

Table SI. Primers used for reverse transcription-quantitative PCR.

| circRNA, Gene<br>(product length, bp) | Direction | Sequence (5'-3')           |
|---------------------------------------|-----------|----------------------------|
| SEMA3C<br>(122)                       | Forward   | TGCAGCGCTGAGATTCCTTT       |
|                                       | Reverse   | GTTGGATGCGCTTGTGTCTC       |
| circ_0004365<br>(125)                 | Forward   | CTGTGGATCGAGTGAACGCT       |
|                                       | Reverse   | ACGTTGGGGTTGAAAGAGCA       |
| Binding site 1, 3<br>(401)            | Forward   | TCTTTCTAGTGTCCAGGAGGAG     |
|                                       | Reverse   | CAAGAATAGGTATACCATGTCAAGCT |
| Binding site 2<br>(401)               | Forward   | TTTATTGATTTGCTGGACAATGCA   |
|                                       | Reverse   | ACCATTATTCATGTAATAGCCTGCT  |
| $\beta$ -actin<br>(592)               | Forward   | GAAAATCTGGCACCACACCTT      |
|                                       | Reverse   | GTTGAAGGTAGTTTCGTGGAT      |

bp, base pair; SEMA3C, Semaphorin 3C.

Table SII. Biological prediction and analysis predicts that circ\_0004365 bind 33 miRNAs to regulate the expression of 187 mRNAs.

| A, Interaction from circRNAto miR |              |        |        |
|-----------------------------------|--------------|--------|--------|
| From                              | To           | Score1 | Score2 |
| circ-4365                         | miR-1197     | 0.121  | NA     |
| circ-4365                         | miR-1225-5p  | 0.177  | NA     |
| circ-4365                         | miR-1248     | 0.076  | NA     |
| circ-4365                         | miR-1276     | 0.113  | NA     |
| circ-4365                         | miR-1283     | 0.154  | NA     |
| circ-4365                         | miR-1289     | 0.205  | NA     |
| circ-4365                         | miR-1292-5p  | 0.152  | NA     |
| circ-4365                         | miR-146b-3p  | 0.193  | NA     |
| circ-4365                         | miR-223-3p   | 0.19   | NA     |
| circ-4365                         | miR-296-5p   | 0.227  | NA     |
| circ-4365                         | miR-338-3p   | 0.147  | NA     |
| circ-4365                         | miR-377-3p   | 0.129  | NA     |
| circ-4365                         | miR-383-5p.1 | 0.134  | NA     |
| circ-4365                         | miR-432-5p   | 0.265  | NA     |
| circ-4365                         | miR-488-3p   | 0.008  | NA     |
| circ-4365                         | miR-490-5p   | 0.119  | NA     |
| circ-4365                         | miR-503-5p   | 0.274  | NA     |
| circ-4365                         | miR-517-3p   | 0.241  | NA     |
| circ-4365                         | miR-520g-3p  | 0.158  | NA     |
| circ-4365                         | miR-532-3p   | 0.138  | NA     |
| circ-4365                         | miR-549a     | 0.121  | NA     |
| circ-4365                         | miR-568      | 0.061  | NA     |
| circ-4365                         | miR-577      | 0.055  | NA     |
| circ-4365                         | miR-579-3p   | 0.032  | NA     |
| circ-4365                         | miR-595      | 0.149  | NA     |
| circ-4365                         | miR-609      | 0.181  | NA     |
| circ-4365                         | miR-616-3p   | 0.017  | NA     |
| circ-4365                         | miR-622      | 0.204  | NA     |
| circ-4365                         | miR-646      | 0.184  | NA     |
| circ-4365                         | miR-653-5p   | 0.036  | NA     |
| circ-4365                         | miR-874-3p   | 0.268  | NA     |

|           |            |       |    |
|-----------|------------|-------|----|
| circ-4365 | miR-876-3p | 0.291 | NA |
| circ-4365 | miR-890    | 0.191 | NA |

---

B, Interaction from miR to gene

---

| From       | To          | Score1 | Score2 |
|------------|-------------|--------|--------|
| miR-890    | AC005008.2  | NA     | 0.985  |
| miR-609    | AC006946.15 | NA     | 0.859  |
| miR-609    | AC015987.2  | NA     | 1.046  |
| miR-377-3p | AC068987.1  | NA     | 0.972  |
| miR-296-5p | ADAP1       | NA     | 0.987  |
| miR-488-3p | AEBP2       | NA     | 0.827  |
| miR-490-5p | AL353791.1  | NA     | 0.835  |
| miR-1289   | AL590235.1  | NA     | 1.187  |
| miR-377-3p | AL590235.1  | NA     | 0.805  |
| miR-296-5p | ALPK3       | NA     | 0.819  |
| miR-653-5p | ANGPTL5     | NA     | 0.813  |
| miR-488-3p | ANKRD26     | NA     | 1      |
| miR-296-5p | ARFGAP1     | NA     | 0.831  |
| miR-503-5p | ARL2        | NA     | 1.026  |
| miR-296-5p | ASGR1       | NA     | 0.933  |
| miR-296-5p | BBC3        | NA     | 0.877  |
| miR-1248   | BCL6B       | NA     | 1.084  |
| miR-296-5p | BMP8A       | NA     | 0.893  |
| miR-296-5p | BOK         | NA     | 4.243  |
| miR-490-5p | BTC         | NA     | 0.875  |
| miR-1248   | C19orf33    | NA     | 2.034  |
| miR-532-3p | C22orf46    | NA     | 1.38   |
| miR-1276   | C6orf123    | NA     | 1.022  |
| miR-1289   | C9orf171    | NA     | 0.944  |
| miR-296-5p | C9orf69     | NA     | 0.938  |
| miR-377-3p | CARTPT      | NA     | 1.004  |
| miR-1248   | CCDC180     | NA     | 1.154  |
| miR-296-5p | CCDC38      | NA     | 0.882  |
| miR-432-5p | CCNH        | NA     | 0.831  |
| miR-296-5p | CD6         | NA     | 1.103  |

|             |                    |    |       |
|-------------|--------------------|----|-------|
| miR-1276    | CDS2               | NA | 1     |
| miR-296-5p  | CHMP1A             | NA | 1.175 |
| miR-1248    | CHRM2              | NA | 0.956 |
| miR-296-5p  | CLCN2              | NA | 1.294 |
| miR-876-3p  | CLDN3              | NA | 0.877 |
| miR-296-5p  | CLEC18A            | NA | 0.988 |
| miR-646     | CMC4               | NA | 0.957 |
| miR-579-3p  | CMC4               | NA | 0.981 |
| miR-503-5p  | CNTNAP1            | NA | 0.885 |
| miR-579-3p  | COL12A1            | NA | 1     |
| miR-296-5p  | COMMD7             | NA | 0.802 |
| miR-296-5p  | COX19              | NA | 0.887 |
| miR-296-5p  | CRYGS              | NA | 0.971 |
| miR-609     | CSNK2B-LY6G5B-1181 | NA | 0.919 |
| miR-1248    | CTB-102L5.4        | NA | 1.85  |
| miR-1225-5p | CTD-3203P2.2       | NA | 1.19  |
| miR-490-5p  | CXorf27            | NA | 0.847 |
| miR-646     | CYB561D1           | NA | 0.957 |
| miR-1248    | CYLC2              | NA | 1.255 |
| miR-874-3p  | CYP11B1            | NA | 0.836 |
| miR-1248    | CYP3A5             | NA | 0.884 |
| miR-890     | DAZ4               | NA | 1.307 |
| miR-532-3p  | DDOST              | NA | 0.888 |
| miR-646     | DGCR2              | NA | 1.077 |
| miR-609     | DNAAF1             | NA | 0.974 |
| miR-532-3p  | DNAL4              | NA | 1.105 |
| miR-1248    | DST                | NA | 3.373 |
| miR-579-3p  | DST                | NA | 1.26  |
| miR-296-5p  | ELAVL3             | NA | 0.958 |
| miR-876-3p  | ELSPBP1            | NA | 1.465 |
| miR-532-3p  | ENSA               | NA | 1.222 |
| miR-296-5p  | EPN1               | NA | 1.403 |
| miR-377-3p  | ETS1               | NA | 1.276 |
| miR-874-3p  | FAM230A            | NA | 14.72 |

|             |           |    |       |
|-------------|-----------|----|-------|
| miR-377-3p  | FAM69C    | NA | 1.358 |
| miR-876-3p  | FAM89A    | NA | 1.056 |
| miR-223-3p  | FBXW7     | NA | 1.055 |
| miR-296-5p  | FGFR3     | NA | 1.063 |
| miR-338-3p  | FKBP1C    | NA | 0.915 |
| miR-296-5p  | FLJ27365  | NA | 0.81  |
| miR-609     | FOXI2     | NA | 2.662 |
| miR-296-5p  | GAB4      | NA | 0.8   |
| miR-876-3p  | GATA1     | NA | 0.844 |
| miR-146b-3p | GBA2      | NA | 0.981 |
| miR-296-5p  | GIMAP5    | NA | 0.801 |
| miR-296-5p  | GPR173    | NA | 0.869 |
| miR-1248    | GPR26     | NA | 1.215 |
| miR-1289    | GSX2      | NA | 1.048 |
| miR-1248    | HBEGF     | NA | 0.801 |
| miR-296-5p  | HMGA1     | NA | 1.476 |
| miR-549a    | HSPB11    | NA | 0.807 |
| miR-532-3p  | ICOSLG    | NA | 1     |
| miR-338-3p  | IDNK      | NA | 0.947 |
| miR-296-5p  | IFITM5    | NA | 1.086 |
| miR-876-3p  | IFNA14    | NA | 0.814 |
| miR-876-3p  | IFNA7     | NA | 0.885 |
| miR-296-5p  | ISCA2     | NA | 0.814 |
| miR-1197    | ITGB1BP1  | NA | 0.818 |
| miR-296-5p  | ITGB4     | NA | 0.983 |
| miR-338-3p  | IZUMO3    | NA | 1.072 |
| miR-296-5p  | JMJD4     | NA | 0.963 |
| miR-490-5p  | KBTBD4    | NA | 0.971 |
| miR-296-5p  | KCNC1     | NA | 1.315 |
| miR-296-5p  | KCTD15    | NA | 0.833 |
| miR-296-5p  | KLF16     | NA | 0.801 |
| miR-1248    | KNTC1     | NA | 0.879 |
| miR-432-5p  | KRTAP19-6 | NA | 0.874 |
| miR-432-5p  | KRTAP21-2 | NA | 0.819 |

|             |          |    |       |
|-------------|----------|----|-------|
| miR-503-5p  | LCE6A    | NA | 0.875 |
| miR-296-5p  | LCN6     | NA | 0.929 |
| miR-296-5p  | LIF      | NA | 1.163 |
| miR-296-5p  | LLGL1    | NA | 0.864 |
| miR-876-3p  | LMLN     | NA | 2.309 |
| miR-609     | LY6G5B   | NA | 1.05  |
| miR-296-5p  | LYNX1    | NA | 0.804 |
| miR-296-5p  | LYPLA2   | NA | 0.857 |
| miR-503-5p  | MAPK8IP2 | NA | 0.852 |
| miR-488-3p  | MARK1    | NA | 1     |
| miR-296-5p  | MRPS14   | NA | 0.813 |
| miR-296-5p  | MTRNR2L1 | NA | 0.945 |
| miR-609     | MTRNR2L9 | NA | 0.932 |
| miR-146b-3p | MUC19    | NA | 6.731 |
| miR-532-3p  | MYOM3    | NA | 0.838 |
| miR-488-3p  | NAT8     | NA | 0.938 |
| miR-1276    | NDST1    | NA | 1     |
| miR-296-5p  | NUMBL    | NA | 0.808 |
| miR-296-5p  | P2RX6    | NA | 0.927 |
| miR-338-3p  | PAGE5    | NA | 0.845 |
| miR-296-5p  | PAX8     | NA | 0.826 |
| miR-377-3p  | PCMTD2   | NA | 0.893 |
| miR-296-5p  | PDX1     | NA | 0.992 |
| miR-296-5p  | PLEKHA7  | NA | 0.846 |
| miR-296-5p  | PLEKHG4B | NA | 1.073 |
| miR-296-5p  | PLXNA3   | NA | 0.935 |
| miR-296-5p  | PNMAL2   | NA | 0.806 |
| miR-296-5p  | POLR3H   | NA | 1.351 |
| miR-609     | PPP1R1C  | NA | 1.071 |
| miR-296-5p  | PPP2R4   | NA | 0.98  |
| miR-568     | PRAC1    | NA | 0.816 |
| miR-1248    | PRKCB    | NA | 0.906 |
| miR-609     | PSMG3    | NA | 0.852 |
| miR-646     | PTCD3    | NA | 1.103 |

|             |              |    |       |
|-------------|--------------|----|-------|
| miR-549a    | PTRHD1       | NA | 0.818 |
| miR-296-5p  | PYCRL        | NA | 0.878 |
| miR-609     | RAG2         | NA | 1.107 |
| miR-1276    | RAPSN        | NA | 0.888 |
| miR-622     | RBL1         | NA | 0.816 |
| miR-1283    | RFPL4B       | NA | 1.004 |
| miR-296-5p  | RGMA         | NA | 0.983 |
| miR-223-3p  | RHOB         | NA | 0.913 |
| miR-296-5p  | RIMS4        | NA | 0.813 |
| miR-223-3p  | RNF168       | NA | 1.691 |
| miR-296-5p  | RNF44        | NA | 1.408 |
| miR-876-3p  | RP11-770J1.5 | NA | 0.845 |
| miR-296-5p  | RPP25        | NA | 0.873 |
| miR-532-3p  | RPRML        | NA | 0.89  |
| miR-488-3p  | RPS6KA6      | NA | 0.932 |
| miR-609     | RSPO4        | NA | 0.855 |
| miR-296-5p  | SCARF1       | NA | 0.836 |
| miR-296-5p  | SECTM1       | NA | 0.841 |
| miR-296-5p  | SIX5         | NA | 1.302 |
| miR-577     | SLC22A24     | NA | 0.922 |
| miR-377-3p  | SLC6A19      | NA | 2.072 |
| miR-377-3p  | SMIM3        | NA | 0.947 |
| miR-579-3p  | SRSF7        | NA | 1     |
| miR-296-5p  | SUMF2        | NA | 0.952 |
| miR-338-3p  | TAX1BP3      | NA | 1.058 |
| miR-296-5p  | TEAD3        | NA | 1.076 |
| miR-296-5p  | TEX22        | NA | 0.827 |
| miR-296-5p  | TFRC         | NA | 1.128 |
| miR-296-5p  | TMEM201      | NA | 0.805 |
| miR-296-5p  | TMEM235      | NA | 1.018 |
| miR-616-3p  | TNFSF14      | NA | 1.5   |
| miR-146b-3p | TNNI1        | NA | 0.916 |
| miR-296-5p  | TNNI1        | NA | 1.041 |
| miR-296-5p  | TP53I11      | NA | 0.942 |

|            |         |    |       |
|------------|---------|----|-------|
| miR-490-5p | TTC29   | NA | 1.089 |
| miR-1276   | TTL12   | NA | 1     |
| miR-549a   | UBE2D3  | NA | 0.869 |
| miR-338-3p | ULBP1   | NA | 0.81  |
| miR-1283   | VMA21   | NA | 0.857 |
| miR-1289   | VPS25   | NA | 0.837 |
| miR-609    | WDR74   | NA | 0.819 |
| miR-377-3p | WNT9A   | NA | 0.863 |
| miR-609    | ZKSCAN8 | NA | 0.926 |
| miR-338-3p | ZNF141  | NA | 1.263 |
| miR-488-3p | ZNF195  | NA | 1.567 |
| miR-338-3p | ZNF208  | NA | 2.216 |
| miR-1197   | ZNF501  | NA | 0.963 |
| miR-296-5p | ZNF512B | NA | 1.324 |
| miR-532-3p | ZNF514  | NA | 1.227 |
| miR-579-3p | ZNF616  | NA | 0.854 |
| miR-490-5p | ZNF627  | NA | 1.444 |
| miR-488-3p | ZNF788  | NA | 1.198 |
| miR-488-3p | ZNF791  | NA | 0.944 |
| miR-622    | ZNF814  | NA | 0.97  |
| miR-488-3p | ZNF844  | NA | 0.918 |

---

circRNA, circular RNA; miR, microRNA; NA, not available.

Table SIII. Kyoto Encyclopedia of Genes and Genomes pathway analysis.

| Term                                               | Count | %    | P-value | Genes                             | Pop Hits | Pop Total | Fold enrichment | Bonferroni | Benjamini | FDR        |
|----------------------------------------------------|-------|------|---------|-----------------------------------|----------|-----------|-----------------|------------|-----------|------------|
| hsa04390:Hippo signaling pathway                   | 5     | 2.98 | 0.03    | BBC3<br>WNT9A<br>LLGL1<br>BMP8A   | 151      | 6879      | 4.14            | 0.98       | 0.98      | 30.2121881 |
| hsa04650:Natural killer cell mediated cytotoxicity | 4     | 2.38 | 0.07    | IFNA7<br>ULBP1<br>IFNA14<br>PRKCB | 122      | 6879      | 4.10            | 1.00       | 0.99      | 57.4567905 |
| hsa04623:Cytosolic DNA-sensing pathway             | 3     | 1.79 | 0.09    | POLR3H<br>IFNA7<br>IFNA14         | 64       | 6879      | 5.86            | 1.00       | 0.99      | 66.7343254 |
| hsa04514:Cell adhesion molecules (CAMs)            | 4     | 2.38 | 0.10    | CLDN3<br>CNTNAP1<br>CD6<br>ICOSLG | 142      | 6879      | 3.52            | 1.00       | 0.97      | 70.8981112 |