9 | Rnd2 | M | 274 | 10 |
| 21 | Tiam2 | U | 187 | 6 |
| 17.1 | Elmod1 | U | 164 | 6 |
| 6.2 | Rgs6 | U | 37 | 2 |
| 5.3 | Rab3d | U | 229 | 6 |
| 4.8 | Rab3c | U | 83 | 3 |
| 4.7 | Gnal | U | 44 | 2 |
| 4.5 | Ica1l | U | 14 | 2 |
| 4.1 | Rab3a | U | 88 | 3 |
| 4.1 | Psd | U | 81 | 3 |
| 4.1 | Arhgap29 | U | 34 | 2 |
| 3.7 | Nin | U | 95 | 4 |
| 3.5 | Rundc3a | U | 181 | 6 |
| 3.4 | Spg3a | U | 52 | 3 |
| 3.3 | Ica1 | U | 85 | 3 |
| 3.1 | Arl8a | U | 135 | 6 |

Synaptic

| Fold | Gene | Zone | Gene# | Clust# |
|------|--------|------|-------|--------|
| 5.6 | Cbln2 | D | 303 | 13 |
| 3.9 | Syn2 | M | 261 | 9 |
| 3.2 | Dlg2 | M | 256 | 9 |
| 6.7 | Syt4 | U | 192 | 6 |
| 6.5 | Sv2b | U | 26 | 2 |
| 6.1 | Ank3 | U | 64 | 3 |
| 5 | Stxbp1 | U | 42 | 2 |
| 5 | Snap25 | U | 202 | 6 |
| 4.7 | Lrrc7 | U | 67 | 3 |
| 4.3 | Snca | U | 45 | 2 |
| 4.1 | Lrrtm4 | U | 53 | 3 |
| 3.9 | Cplx1 | U | 123 | 6 |
| 3.9 | Dmxl2 | U | 55 | 3 |
| 3.9 | Gp1bb | U | 153 | 6 |
| 3.8 | Trim9 | U | 41 | 2 |
| 3.7 | Unc13a | U | 68 | 3 |
| 3.5 | Lrrtm1 | U | 150 | 6 |
| 3.4 | Sv2a | U | 31 | 2 |
| 3.3 | Svop | U | 179 | 6 |
| 3.2 | Erc2 | U | 156 | 6 |
| 3.1 | Syn1 | U | 136 | 6 |
| 2.8 | Lrrtm3 | U | 57 | 3 |

Phosphatases

| Fold | Gene | Zone | Gene# | Clust# |
|------|----------|------|-------|--------|
| 3.7 | Ppp1r14a | D U | 287 | 11 |
| 2.8 | Lpin1 | M | 266 | 10 |
| 9.1 | Dnajc6 | U | 148 | 6 |
| 8.8 | Ppp2r2c | U | 30 | 2 |
| 6.5 | Arpp21 | U | 168 | 6 |
| 3.4 | Ppp2r2b | U | 225 | 6 |
| 3.4 | Nav1 | U | 228 | 6 |
| 3.4 | Phactr3 | U | 154 | 6 |
| 3 | Ppp1r1b | U | 75 | 3 |

Cytoskeletal

| Fold | Gene | Zone | Gene# | Clust# |
|------|---------|------|-------|--------|
| 7.6 | Kif21b | M | 255 | 9 |
| 15 | Dync1i1 | U | 17 | 2 |
| 6.1 | Gas7 | U | 126 | 6 |
| 5.5 | Jakmip1 | U | 79 | 3 |
| 5 | Cttnbp2 | U | 213 | 6 |
| 4.9 | Kif5a | U | 204 | 6 |
| 4.9 | Slitrk1 | U | 65 | 3 |
| 3.9 | Dixdc1 | U | 91 | 3 |
| 3.5 | Mapt | U | 175 | 6 |
| 3.3 | Dcx | U | 56 | 3 |
| 3.3 | Atcay | U | 86 | 3 |
| 3.3 | Cotl1 | U | 184 | 6 |
| 3.2 | Apc2 | U | 11 | 2 |
| 3 | Stmn2 | U | 201 | 6 |
| 3 | Add2 | U | 145 | 6 |
| 3 | Nav2 | U | 188 | 6 |
| 2.9 | Gap43 | U | 13 | 2 |
| 2.9 | Dpysl5 | U | 227 | 6 |

Proteolysis

| Fold | Gene | Zone | Gene# | Clust# |
|------|--------|------|-------|--------|
| 4.2 | Pappa2 | D U | 312 | 14 |
| 3.9 | Herc3 | D U | 114 | 5 |
| 3.5 | Odz1 | D U | 293 | 12 |
| 8.4 | Hecw1 | U | 127 | 6 |
| 4.9 | Znrf2 | U | 163 | 6 |
| 4.3 | Rnf182 | U | 4 | 2 |
| 4 | Usp29 | U | 7 | 2 |
| 3.7 | Dact1 | U | 98 | 4 |

Other enzymes

| Fold | Gene | Zone | Gene# | Clust# |
|------|---------------|------|-------|--------|
| 4.9 | Ust | D | 305 | 13 |
| 3.9 | Csmd3 | D | 309 | 13 |
| 4.2 | Atp1a3 | D U | 314 | 15 |
| 4 | Pde1a | D U | 115 | 5 |
| 3.7 | Pde10a | D U | 233 | 7 |
| 3.4 | Lpl | D U | 295 | 12 |
| 3.4 | Adcy1 | D U | 291 | 11 |
| 3 | Eno2 | D U | 112 | 5 |
| 6.4 | Plcb1 | M | 248 | 9 |
| 5.1 | 4631426J05Rik | M | 265 | 10 |
| 4.8 | Gramd1b | M | 278 | 10 |
| 3 | Pam | M | 273 | 10 |
| 6.1 | Wbscr17 | U | 171 | 6 |
| 5.9 | Prmt8 | U | 185 | 6 |
| 5.5 | St3gal1 | U | 104 | 4 |
| 4.8 | Chst1 | U | 141 | 6 |
| 4.6 | Mpped1 | U | 212 | 6 |
| 4.4 | Sgip1 | U | 162 | 6 |
| 4.2 | St8sia3 | U | 84 | 3 |
| 4 | Nsg2 | U | 180 | 6 |
| 3.7 | B3galt1 | U | 99 | 4 |
| 3.6 | Parp6 | U | 199 | 6 |
| 3.3 | Pde9a | U | 69 | 3 |
| 3.2 | Mmp24 | U | 54 | 3 |
| 3.2 | Tmem108 | U | 105 | 4 |
| 3.1 | Mgll1 | U | 117 | 6 |
| 3.1 | Acot9 | U | 78 | 3 |
| 3.1 | Nmnat2 | U | 207 | 6 |
| 3.1 | B3gat1 | U | 110 | 4 |
| 3 | Atp2b2 | U | 198 | 6 |

Other

| Fold | Gene | Zone | Gene# | Clust# |
|------|---------|------|-------|--------|
| 3.6 | Palmd | D | 304 | 13 |
| 17 | Nrn1 | D U | 297 | 12 |
| 11 | Rlbp111 | D U | 298 | 12 |
| 5.9 | Sec24d | D U | 116 | 5 |
| 3.9 | Vat1 | D U | 288 | 11 |
| 3.7 | Gdap1 | D U | 313 | 15 |
| 8.9 | Tmem74 | M | 269 | 10 |
| 6.8 | Pcp4 | M | 250 | 9 |
| 5.1 | Serinc5 | M | 237 | 9 |
| 3.2 | Lzts1 | M | 277 | 10 |
| 3 | Gdap111 | M | 280 | 10 |
| 8.3 | A2bp1 | U | 21 | 2 |
| 7.6 | Nos1 | U | 230 | 6 |
| 6.3 | Ppfla2 | U | 157 | |