

Table SI. Primer sequences used for reverse transcription-quantitative PCR.

| Gene | Primers, 5'-3' |
|-------|-----------------------------|
| FGGY | F: AGGACCTTGATGATCTTGCCATTC |
| | R: CTGCTGCCTCCATGGCTTCTA |
| GAPDH | F: ATGGGGAAGGTGAAGGTCG |
| | R: GGGGTCATTGATGGCAACAATA |

FGGY, FGGY carbohydrate kinase domain containing; F, forward; R, reverse.

Table SII. Clinicopathologic characteristics of patients whose samples are in the cDNA array.

| Characteristic | n (%) |
|-----------------------|-----------|
| Age, years | |
| <65 | 37 (46.8) |
| ≥65 | 42 (53.2) |
| Sex | |
| Male | 46 (58.2) |
| Female | 33 (41.8) |
| Clinical stage | |
| I | 2 (2.5) |
| II | 58 (73.4) |
| III | 19 (24.1) |
| IV | 0 (0) |
| Lymph node metastasis | 35 (44.3) |
| Distant metastasis | 2 (2.5) |

Table SIII. Clinicopathologic characteristics of patients whose samples are in the tissue microarray (cat. no. HColA180Su15).

| Characteristic | n (%) |
|-----------------------|-----------|
| Age, years | |
| <65 | 32 (45.1) |
| ≥65 | 39 (54.9) |
| Sex | |
| Male | 43 (60.6) |
| Female | 28 (39.4) |
| Tumor size, cm | |
| ≤5 cm | 30 (42.3) |
| >5 cm | 41 (57.7) |
| TNM stage | |
| I | 1 (1.4) |
| II | 3 (4.3) |
| III | 38 (53.5) |
| IV | 29 (40.8) |
| Lymph node metastasis | 22 (30.1) |
| Distant metastasis | 2 (2.8) |

Table SIV. Double-stranded shRNAs targeting each gene.

| Target gene | Code | Target sequence, 5'-3' |
|-------------|-----------|------------------------|
| FGGY-RNAi | sh-FGGY-1 | ccACAGTTCAAGCCATTGCTT |
| FGGY-RNAi | sh-FGGY-2 | gtGGGTTTCCTTACTGTTGAT |
| FGGY-RNAi | sh-FGGY-3 | ggATCAGCAAAGACCCGATTT |
| Control | sh-Ctrl | TTCTCCGAACGTGTCACGT |

All oligonucleotides were double-stranded; only the 5'-3' strand is shown. FGGY, FGGY carbohydrate kinase domain containing; sh, short hairpin.

Table SV. The 573 downregulated proteins determined using isobaric tags for relative and absolute quantitation methodology.

| Protein | Fold change | P-value |
|----------|-------------|----------|
| CFL2 | 0.461 | 0.001339 |
| ARPP19 | 0.469 | 0.00463 |
| PFN1 | 0.517 | 0.000151 |
| PSAT1 | 0.518 | 2.49E-05 |
| MTHFD2 | 0.52 | 9.96E-05 |
| PGAM1 | 0.532 | 0.000463 |
| HMG5 | 0.533 | 0.040526 |
| CADM4 | 0.547 | 0.00483 |
| S100A4 | 0.558 | 0.001683 |
| ADIRF | 0.564 | 0.026711 |
| MT1E | 0.565 | 0.033275 |
| ASNS | 0.57 | 0.000299 |
| STRN | 0.575 | 0.004786 |
| TNFRSF6B | 0.579 | 0.008743 |
| MTMR9 | 0.588 | 0.0003 |
| DDI2 | 0.593 | 0.028972 |
| PFDN1 | 0.595 | 0.000805 |
| PRCP | 0.595 | 0.021911 |
| RPL37 | 0.598 | 0.001866 |
| MBD3 | 0.599 | 0.010725 |
| EI24 | 0.606 | 0.018831 |
| MDC1 | 0.61 | 0.000776 |
| RCC2 | 0.62 | 0.000718 |
| CHAF1A | 0.623 | 0.032828 |
| HSPA12A | 0.623 | 0.004153 |
| RPL39 | 0.626 | 0.00805 |
| IGF2BP2 | 0.628 | 0.000523 |
| RALBP1 | 0.628 | 0.021125 |
| KIF23 | 0.629 | 0.011298 |
| PRRC1 | 0.629 | 0.003997 |
| SPC24 | 0.632 | 0.013412 |
| LARS2 | 0.637 | 0.02321 |
| SPC25 | 0.638 | 0.00035 |
| MCRIP2 | 0.641 | 0.000933 |
| UBE2T | 0.642 | 0.031644 |
| TXNDC12 | 0.644 | 0.001067 |
| MIS18A | 0.648 | 0.009646 |
| ZC3H11A | 0.648 | 0.049566 |
| DUT | 0.65 | 0.018354 |
| TJP3 | 0.651 | 0.002646 |
| DERPC | 0.656 | 0.013775 |
| INTS12 | 0.657 | 0.023842 |
| CA2 | 0.661 | 3.62E-05 |
| PTAR1 | 0.661 | 0.036281 |
| REPS1 | 0.664 | 0.006157 |
| TYSND1 | 0.665 | 0.000624 |
| ALDH2 | 0.666 | 0.00049 |
| IBTK | 0.666 | 0.024503 |
| TIPIN | 0.667 | 0.015239 |
| TMPO | 0.667 | 0.001686 |
| HNRNPL | 0.668 | 0.00401 |

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| LENG1 | 0.669 | 0.001559 |
| C11orf98 | 0.67 | 0.006117 |
| RER1 | 0.67 | 0.039899 |
| SH3PXD2B | 0.67 | 0.001285 |
| CTDSPL2 | 0.671 | 0.018637 |
| CUEDC2 | 0.676 | 0.045958 |
| PRPF39 | 0.677 | 0.020446 |
| CALB2 | 0.679 | 0.013326 |
| LUC7L | 0.68 | 0.006628 |
| H2AC21 | 0.681 | 0.023173 |
| KPNA6 | 0.681 | 0.022323 |
| GLUD1 | 0.682 | 0.003144 |
| PTMA | 0.682 | 0.027127 |
| LIMS1 | 0.683 | 0.024953 |
| TAF15 | 0.684 | 0.028507 |
| CRLF3 | 0.685 | 0.029982 |
| SRSF11 | 0.685 | 0.001198 |
| GTF2A1 | 0.686 | 0.005843 |
| BZW2 | 0.687 | 0.000493 |
| GDAP2 | 0.688 | 0.00279 |
| LIG1 | 0.688 | 0.000487 |
| CBX5 | 0.689 | 0.023265 |
| CHRAC1 | 0.69 | 0.027938 |
| C12orf43 | 0.691 | 0.015341 |
| FAH | 0.691 | 0.025019 |
| MOV10 | 0.692 | 0.002486 |
| NUP43 | 0.692 | 0.015978 |
| HNRNPDL | 0.693 | 0.000281 |
| HSD17B10 | 0.693 | 0.000979 |
| SUPT6H | 0.693 | 0.002918 |
| TLK1 | 0.693 | 0.012454 |
| BRD2 | 0.694 | 0.007455 |
| GBE1 | 0.694 | 0.002527 |
| SLC38A2 | 0.695 | 0.033804 |
| ST13 | 0.696 | 0.000594 |
| MACROD1 | 0.697 | 0.002057 |
| RB1 | 0.697 | 0.009598 |
| SNX18 | 0.697 | 0.008622 |
| SF3B5 | 0.698 | 0.026751 |
| TRUB1 | 0.698 | 0.003643 |
| ABRAXAS2 | 0.699 | 0.031734 |
| CDC40 | 0.699 | 0.00581 |
| CEP55 | 0.699 | 0.009651 |
| KARS1 | 0.701 | 0.009931 |
| BRD7 | 0.702 | 0.02292 |
| CWC27 | 0.703 | 0.01907 |
| SEC24D | 0.703 | 0.001673 |
| SNX9 | 0.703 | 0.00206 |
| COMMD2 | 0.704 | 0.005313 |
| DHFR | 0.704 | 0.002061 |
| E2F4 | 0.704 | 0.011175 |
| IGF2BP3 | 0.704 | 0.009384 |
| MCM4 | 0.704 | 0.005646 |
| PALM | 0.704 | 0.007825 |
| RBFOX1 | 0.705 | 0.043692 |

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| FTO | 0.706 | 0.00151 |
| POFUT1 | 0.707 | 0.000591 |
| ALDOC | 0.708 | 0.010281 |
| HNRNPD | 0.708 | 0.00198 |
| KLHL12 | 0.708 | 0.012174 |
| KLHL26 | 0.708 | 0.015235 |
| LAMTOR3 | 0.708 | 0.008172 |
| SETX | 0.709 | 0.005844 |
| IMPDH1 | 0.71 | 0.001025 |
| NUDT4 | 0.711 | 0.015418 |
| PIK3C2A | 0.711 | 0.00013 |
| ACLY | 0.712 | 0.002613 |
| SEC31A | 0.712 | 0.000612 |
| SGTB | 0.712 | 0.006535 |
| PSPC1 | 0.713 | 0.008648 |
| ASF1B | 0.714 | 0.007279 |
| EXOC2 | 0.714 | 0.001349 |
| GCA | 0.714 | 0.028965 |
| HNRNPA0 | 0.714 | 0.001484 |
| PRCC | 0.715 | 0.003828 |
| RPL22L1 | 0.715 | 0.006878 |
| WDR70 | 0.716 | 0.019204 |
| FAM98B | 0.717 | 0.003888 |
| PGGT1B | 0.717 | 0.003634 |
| SIRT1 | 0.717 | 0.008332 |
| SWAP70 | 0.717 | 0.001242 |
| TXNL1 | 0.717 | 0.001455 |
| NUDT5 | 0.72 | 0.00159 |
| LTBP4 | 0.721 | 0.027101 |
| MTA1 | 0.721 | 0.001512 |
| POLR2J | 0.721 | 0.016461 |
| MCM2 | 0.722 | 0.006787 |
| CAPZA2 | 0.723 | 0.024839 |
| PHGDH | 0.723 | 0.001716 |
| RBBP4 | 0.723 | 0.017829 |
| TPM4 | 0.723 | 0.044709 |
| EXOC8 | 0.725 | 0.028562 |
| FERMT2 | 0.725 | 0.017864 |
| POLA2 | 0.725 | 0.022809 |
| GPALPP1 | 0.726 | 0.013636 |
| PGM1 | 0.726 | 0.00023 |
| RANBP9 | 0.726 | 0.042067 |
| MED6 | 0.727 | 0.008023 |
| RBBP5 | 0.727 | 0.022564 |
| ARMC1 | 0.728 | 0.001525 |
| EXOC5 | 0.728 | 0.032859 |
| RPL32 | 0.728 | 0.00518 |
| ANP32E | 0.729 | 0.020043 |
| YJU2 | 0.729 | 0.004814 |
| NANS | 0.73 | 0.005805 |
| RBPJ | 0.73 | 0.033548 |
| STK39 | 0.73 | 0.001334 |
| CHUK | 0.731 | 0.00355 |
| NUDT1 | 0.731 | 3.83E-05 |
| BABAM1 | 0.732 | 0.002578 |

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| RBM17 | 0.732 | 0.004025 |
| SRSF10 | 0.732 | 0.004651 |
| CDKN2AIPNL | 0.733 | 0.004578 |
| NQO1 | 0.733 | 0.001284 |
| MSI2 | 0.734 | 0.008115 |
| CKS2 | 0.735 | 0.014078 |
| C11orf58 | 0.736 | 0.044635 |
| CCDC59 | 0.736 | 0.04378 |
| RECQL | 0.736 | 0.001484 |
| RFK | 0.736 | 0.006799 |
| SRPK1 | 0.736 | 0.001071 |
| DDX1 | 0.737 | 0.00123 |
| PDCD4 | 0.738 | 0.004034 |
| CD2BP2 | 0.739 | 0.002914 |
| EML4 | 0.739 | 0.031454 |
| FKBP9 | 0.739 | 0.01289 |
| PIH1D1 | 0.739 | 0.009963 |
| C9orf78 | 0.74 | 0.007057 |
| GSR | 0.74 | 0.006743 |
| MPP6 | 0.74 | 0.014635 |
| MSI1 | 0.74 | 0.04134 |
| SLBP | 0.74 | 0.008211 |
| RPL27A | 0.741 | 0.008306 |
| SLC7A1 | 0.741 | 0.036114 |
| APPL2 | 0.742 | 0.03044 |
| DCAF13 | 0.743 | 0.010045 |
| EXOSC4 | 0.744 | 0.041556 |
| MCM3 | 0.744 | 0.000599 |
| GLUL | 0.745 | 0.002206 |
| GMEB2 | 0.745 | 0.028563 |
| PDPR | 0.745 | 0.009245 |
| PLD3 | 0.745 | 0.014456 |
| UCHL5 | 0.745 | 0.016398 |
| MCMBP | 0.746 | 0.001239 |
| NASP | 0.746 | 0.006072 |
| PPP2R1B | 0.746 | 0.005579 |
| IMPA1 | 0.747 | 0.000559 |
| PM20D2 | 0.747 | 0.001561 |
| POLR2D | 0.747 | 0.035624 |
| SUPT16H | 0.747 | 0.013975 |
| AKAP12 | 0.748 | 0.007437 |
| DDX52 | 0.748 | 0.028975 |
| MPHOSPH10 | 0.748 | 0.002642 |
| PDPR | 0.745 | 0.009245 |
| PLD3 | 0.745 | 0.014456 |
| UCHL5 | 0.745 | 0.016398 |
| MCMBP | 0.746 | 0.001239 |
| NASP | 0.746 | 0.006072 |
| PPP2R1B | 0.746 | 0.005579 |
| IMPA1 | 0.747 | 0.000559 |
| PM20D2 | 0.747 | 0.001561 |
| POLR2D | 0.747 | 0.035624 |
| SUPT16H | 0.747 | 0.013975 |
| AKAP12 | 0.748 | 0.007437 |
| DDX52 | 0.748 | 0.028975 |

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| MPHOSPH10 | 0.748 | 0.002642 |
| SP100 | 0.748 | 0.027528 |
| ANAPC16 | 0.749 | 0.045343 |
| MTAP | 0.749 | 0.030092 |
| TXNL4A | 0.749 | 0.016926 |
| ADSS2 | 0.75 | 0.001482 |
| FUBP1 | 0.75 | 0.002305 |
| NCAPH | 0.75 | 0.014178 |
| HYOU1 | 0.751 | 0.014635 |
| SSU72 | 0.751 | 0.021317 |
| CLOCK | 0.752 | 0.037968 |
| GINS4 | 0.752 | 0.006586 |
| STAM | 0.752 | 0.024696 |
| APMAP | 0.753 | 0.00188 |
| RAD18 | 0.753 | 0.010332 |
| WRNIP1 | 0.753 | 0.013027 |
| CALU | 0.754 | 0.001067 |
| LIN7C | 0.754 | 0.014993 |
| RPS6KA1 | 0.754 | 0.010336 |
| SDF2 | 0.754 | 0.041834 |
| SNX7 | 0.754 | 0.007638 |
| TIFA | 0.754 | 0.004648 |
| ARHGEF2 | 0.755 | 0.021062 |
| BCL7A | 0.755 | 0.036352 |
| FNBP4 | 0.755 | 0.001452 |
| IQSEC1 | 0.755 | 0.029713 |
| PCCA | 0.755 | 0.019729 |
| SRSF2 | 0.755 | 0.009175 |
| TRIOBP | 0.755 | 0.002802 |
| HSPA14 | 0.756 | 0.019316 |
| OSGEP | 0.756 | 0.036281 |
| PAF1 | 0.756 | 0.007735 |
| RBM26 | 0.756 | 0.003331 |
| YWHAZ | 0.757 | 0.039961 |
| CCNT1 | 0.758 | 0.019574 |
| FUBP3 | 0.758 | 0.004852 |
| PPIL1 | 0.758 | 0.004802 |
| ZMYND8 | 0.758 | 0.016014 |
| OTUD4 | 0.759 | 0.022021 |
| WNK1 | 0.759 | 0.01216 |
| BPTF | 0.76 | 0.029223 |
| CSTF1 | 0.76 | 0.011493 |
| DVL2 | 0.76 | 0.010776 |
| GPD2 | 0.76 | 0.003119 |
| TDP2 | 0.76 | 0.012015 |
| TSEN54 | 0.76 | 0.009539 |
| EIF4A2 | 0.761 | 0.006146 |
| POLR2C | 0.761 | 0.019996 |
| SEL1L | 0.761 | 0.035061 |
| SFSWAP | 0.761 | 0.003205 |
| USP10 | 0.761 | 0.003792 |
| WAC | 0.761 | 0.017109 |
| KBTBD4 | 0.762 | 0.002687 |
| RAMAC | 0.762 | 0.004904 |
| RNPS1 | 0.762 | 0.007131 |

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| SH2D4A | 0.762 | 0.035718 |
| SH3BGRL | 0.762 | 0.007513 |
| WARS1 | 0.762 | 0.021402 |
| ARHGEF7 | 0.763 | 0.018766 |
| EHMT1 | 0.764 | 0.00066 |
| RPL8 | 0.764 | 0.029094 |
| CKMT1B | 0.765 | 0.002064 |
| NOP9 | 0.765 | 0.016219 |
| PPWD1 | 0.765 | 0.023745 |
| CIRBP | 0.766 | 0.0243 |
| CLINT1 | 0.766 | 0.001635 |
| PPHLN1 | 0.766 | 0.02061 |
| SSRP1 | 0.766 | 0.001056 |
| HMGA1 | 0.767 | 0.006592 |
| IRF2BP1 | 0.767 | 0.04892 |
| KIAA1143 | 0.767 | 0.003317 |
| RBM8A | 0.767 | 0.009876 |
| BRD4 | 0.768 | 0.037978 |
| ARHGEF7 | 0.763 | 0.018766 |
| EHMT1 | 0.764 | 0.00066 |
| RPL8 | 0.764 | 0.029094 |
| CKMT1B | 0.765 | 0.002064 |
| NOP9 | 0.765 | 0.016219 |
| PPWD1 | 0.765 | 0.023745 |
| CIRBP | 0.766 | 0.0243 |
| CLINT1 | 0.766 | 0.001635 |
| HNRNPA2B1 | 0.768 | 0.040065 |
| NAB2 | 0.768 | 0.03059 |
| NADK2 | 0.768 | 0.003791 |
| TRPC4AP | 0.768 | 0.025463 |
| ZRANB2 | 0.768 | 0.006141 |
| NDRG3 | 0.769 | 0.02503 |
| PPP1CC | 0.769 | 0.009685 |
| TRIM28 | 0.769 | 0.015946 |
| TRIM33 | 0.769 | 0.038286 |
| ARGLU1 | 0.77 | 0.032793 |
| FAT1 | 0.77 | 0.019344 |
| UHRF1BP1L | 0.77 | 0.004891 |
| CCDC6 | 0.771 | 0.003432 |
| GTF2A2 | 0.771 | 0.00151 |
| LSM12 | 0.771 | 0.046629 |
| MPHOSPH6 | 0.771 | 0.026996 |
| PTGFRN | 0.771 | 0.02521 |
| SNRPA | 0.771 | 0.013522 |
| MED20 | 0.772 | 0.029821 |
| MSH2 | 0.772 | 0.001659 |
| LTV1 | 0.773 | 0.035551 |
| SEC11C | 0.773 | 0.003461 |
| SHMT2 | 0.773 | 0.006677 |
| BIN1 | 0.775 | 0.005506 |
| FCHO2 | 0.775 | 0.038088 |
| PRKRA | 0.775 | 0.011729 |
| GFPT2 | 0.776 | 0.030088 |
| NUCKS1 | 0.776 | 0.02879 |
| ABCE1 | 0.777 | 0.000808 |

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| MTPAP | 0.777 | 0.024253 |
| PPIL2 | 0.777 | 0.033736 |
| SLIRP | 0.777 | 0.006485 |
| DNAJC8 | 0.778 | 0.022125 |
| FAM91A1 | 0.778 | 0.015903 |
| MCM6 | 0.778 | 0.007596 |
| PHF5A | 0.778 | 0.000742 |
| THOC3 | 0.778 | 0.002403 |
| TOMM34 | 0.778 | 0.004992 |
| TRNT1 | 0.779 | 0.002231 |
| HDLBP | 0.78 | 0.0237 |
| OSTF1 | 0.78 | 0.045358 |
| PPP1R10 | 0.78 | 0.034906 |
| SLC4A7 | 0.783 | 0.020091 |
| YTHDC1 | 0.783 | 0.017688 |
| SEC13 | 0.784 | 0.005951 |
| TLE3 | 0.784 | 0.001258 |
| ASPSCR1 | 0.785 | 0.019777 |
| DCAF1 | 0.785 | 0.032152 |
| TRA2B | 0.785 | 0.021247 |
| CBWD1 | 0.786 | 0.013414 |
| CDK1 | 0.786 | 0.002116 |
| CENPB | 0.786 | 0.029584 |
| EEF2K | 0.786 | 0.027192 |
| NQO2 | 0.786 | 0.022551 |
| PLRG1 | 0.786 | 0.004288 |
| PSPH | 0.786 | 0.006519 |
| SIRPA | 0.786 | 0.030926 |
| VCP | 0.786 | 0.001067 |
| CBLL1 | 0.787 | 0.029589 |
| CFDP1 | 0.787 | 0.024977 |
| MAPK14 | 0.787 | 0.01483 |
| MCM5 | 0.787 | 0.000529 |
| OSBPL8 | 0.787 | 0.044143 |
| SCAF8 | 0.788 | 0.013124 |
| TTC19 | 0.788 | 0.004787 |
| HMOX1 | 0.789 | 0.032567 |
| MED29 | 0.789 | 0.044973 |
| NUP214 | 0.789 | 0.021345 |
| SORBS3 | 0.789 | 0.049438 |
| UTP14A | 0.789 | 0.028336 |
| CHCHD2 | 0.79 | 0.001247 |
| CLYBL | 0.79 | 0.001366 |
| HADH | 0.79 | 0.001751 |
| PLCG1 | 0.79 | 0.023609 |
| PTER | 0.79 | 9.81E-05 |
| SERPINE2 | 0.79 | 0.011487 |
| WDFY1 | 0.791 | 0.002458 |
| CKB | 0.792 | 0.018813 |
| ESRP1 | 0.792 | 0.010254 |
| GABPA | 0.792 | 0.022019 |
| LONP1 | 0.792 | 0.019283 |
| NOL9 | 0.792 | 0.049712 |
| NSMCE2 | 0.792 | 0.009432 |
| UNG | 0.792 | 0.045927 |

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| CARS1 | 0.793 | 0.001087 |
| HAUS1 | 0.793 | 0.042619 |
| HSPA1A | 0.793 | 0.004609 |
| ITCH | 0.793 | 0.046346 |
| NFKB1 | 0.793 | 0.034547 |
| NT5DC3 | 0.793 | 0.024461 |
| PCYOX1L | 0.793 | 0.037566 |
| PNO1 | 0.793 | 0.005804 |
| HNRNPF | 0.794 | 0.010903 |
| NUP58 | 0.794 | 0.019508 |
| RPL21 | 0.794 | 0.000255 |
| AIP | 0.795 | 0.014597 |
| DPYSL3 | 0.795 | 0.001587 |
| RNMT | 0.795 | 0.011814 |
| UBXN1 | 0.795 | 0.013062 |
| AHCYL1 | 0.796 | 0.016354 |
| CHMP3 | 0.796 | 0.028895 |
| LARP1 | 0.796 | 0.00978 |
| MED30 | 0.796 | 0.03477 |
| PHRF1 | 0.796 | 0.040571 |
| CHMP5 | 0.797 | 0.003439 |
| DNAJC10 | 0.797 | 0.003302 |
| PNN | 0.797 | 0.00662 |
| RPS6KA5 | 0.797 | 0.020821 |
| ZC3H13 | 0.797 | 0.036522 |
| FER | 0.798 | 0.02785 |
| FUCA2 | 0.798 | 0.01227 |
| NUCB2 | 0.798 | 0.016882 |
| PPIH | 0.798 | 0.006961 |
| ANAPC5 | 0.799 | 0.026651 |
| MANF | 0.799 | 0.019413 |
| MED24 | 0.799 | 0.037312 |
| POLR3F | 0.799 | 0.032262 |
| SNX27 | 0.799 | 0.000658 |
| TRAP1 | 0.799 | 0.002593 |
| HMGB2 | 0.801 | 0.009683 |
| MIEN1 | 0.801 | 0.039784 |
| PPP1CB | 0.801 | 0.031774 |
| ADK | 0.802 | 0.026291 |
| IWS1 | 0.802 | 0.01512 |
| UBXN7 | 0.802 | 0.027143 |
| ALDH3A2 | 0.803 | 0.045121 |
| GFM2 | 0.803 | 0.045336 |
| HSPE1-MOB4 | 0.803 | 0.039992 |
| PEPD | 0.803 | 0.008555 |
| PLK1 | 0.803 | 0.032673 |
| POLR2A | 0.803 | 0.025579 |
| RPL35 | 0.803 | 0.016179 |
| CCS | 0.804 | 0.006306 |
| DEK | 0.804 | 0.000516 |
| MAEA | 0.804 | 0.010812 |
| PGM2 | 0.804 | 0.004628 |
| SAP18 | 0.804 | 0.015276 |
| SART3 | 0.804 | 0.007624 |
| SCAF1 | 0.804 | 0.03267 |

| | | |
|----------|-------|----------|
| MCM7 | 0.805 | 0.00804 |
| PTEN | 0.805 | 0.034693 |
| RIF1 | 0.805 | 0.0339 |
| SUMO1 | 0.805 | 0.009058 |
| CSTF2 | 0.806 | 0.025787 |
| ELP5 | 0.806 | 0.027865 |
| HIBADH | 0.806 | 0.035685 |
| PSME3IP1 | 0.806 | 0.047217 |
| RAD21 | 0.806 | 0.00892 |
| SERPINB9 | 0.806 | 0.003578 |
| DDX51 | 0.807 | 0.048872 |
| ERI1 | 0.807 | 0.036096 |
| HLTF | 0.807 | 0.03136 |
| SAC3D1 | 0.807 | 0.013309 |
| SNUPN | 0.807 | 0.022281 |
| WBP2 | 0.807 | 0.019409 |
| CHEK2 | 0.808 | 0.032559 |
| INTS11 | 0.808 | 0.016214 |
| MED8 | 0.808 | 0.04785 |
| NACC1 | 0.808 | 0.025169 |
| RPL4 | 0.808 | 0.019493 |
| SNRPD2 | 0.808 | 0.016008 |
| COASY | 0.809 | 0.010464 |
| DBR1 | 0.809 | 0.020846 |
| DHX38 | 0.809 | 0.026556 |
| NUP50 | 0.809 | 0.004113 |
| RPL3 | 0.809 | 0.037718 |
| BCL10 | 0.81 | 0.008478 |
| CWF19L1 | 0.81 | 0.048756 |
| MAD2L1 | 0.81 | 0.000215 |
| OS9 | 0.81 | 0.02822 |
| RBM12B | 0.81 | 0.032947 |
| RSRC2 | 0.81 | 0.031595 |
| USP22 | 0.81 | 0.049888 |
| CDC23 | 0.811 | 0.020674 |
| DSCC1 | 0.811 | 0.015287 |
| RFC3 | 0.811 | 0.00731 |
| SMC2 | 0.811 | 0.015858 |
| ERH | 0.812 | 0.019026 |
| GATB | 0.812 | 0.036551 |
| RFC4 | 0.812 | 0.007469 |
| SNRPF | 0.812 | 0.028293 |
| SUCLG2 | 0.812 | 0.014522 |
| DNASE2 | 0.813 | 0.023133 |
| NMRAL1 | 0.813 | 0.034426 |
| SCPEP1 | 0.813 | 0.044638 |
| SNX5 | 0.813 | 0.004829 |
| LHPP | 0.814 | 0.026533 |
| MAN2B1 | 0.814 | 0.032544 |
| MED14 | 0.814 | 0.032684 |
| PRKAR2B | 0.814 | 0.009778 |
| RBM42 | 0.814 | 0.016354 |
| FMR1 | 0.815 | 0.002693 |
| HDDC2 | 0.815 | 0.018019 |
| PHLDA2 | 0.815 | 0.003001 |

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|----------------|-------|----------|
| APIP | 0.816 | 0.01681 |
| HCFC1 | 0.816 | 0.009405 |
| PNPT1 | 0.816 | 0.012975 |
| PRPF40A | 0.816 | 0.004304 |
| PSMG4 | 0.816 | 0.014449 |
| RPL36A-HNRNPH2 | 0.816 | 0.036036 |
| SMAD4 | 0.816 | 0.027139 |
| VPS4A | 0.816 | 0.017366 |
| LUC7L3 | 0.817 | 0.011324 |
| SRSF7 | 0.817 | 0.034525 |
| TXNDC5 | 0.817 | 0.044388 |
| ALDH4A1 | 0.818 | 0.03918 |
| NUFIP2 | 0.818 | 0.035872 |
| UBL4A | 0.818 | 0.037893 |
| FIP1L1 | 0.819 | 0.039371 |
| PDHA1 | 0.819 | 0.006023 |
| RCN2 | 0.819 | 0.015266 |
| RPS21 | 0.819 | 0.002765 |
| WDR46 | 0.819 | 0.006253 |
| BTF3 | 0.82 | 0.004985 |
| PRRC2C | 0.82 | 0.003602 |
| RBMXL1 | 0.82 | 0.046748 |
| ANKRD40 | 0.821 | 0.02974 |
| CDC16 | 0.821 | 0.007451 |
| MRPS28 | 0.821 | 0.016573 |
| STIP1 | 0.821 | 0.026123 |
| AKR1B1 | 0.822 | 0.014283 |
| C19orf25 | 0.822 | 0.043458 |
| G3BP1 | 0.822 | 0.015322 |
| H2BC5 | 0.822 | 0.036559 |
| MED1 | 0.822 | 0.01859 |
| MRPS35 | 0.822 | 0.006199 |
| CHERP | 0.823 | 0.007232 |
| LDHAL6A | 0.823 | 0.03415 |
| PCBP2 | 0.823 | 0.013441 |
| PFKFB2 | 0.823 | 0.045995 |
| RTCB | 0.823 | 0.001114 |
| THYN1 | 0.823 | 0.041522 |
| BTF3 | 0.824 | 0.024868 |
| DDX46 | 0.824 | 0.014984 |
| MET | 0.824 | 0.0381 |
| METAP2 | 0.824 | 0.010387 |
| NSRP1 | 0.824 | 0.049862 |
| PACSIN3 | 0.824 | 0.00597 |
| PPP1R8 | 0.824 | 0.009683 |
| PPP2CA | 0.824 | 0.037379 |
| TBRG4 | 0.824 | 0.018273 |
| KLC2 | 0.825 | 0.032119 |
| LSM14A | 0.825 | 0.030905 |
| OSBPL9 | 0.825 | 0.020201 |
| SUN2 | 0.825 | 0.049182 |
| HSPA5 | 0.826 | 0.025829 |
| MED15 | 0.826 | 0.006473 |
| PHLDA1 | 0.826 | 0.011896 |
| PYCR2 | 0.826 | 0.010842 |

| | | |
|-------------|-------|----------|
| SF3B3 | 0.826 | 0.014912 |
| CSTF2T | 0.827 | 0.007522 |
| DNAAF5 | 0.827 | 0.009805 |
| PDIA4 | 0.827 | 0.022648 |
| SET | 0.827 | 0.014705 |
| CTU1 | 0.828 | 0.04346 |
| NUP85 | 0.828 | 0.017851 |
| TCOF1 | 0.828 | 0.003321 |
| ZC3H18 | 0.828 | 0.017368 |
| ARPIN-AP3S2 | 0.829 | 0.023887 |
| MRPS10 | 0.829 | 0.012714 |
| MYO1B | 0.829 | 0.033495 |
| VWA8 | 0.829 | 0.032811 |
| CCAR1 | 0.83 | 0.01384 |
| DNM2 | 0.83 | 0.020874 |
| EFHD2 | 0.83 | 0.027179 |
| OPA1 | 0.83 | 0.049577 |
| BCLAF1 | 0.831 | 0.005759 |
| EIF2D | 0.831 | 0.009525 |
| MSH6 | 0.831 | 0.000802 |
| RBBP7 | 0.831 | 0.02153 |
| ARHGAP18 | 0.832 | 0.027003 |
| CBL | 0.832 | 0.016417 |
| EXOSC2 | 0.832 | 0.020792 |
| NECAP1 | 0.832 | 0.024513 |
| PHF23 | 0.832 | 0.007602 |
| PSMG1 | 0.832 | 0.037946 |
| FRAS1 | 0.833 | 0.022137 |
| HSPA9 | 0.833 | 0.022351 |
| NDUFV1 | 0.833 | 0.041716 |
| PUM3 | 0.833 | 0.0139 |
| TPM2 | 0.833 | 0.034459 |
| VPS72 | 0.833 | 0.020691 |

Table SVI. The 236 upregulated expressed proteins in isobaric tags for relative and absolute quantitation methodology.

| Protein | Fold change | P-value |
|-----------|-------------|-------------|
| C20orf27 | 16.345 | 0.008880036 |
| LYSMD2 | 15.519 | 0.049498578 |
| IFIT5 | 10.025 | 0.029924695 |
| DIP2A | 8.135 | 0.02508652 |
| MAPK9 | 7.525 | 0.011550711 |
| UBL7 | 6.687 | 0.02457958 |
| HLA-B | 6.2 | 0.013883771 |
| OTUD6B | 5.434 | 0.003521218 |
| MYL9 | 4.772 | 0.004223907 |
| THNSL1 | 4.34 | 0.005741828 |
| RB1CC1 | 4.328 | 0.045337906 |
| HRAS | 4.211 | 0.017785139 |
| MED22 | 4.206 | 0.04613759 |
| ARHGAP27 | 3.595 | 0.00706397 |
| KHDRBS3 | 3.381 | 0.016647026 |
| PAWR | 3.334 | 0.044101372 |
| ACTR5 | 2.637 | 0.00822199 |
| SMAD3 | 2.483 | 0.007975569 |
| ARHGAP35 | 2.474 | 0.040677167 |
| MED15 | 2.338 | 0.027650859 |
| EMC1 | 2.287 | 0.002839356 |
| HBA1 | 2.261 | 0.043546562 |
| H1-4 | 2.243 | 0.019553554 |
| H3-2 | 2.224 | 0.012247227 |
| TOMM22 | 2.22 | 0.006644798 |
| RHOA | 2.109 | 0.000524656 |
| CYB5R1 | 2.067 | 0.000585128 |
| H1-2 | 2.066 | 0.025767596 |
| GALNT5 | 1.993 | 0.007195677 |
| PRDX5 | 1.97 | 0.001110568 |
| PEX14 | 1.929 | 0.000175193 |
| TP53I3 | 1.906 | 0.000203389 |
| FAM3C | 1.895 | 0.005175085 |
| SERPINB5 | 1.883 | 0.007663418 |
| KDSR | 1.86 | 0.004105184 |
| TIPRL | 1.831 | 0.001372438 |
| H4C8 | 1.829 | 0.000658716 |
| MAP1LC3B2 | 1.76 | 0.005542952 |
| SRPRB | 1.755 | 0.006573491 |
| CCNH | 1.749 | 0.000639249 |
| CISD1 | 1.737 | 0.049949307 |
| GLS | 1.731 | 0.000584434 |
| DDX47 | 1.73 | 0.001808941 |
| HMOX2 | 1.717 | 0.000188441 |
| PISD | 1.716 | 0.028971763 |
| RHOF | 1.715 | 0.003310096 |
| SQOR | 1.708 | 0.021894014 |
| RAB18 | 1.701 | 0.027590168 |
| FAM89B | 1.698 | 0.032933339 |
| RETSAT | 1.679 | 0.017692682 |
| CCN1 | 1.656 | 0.01259582 |
| CRYBG1 | 1.656 | 0.008209562 |

| | | |
|--------------|-------|-------------|
| CNN3 | 1.651 | 0.035397556 |
| NAA25 | 1.636 | 0.034029131 |
| CARNMT1 | 1.634 | 0.008805741 |
| TMEM43 | 1.627 | 0.021354286 |
| CD59 | 1.624 | 0.00862123 |
| BCAR1 | 1.622 | 0.00739984 |
| C3 | 1.62 | 0.015345035 |
| PLEC | 1.616 | 0.00223061 |
| TNFRSF12A | 1.609 | 0.004616899 |
| S100A16 | 1.604 | 0.017698285 |
| WDR1 | 1.603 | 0.005022309 |
| MVP | 1.601 | 0.001044807 |
| SAP130 | 1.59 | 0.006599363 |
| NCEH1 | 1.588 | 0.009487813 |
| GLTP | 1.577 | 0.015956013 |
| ARF4 | 1.574 | 0.018388473 |
| SLIT1 | 1.563 | 0.005209709 |
| TOP1 | 1.551 | 0.027719684 |
| EHD1 | 1.54 | 0.026026829 |
| PALM2AKAP2 | 1.54 | 0.003465094 |
| PEDS1-UBE2V1 | 1.536 | 7.54317E-05 |
| C1orf116 | 1.531 | 0.006218709 |
| ANXA2 | 1.528 | 0.003871237 |
| RAB5B | 1.526 | 0.006115203 |
| DERL1 | 1.524 | 0.011147875 |
| S100A10 | 1.507 | 0.004061902 |
| NT5C2 | 1.502 | 0.01509383 |
| SHTN1 | 1.501 | 0.001714 |
| RAB3B | 1.499 | 0.027879 |
| KRT8 | 1.491 | 0.001389 |
| TMX2 | 1.485 | 0.017692 |
| NDUFS2 | 1.484 | 0.008447 |
| CAVIN1 | 1.469 | 0.028864 |
| ANXA1 | 1.467 | 0.010611 |
| H1-0 | 1.465 | 0.005236 |
| NAA10 | 1.461 | 0.004276 |
| KHDRBS1 | 1.457 | 0.02262 |
| GIPC1 | 1.455 | 0.043827 |
| YME1L1 | 1.453 | 0.021885 |
| PRKAR1A | 1.449 | 0.015329 |
| SFN | 1.447 | 0.001823 |
| EMD | 1.446 | 0.003307 |
| RBKS | 1.434 | 0.028629 |
| PREB | 1.432 | 0.04083 |
| NT5E | 1.427 | 0.017059 |
| SAR1A | 1.427 | 0.041296 |
| KRT19 | 1.424 | 0.000792 |
| LDLR | 1.423 | 0.008744 |
| STT3A | 1.423 | 0.042728 |
| STX3 | 1.42 | 0.014772 |
| ATL3 | 1.411 | 0.011342 |
| CLN5 | 1.405 | 0.019916 |
| BTF3L4 | 1.403 | 0.011578 |
| LIMA1 | 1.402 | 0.002111 |
| PDE12 | 1.401 | 0.007812 |

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|----------|-------|----------|
| TRIM16 | 1.4 | 0.003312 |
| BCAP31 | 1.399 | 0.032276 |
| HSDL1 | 1.397 | 0.004592 |
| MSRA | 1.395 | 0.011967 |
| COPB1 | 1.392 | 0.006773 |
| MARCKS | 1.392 | 0.000359 |
| GANAB | 1.389 | 0.0151 |
| H3C13 | 1.389 | 0.03327 |
| HEBP1 | 1.389 | 0.018181 |
| FUCA1 | 1.387 | 0.021233 |
| VDAC3 | 1.387 | 0.012234 |
| LGALS1 | 1.386 | 0.013146 |
| IL18 | 1.383 | 0.017259 |
| GSTK1 | 1.379 | 0.004734 |
| FAS | 1.378 | 0.048426 |
| SH3KBP1 | 1.376 | 0.000376 |
| STAT3 | 1.376 | 0.001578 |
| FDX1 | 1.373 | 0.009069 |
| SH3GL1 | 1.371 | 0.003165 |
| MTX1 | 1.369 | 0.010902 |
| AHNAK2 | 1.363 | 0.007971 |
| GOLPH3L | 1.363 | 0.002166 |
| PLEC | 1.361 | 0.000395 |
| PGRMC1 | 1.36 | 0.01766 |
| MYH9 | 1.356 | 0.022716 |
| MACF1 | 1.355 | 0.024073 |
| SLC25A3 | 1.354 | 0.008751 |
| MYO6 | 1.352 | 0.000572 |
| KRT18 | 1.348 | 0.000256 |
| C19orf33 | 1.344 | 0.00357 |
| CNN2 | 1.341 | 0.029921 |
| GANAB | 1.341 | 0.002603 |
| RAP2B | 1.337 | 0.003619 |
| TMEM263 | 1.336 | 0.025906 |
| ARCN1 | 1.331 | 0.026256 |
| CDA | 1.33 | 0.006048 |
| TFRC | 1.329 | 0.023362 |
| TFAM | 1.327 | 0.006281 |
| NECAP2 | 1.325 | 0.012491 |
| NPC2 | 1.325 | 0.001272 |
| PDLIM2 | 1.325 | 0.024057 |
| PHLDB1 | 1.324 | 0.038233 |
| ZNF185 | 1.324 | 0.002158 |
| HOOK1 | 1.323 | 5.73E-05 |
| CPNE1 | 1.322 | 0.015147 |
| CCNL1 | 1.319 | 0.042668 |
| TM9SF2 | 1.315 | 0.048299 |
| CAPN1 | 1.312 | 0.032846 |
| MSN | 1.31 | 0.01411 |
| PRMT1 | 1.308 | 0.003189 |
| CLPP | 1.305 | 0.000971 |
| AGPAT5 | 1.3 | 0.028076 |
| H2AC16 | 1.3 | 0.040097 |
| APEH | 1.294 | 0.000777 |
| EIF2B4 | 1.292 | 0.023331 |

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|----------|-------|----------|
| POR | 1.291 | 0.005809 |
| EPS8L2 | 1.29 | 0.002207 |
| MDN1 | 1.29 | 0.026335 |
| RUVBL1 | 1.29 | 0.006032 |
| APOBEC3C | 1.289 | 0.043916 |
| FAM162A | 1.288 | 0.040517 |
| GBF1 | 1.288 | 0.003411 |
| MARK2 | 1.287 | 0.048398 |
| PYGL | 1.287 | 0.002041 |
| CHMP6 | 1.286 | 0.004912 |
| FTL | 1.285 | 0.015152 |
| GRB2 | 1.28 | 0.042993 |
| CLPTM1 | 1.279 | 0.028177 |
| UBA3 | 1.279 | 0.008715 |
| PMM2 | 1.278 | 0.028139 |
| DGKA | 1.276 | 0.013027 |
| RAB11B | 1.276 | 0.007522 |
| TMEM38B | 1.271 | 0.019457 |
| ARPC1A | 1.269 | 0.002641 |
| GSTO1 | 1.266 | 0.000859 |
| NR2F2 | 1.266 | 0.035645 |
| PTRH1 | 1.266 | 0.03848 |
| FHL2 | 1.265 | 0.001412 |
| IRS2 | 1.263 | 0.022739 |
| PAIP1 | 1.261 | 0.007412 |
| RNH1 | 1.255 | 0.000694 |
| ETHE1 | 1.254 | 0.009624 |
| PPP2R5E | 1.254 | 0.002876 |
| LMNA | 1.253 | 0.005378 |
| SEC61A1 | 1.253 | 0.013383 |
| NDUFA10 | 1.252 | 0.012355 |
| ATP6V1C1 | 1.251 | 0.036621 |
| ITIH1 | 1.251 | 0.04992 |
| UFC1 | 1.251 | 0.001673 |
| SNRPD3 | 1.249 | 0.011455 |
| ANXA4 | 1.247 | 0.038815 |
| CAP1 | 1.247 | 0.006421 |
| FAF2 | 1.246 | 0.028961 |
| FAM136A | 1.244 | 0.038369 |
| FAM120B | 1.243 | 0.014009 |
| CTTN | 1.241 | 0.005608 |
| RAB8A | 1.24 | 0.032471 |
| ARL6IP5 | 1.239 | 0.037662 |
| MRPL45 | 1.239 | 0.018343 |
| EFL1 | 1.236 | 0.008724 |
| PARP4 | 1.236 | 0.004152 |
| PPP1R18 | 1.236 | 0.008472 |
| IQGAP1 | 1.235 | 0.020648 |
| POLDIP3 | 1.235 | 0.019965 |
| JUP | 1.234 | 0.018878 |
| ATP2A2 | 1.229 | 0.041391 |
| ESYT2 | 1.229 | 0.034307 |
| PRDX6 | 1.229 | 0.004163 |
| DDX54 | 1.225 | 0.039212 |
| NAA15 | 1.223 | 0.026234 |

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|----------|-------|----------|
| SEPTIN10 | 1.222 | 0.002542 |
| EZR | 1.221 | 0.003469 |
| SIGIRR | 1.22 | 0.038506 |
| TAGLN2 | 1.216 | 6.87E-05 |
| BOLA2 | 1.215 | 0.018339 |
| S100A13 | 1.215 | 0.009121 |
| DNAJB2 | 1.214 | 0.029581 |
| NUDT12 | 1.213 | 0.029129 |
| CSNK2B | 1.212 | 0.024519 |
| EEF1G | 1.21 | 0.006825 |
| RSL1D1 | 1.209 | 0.014695 |
| MPRIIP | 1.208 | 0.013267 |
| DNAJB4 | 1.207 | 0.011687 |
| EIPR1 | 1.206 | 0.010708 |
| PEA15 | 1.206 | 0.023989 |
| PSMD10 | 1.206 | 0.01897 |
| NPEPPS | 1.203 | 0.02169 |
| NME3 | 1.201 | 0.01755 |
| MRPS21 | 1.2 | 0.045771 |

Table SVII. The 159 downregulated phosphopeptides in phosphoproteomics analysis.

| Protein | Fold change | P-value |
|----------|-------------|----------|
| SLC4A7 | 0.467 | 0.003199 |
| COL19A1 | 0.501 | 0.002844 |
| EI24 | 0.536 | 0.009505 |
| H1-0 | 0.578 | 0.001645 |
| ASH2L | 0.581 | 0.029282 |
| TOP2B | 0.587 | 0.00066 |
| TCP11L1 | 0.6 | 0.005427 |
| CRKL | 0.61 | 0.000355 |
| ZBTB21 | 0.611 | 0.000529 |
| JUNB | 0.624 | 0.000308 |
| NASP | 0.625 | 0.011947 |
| PBRM1 | 0.627 | 0.000642 |
| PTMA | 0.629 | 0.006278 |
| SLC38A1 | 0.629 | 0.000322 |
| SIRPA | 0.632 | 0.01296 |
| RB1 | 0.634 | 0.000829 |
| H1-2 | 0.64 | 0.000356 |
| SIRT1 | 0.643 | 0.00645 |
| LBR | 0.647 | 0.000108 |
| DENR | 0.648 | 0.038828 |
| LIG1 | 0.653 | 0.017306 |
| NFATC2IP | 0.653 | 0.011262 |
| EML4 | 0.656 | 0.010041 |
| REPS1 | 0.657 | 0.000369 |
| TFDP1 | 0.66 | 0.004948 |
| TMEM185B | 0.666 | 0.013064 |
| F2RL1 | 0.668 | 0.000375 |
| ACTL6A | 0.669 | 0.002912 |
| TK1 | 0.674 | 0.03406 |
| H1-4 | 0.675 | 0.007693 |
| ITGA2 | 0.678 | 0.014356 |
| GLI2 | 0.684 | 0.024231 |
| NUP210 | 0.685 | 0.004594 |
| KLF16 | 0.686 | 0.005112 |
| NOP58 | 0.687 | 0.008381 |
| ZFP36L2 | 0.687 | 0.0215 |
| RFC1 | 0.688 | 0.000273 |
| CKAP4 | 0.69 | 0.011857 |
| HMGA1 | 0.69 | 0.012559 |
| SCML2 | 0.692 | 0.003365 |
| TBCB | 0.695 | 0.007558 |
| ZFAND2B | 0.697 | 0.014183 |
| CHTF18 | 0.699 | 0.001931 |
| RPL14 | 0.699 | 0.025742 |
| SKA3 | 0.704 | 0.007701 |
| DEK | 0.706 | 0.007732 |
| H1-10 | 0.71 | 3.8E-05 |
| WRN | 0.709 | 0.006338 |
| NUP50 | 0.714 | 0.001521 |
| TOP1 | 0.714 | 0.047379 |
| NCL | 0.715 | 0.000479 |
| FLYWCH2 | 0.716 | 0.007885 |

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|-----------|-------|----------|
| CUL4B | 0.718 | 0.00531 |
| CDC23 | 0.722 | 0.015317 |
| MCM3 | 0.725 | 0.009304 |
| CAP2 | 0.728 | 0.002091 |
| ZNF622 | 0.729 | 0.00276 |
| RAI1 | 0.73 | 0.003059 |
| TOMM70 | 0.732 | 0.014897 |
| CHEK1 | 0.733 | 0.001916 |
| ISL2 | 0.734 | 0.01853 |
| RPL22 | 0.734 | 0.023321 |
| RRP36 | 0.734 | 0.005389 |
| IGF2BP3 | 0.735 | 0.021981 |
| NANS | 0.735 | 0.037618 |
| SCLY | 0.735 | 0.014325 |
| SET | 0.737 | 0.00443 |
| NUCKS1 | 0.739 | 0.002932 |
| SETD1A | 0.74 | 0.049593 |
| WRNIP1 | 0.742 | 0.013706 |
| ZCCHC8 | 0.742 | 0.02167 |
| MAGED2 | 0.744 | 0.009061 |
| OSTM1 | 0.744 | 0.015874 |
| RAB8A | 0.746 | 0.002273 |
| CTDSPL | 0.749 | 0.001771 |
| H3C13 | 0.75 | 0.030352 |
| ZNF609 | 0.75 | 0.032919 |
| CCDC137 | 0.753 | 0.040393 |
| PSMA5 | 0.753 | 0.0214 |
| SLC4A2 | 0.753 | 0.048761 |
| ADAR | 0.754 | 0.031305 |
| FXR1 | 0.756 | 0.038508 |
| RALBP1 | 0.756 | 0.006191 |
| UNG | 0.759 | 0.019851 |
| BCL2L12 | 0.762 | 0.003241 |
| CROCC | 0.762 | 0.008807 |
| CTR9 | 0.763 | 0.025152 |
| ERMP1 | 0.764 | 0.041578 |
| ILF3 | 0.764 | 0.018848 |
| SNRK | 0.765 | 0.018361 |
| TMEM238 | 0.765 | 0.023734 |
| ZBTB11 | 0.766 | 0.002707 |
| MDC1 | 0.767 | 0.011721 |
| INCENP | 0.77 | 0.001767 |
| ZNF638 | 0.771 | 0.014609 |
| HNRNPA2B1 | 0.772 | 0.022758 |
| CHAF1A | 0.776 | 0.02413 |
| MCMBP | 0.777 | 0.016516 |
| HARS2 | 0.778 | 0.015534 |
| ZNF280C | 0.778 | 0.044634 |
| QSOX2 | 0.78 | 0.029843 |
| RAB11FIP1 | 0.78 | 0.002319 |
| CDC20 | 0.782 | 0.023378 |
| ABCF1 | 0.786 | 0.005638 |
| PDS5A | 0.787 | 0.0143 |
| TFAP4 | 0.787 | 0.011733 |
| UHRF1 | 0.787 | 0.009528 |

| | | |
|----------|-------|----------|
| ARHGAP19 | 0.788 | 0.015026 |
| CDC6 | 0.789 | 0.019543 |
| YRDC | 0.792 | 0.002536 |
| C16orf72 | 0.793 | 0.008331 |
| MTA1 | 0.793 | 0.004652 |
| TRAPPC12 | 0.793 | 0.01748 |
| HUWE1 | 0.794 | 0.04568 |
| UBTF | 0.794 | 0.001475 |
| CDC42EP1 | 0.795 | 0.042464 |
| VSIR | 0.795 | 0.006146 |
| DDX21 | 0.796 | 0.007982 |
| AGAP3 | 0.798 | 0.012529 |
| PTPN2 | 0.798 | 0.01163 |
| TCOF1 | 0.798 | 0.009288 |
| BAZ1B | 0.803 | 0.00732 |
| GPATCH2L | 0.803 | 0.003553 |
| KIF11 | 0.803 | 0.045411 |
| ESF1 | 0.804 | 0.007573 |
| PNN | 0.804 | 0.004984 |
| SHMT2 | 0.804 | 0.010701 |
| CCNYL1 | 0.806 | 0.037697 |
| MSH6 | 0.807 | 0.00325 |
| SLC39A7 | 0.807 | 0.029224 |
| UTP18 | 0.809 | 0.013605 |
| WDR43 | 0.809 | 0.001269 |
| SLC20A1 | 0.81 | 0.0315 |
| SSRP1 | 0.811 | 0.028134 |
| VCPIP1 | 0.811 | 0.045839 |
| CD2BP2 | 0.812 | 0.001281 |
| PCF11 | 0.812 | 0.030306 |
| LMNB1 | 0.814 | 0.001181 |
| SRSF11 | 0.815 | 0.033278 |
| NUP93 | 0.816 | 0.011259 |
| DTNBP1 | 0.817 | 0.035244 |
| ACLY | 0.818 | 0.021251 |
| EREG | 0.819 | 0.021434 |
| RHBDF2 | 0.819 | 0.000887 |
| LIPE | 0.821 | 0.01439 |
| BCL3 | 0.822 | 0.024713 |
| POLR2A | 0.822 | 0.047999 |
| GTSE1 | 0.825 | 0.015406 |
| DTL | 0.826 | 0.002812 |
| ANKRD17 | 0.827 | 0.049158 |
| BCL7C | 0.827 | 0.019726 |
| NCAPD2 | 0.827 | 0.041222 |
| CBX3 | 0.83 | 0.011611 |
| HDAC1 | 0.83 | 0.034421 |
| BORCS5 | 0.831 | 0.006193 |
| CAMKK1 | 0.831 | 0.035216 |
| ANKRD13D | 0.832 | 0.003767 |
| CDCA7L | 0.832 | 0.020383 |
| POM121 | 0.832 | 0.014939 |

Table SVIII. The 145 upregulated phosphopeptides in phosphoproteomics analysis.

| Protein | Fold change | P value |
|----------|-------------|----------|
| PARG | 2.741 | 0.033929 |
| SARNP | 2.641 | 0.020877 |
| NOSIP | 2.374 | 0.014603 |
| SH3KBP1 | 2.246 | 0.00882 |
| MESD | 2.244 | 0.000882 |
| RPS28 | 2.211 | 0.013085 |
| MARCKS | 2.145 | 0.004998 |
| MTMR12 | 2.102 | 0.00089 |
| LMO7 | 1.997 | 0.008455 |
| KRT8 | 1.981 | 0.006384 |
| HOMER3 | 1.926 | 0.03531 |
| NUMBL | 1.918 | 0.015036 |
| RBM15B | 1.91 | 0.000988 |
| KLC3 | 1.909 | 0.017276 |
| KRT19 | 1.909 | 0.001439 |
| PDLIM5 | 1.903 | 0.000112 |
| FLNC | 1.885 | 0.00193 |
| ARHGEF28 | 1.802 | 0.044243 |
| RRAGD | 1.785 | 0.009806 |
| ENSA | 1.769 | 0.013317 |
| FBNP1L | 1.724 | 0.000246 |
| ESPN | 1.709 | 0.015454 |
| PTPN12 | 1.698 | 0.00949 |
| NEDD4L | 1.645 | 0.006874 |
| SSH1 | 1.63 | 0.014773 |
| SOWAHC | 1.618 | 0.029041 |
| GFPT1 | 1.602 | 0.007697 |
| ABI1 | 1.596 | 0.001168 |
| ARHGEF37 | 1.584 | 0.01774 |
| RRP12 | 1.584 | 0.032038 |
| PRKAB2 | 1.582 | 0.004186 |
| UFD1 | 1.582 | 0.037686 |
| MYO6 | 1.579 | 0.029372 |
| NAV3 | 1.571 | 0.013991 |
| MTMR3 | 1.556 | 0.000974 |
| ANXA1 | 1.547 | 0.003859 |
| FBNP1 | 1.545 | 0.027063 |
| PLEC | 1.535 | 0.007797 |
| MAP7 | 1.533 | 0.044607 |
| SNRPE | 1.528 | 0.01651 |
| LIMA1 | 1.524 | 0.000912 |
| TPD52L2 | 1.504 | 0.004895 |
| AHNAK | 1.497 | 0.003596 |
| ARHGAP1 | 1.484 | 0.011394 |
| PPP2R5A | 1.484 | 0.003505 |
| DLG5 | 1.479 | 0.003365 |
| IMPDH2 | 1.476 | 0.003579 |
| SEC61B | 1.461 | 0.025975 |
| DBNL | 1.46 | 0.020853 |
| IRS2 | 1.46 | 3.54E-05 |
| EPS8L1 | 1.457 | 0.015739 |
| DDX17 | 1.454 | 0.005622 |

| | | |
|------------|-------|----------|
| PEA15 | 1.447 | 0.029402 |
| CNP | 1.435 | 0.001445 |
| AP1M2 | 1.433 | 0.018344 |
| DSG2 | 1.433 | 0.001519 |
| CCNE1 | 1.431 | 0.000875 |
| DNMBP | 1.429 | 0.006941 |
| MICAL1 | 1.425 | 0.011773 |
| CSNK1D | 1.422 | 0.044839 |
| SEC22B | 1.417 | 0.007281 |
| LAP3 | 1.412 | 0.011763 |
| WDR44 | 1.41 | 0.007548 |
| GTF2F1 | 1.407 | 0.032649 |
| TRIO | 1.407 | 0.000692 |
| SH2D3A | 1.401 | 0.000245 |
| SHTN1 | 1.401 | 0.040117 |
| KRT18 | 1.395 | 0.001839 |
| AHCY | 1.39 | 0.044859 |
| DDB2 | 1.386 | 0.000745 |
| PKP3 | 1.383 | 0.027739 |
| TFRC | 1.376 | 0.003502 |
| DSP | 1.374 | 0.029613 |
| CXorf38 | 1.371 | 0.000788 |
| PDAP1 | 1.37 | 0.031246 |
| AHNAK2 | 1.369 | 0.030072 |
| NHSL1 | 1.361 | 0.012018 |
| RPL34 | 1.358 | 0.01021 |
| ITSN1 | 1.357 | 0.007778 |
| PLEKHN1 | 1.357 | 0.006159 |
| ARHGEF17 | 1.348 | 0.019016 |
| EPS8L2 | 1.348 | 0.027529 |
| NEDD8-MDP1 | 1.347 | 0.027003 |
| CLTC | 1.343 | 0.03067 |
| DDX28 | 1.343 | 0.003065 |
| LRFN4 | 1.343 | 0.008288 |
| PLEKHM2 | 1.34 | 0.002886 |
| YWHAB | 1.34 | 0.010738 |
| PLIN3 | 1.335 | 0.022294 |
| CUL4A | 1.333 | 0.021885 |
| PRAG1 | 1.332 | 0.000163 |
| PRDX1 | 1.332 | 0.017185 |
| HNRNPA1 | 1.327 | 0.00921 |
| TMEM184B | 1.323 | 0.038984 |
| TBC1D25 | 1.32 | 0.030244 |
| PTPN21 | 1.317 | 0.022128 |
| MON2 | 1.315 | 0.007474 |
| RBM34 | 1.315 | 0.002152 |
| ANXA2 | 1.311 | 0.008756 |
| MICAL1 | 1.304 | 0.020539 |
| PLA2G4A | 1.304 | 0.013925 |
| RNF25 | 1.302 | 0.046933 |
| MEX3D | 1.299 | 0.046524 |
| APOA5 | 1.298 | 0.025926 |
| SUB1 | 1.298 | 0.015083 |
| RIMS3 | 1.296 | 0.019637 |
| AKAP11 | 1.29 | 0.00255 |

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|------------|-------|----------|
| PFKP | 1.287 | 0.001494 |
| HID1 | 1.285 | 0.040552 |
| CDK9 | 1.282 | 0.031971 |
| LMNA | 1.275 | 0.001786 |
| PHLDB1 | 1.275 | 0.010775 |
| BRSK2 | 1.273 | 0.044521 |
| PRKAR1A | 1.269 | 0.04426 |
| LAD1 | 1.268 | 0.020154 |
| SFN | 1.268 | 0.003472 |
| RAB12 | 1.265 | 0.027185 |
| OSBPL3 | 1.26 | 0.020348 |
| PDLIM2 | 1.259 | 0.014909 |
| CGN | 1.257 | 0.006223 |
| PEBP1 | 1.255 | 0.041824 |
| JUND | 1.254 | 0.002799 |
| C11orf52 | 1.253 | 0.029229 |
| MYO9B | 1.252 | 0.040079 |
| AFDN | 1.246 | 0.039774 |
| MAP1S | 1.243 | 0.042982 |
| PALM2AKAP2 | 1.243 | 0.006685 |
| TRIP12 | 1.24 | 0.000577 |
| DNAL1 | 1.238 | 0.011949 |
| RASAL2 | 1.233 | 0.002614 |
| AMPD3 | 1.226 | 0.006931 |
| DCP1B | 1.225 | 0.008711 |
| GNAS | 1.225 | 0.011556 |
| RRAS2 | 1.224 | 0.012342 |
| SLTM | 1.223 | 0.010221 |
| UBE2J1 | 1.216 | 0.014145 |
| PPP1R13L | 1.215 | 0.039199 |
| AJUBA | 1.21 | 0.023267 |
| RCC1 | 1.21 | 0.000911 |
| PLEC | 1.207 | 0.006289 |
| HINT1 | 1.206 | 0.02976 |
| RBM17 | 1.204 | 0.031921 |
| TMEM245 | 1.202 | 0.036033 |
| PHACTR4 | 1.201 | 0.015327 |
| KIAA1671 | 1.2 | 0.000224 |

Table SIX. The 25 enriched pathways in isobaric tags for relative and absolute quantitation analysis.

| Term | Database | ID | P-value | Protein |
|---|--------------|--------------|----------|--|
| Unwinding of DNA | Reactome | R-HSA-176974 | 0.003107 | MCM5,MCM6,MCM7,MCM2,MCM3,MCM4,GINS4 |
| mRNA splicing - major pathway | Reactome | R-HSA-72163 | 0.004765 | HNRNPA0,PCBP2,RBM17,DDX46,SNRPA,SNW1,POLR2C,POLR2D,POLR2A,TRA2B,SRSF7,CCAR1,FIP1L1,HNRNPA2B1,POLR2J,PRCC,RNPS1,HNRNPD,HNRNPF,DNAJC8,DHX38,PPWD1,PRPF40A,CDC40,CHERP,PLRG1,CWC27,PPIH,SF3B3,SNRPD2,CD2BP2,SNRPD3,SNRPF,PHF5A,SRSF2,RBM8A,SRSF10,SRSF11,SF3B5,PPIL1,TXNL4A,CSTF1,HNRNPL,CSTF2 |
| mRNA splicing | Reactome | R-HSA-72172 | 0.004765 | HNRNPA0, PCBP2, RBM17, DDX46, SNRPA, SNW1, POLR2C, POLR2D, POLR2A, TRA2B, SRSF7, CCAR1, FIP1L1, HNRNPA2B1, POLR2J, PRCC, RNPS1, HNRNPD, HNRNPF, DNAJC8, DHX38, PPWD1, PRPF40A, CDC40, CHERP, PLRG1, CWC27, PPIH, SF3B3, SNRPD2, CD2BP2, SNRPD3, SNRPF, PHF5A, SRSF2, RBM8A, SRSF10, SRSF11, SF3B5, PPIL1, TXNL4A, CSTF1, HNRNPL, CSTF2 |
| Transcriptional regulation of white adipocyte differentiation | Reactome | R-HSA-381340 | 0.004916 | MED22, MED6, MED30, MED15, MED20, MED14, MED1, NR2F2, MED29, MED8, MED24, NFKB1 |
| Processing of capped intron-containing pre-mRNA | Reactome | R-HSA-72203 | 0.005756 | HNRNPA0, PCBP2, RBM17, NUP85, DDX46, SNRPA, ZC3H11A, POLR2C, THOC3, POLR2A, TRA2B, SRSF7, CD2BP2, CCAR1, FIP1L1, HNRNPA2B1, POLR2J, PRCC, RNPS1, HNRNPD, HNRNPF, DNAJC8, NUP50, DHX38, PPWD1, SLBP, SNW1, PRPF40A, CDC40, CHERP, POLR2D, CWC27, PPIH, SF3B3, SNRPD2, NUP214, SNRPD3, SNRPF, PHF5A, SRSF2, RBM8A, SRSF10, SRSF11, SF3B5, PPIL1, PLRG1, TXNL4A, CSTF1, HNRNPL, NUP43, CSTF2, POLDIP3 |
| Cell cycle | KEGG PATHWAY | hsa04110 | 0.006027 | MAD2L1, SMAD3, CDK1, ANAPC5, CHEK2, E2F4, RAD21, CDC16, RB1, SMAD4, YWHAZ, CCNA2, MCM5, SFN, CDC23, CCNH, MCM6, MCM7, PLK1, MCM2, MCM3, MCM4 |
| Amino acid synthesis and interconversion (transamination) | Reactome | R-HSA-70614 | 0.007124 | PSAT1, PSPH, ASNS, GLUL, GLS, GLUD1, PHGDH, PYCR2 |
| DNA strand elongation | Reactome | R-HSA-69190 | 0.009052 | MCM5, POLA2, MCM7, MCM2, MCM3, MCM4, RFC3, RFC4, MCM6, GINS4, LIG1 |

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|--|--------------|---------------|----------|---|
| HATs acetylate histones | Reactome | R-HSA-3214847 | 0.012405 | HIST1H2AL, HIST1H4H, CLOCK, USP22, HIST1H2BD, RUVBL1, ELP5, HIST2H3D, RBBP7, HCFC1, HIST2H2AB, SAP130, VPS72 |
| MicroRNAs in cancer | KEGG PATHWAY | hsa05206 | 0.013435 | IRS2, PTEN, SIRT1, SLC7A1, PDCD4, STAT3, NFKB1, GRB2, RPS6KA5, MARCKS, SERPINB5, MET, EZR, GLS, PLCG1, RHOA, HRAS, KIF23, HMOX1 |
| Cellular senescence | Reactome | R-HSA-2559583 | 0.017268 | HIST1H4H, ANAPC5, H1F0, HIST1H1C, MAPK9, HIST2H3D, MOV10, HMGA1, CDC16, HIST1H1E, RB1, RBBP4, CCNA2, CDC23, NFKB1, MAPK14, STAT3, EHMT1, ANAPC16, HIST1H2BD, RPS6KA1, RBBP7 |
| HDACs deacetylate histones | Reactome | R-HSA-3214815 | 0.020338 | HIST1H4H, MBD3, SAP18, MTA1, HIST1H2BD, HIST1H2AL, HIST2H3D, RBBP7, RBBP4, HIST2H2AB |
| Formation of senescence-associated heterochromatin foci (SAHF) | Reactome | R-HSA-2559584 | 0.021665 | H1F0, RB1, HMGA1, HIST1H1C, HIST1H1E |
| Condensation of prophase chromosomes | Reactome | R-HSA-2299718 | 0.022155 | PLK1, HIST1H4H, SET, CDK1, HIST1H2BD, SMC2, RB1, HIST2H3D |
| RNA polymerase II transcription | Reactome | R-HSA-73857 | 0.0275 | SUPT16H, ZC3H11A, SSRP1, POLR2C, THOC3, POLR2A, SRSF7, FIP1L1, POLR2J, RBM8A, DHX38, SLBP, RNMT, CDC40, POLR2D, GTF2A2, GTF2A1, SNRPD3, SNRPF, CCNH, SRSF2, CCNT1, SRSF11, RNPS1, PAF1, CSTF1, CSTF2, POLDIP3 |
| VxPx cargo-targeting to cilium | Reactome | R-HSA-5620916 | 0.028547 | EXOC8, ARF4, RAB8A, EXOC5, GBF1, EXOC2 |
| DNA replication | KEGG PATHWAY | hsa03030 | 0.030044 | MCM5, POLA2, MCM7, MCM2, MCM3, MCM4, RFC3, RFC4, MCM6, LIG1 |
| Serine glycine biosynthesis | PANTHER | P02776 | 0.031297 | SHMT2, PSAT1, PHGDH, PSPH |
| Cleavage of growing transcript in the termination region | Reactome | R-HSA-109688 | 0.033809 | CDC40, THOC3, SRSF2, SRSF7, SRSF11, FIP1L1, RBM8A, SLBP, RNPS1, CSTF1, SNRPF, ZC3H11A, CSTF2, POLDIP3, SNRPD3, DHX38 |
| RNA polymerase II transcription termination | Reactome | R-HSA-73856 | 0.033809 | CDC40, THOC3, SRSF2, SRSF7, SRSF11, FIP1L1, RBM8A, SLBP, RNPS1, CSTF1, SNRPF, ZC3H11A, CSTF2, POLDIP3, SNRPD3, DHX38 |
| Senescence-associated secretory phenotype (SASP) | Reactome | R-HSA-2559582 | 0.034708 | CCNA2, HIST1H4H, STAT3, EHMT1, ANAPC16, HIST1H2BD, CDC16, RPS6KA1, ANAPC5, HIST2H3D, CDC23, NFKB1 |
| DNA | Reactome | R-HSA- | 0.034864 | CCNA2, HIST1H4H, HIST1H2BD, |

| | | | | |
|---|--------------|---------------|----------|--|
| damage/telomere stress induced senescence | | 2559586 | | H1F0, RB1, HIST1H1C, HMGA1, HIST1H1E |
| PPARA activates gene expression | Reactome | R-HSA-1989781 | 0.040345 | FHL2, MED22, CLOCK, MED30, MED20, MED14, MED1, MED29, MED8, MED24, MED15, MED6 |
| Cytokine-cytokine receptor interaction | KEGG PATHWAY | hsa04060 | 0.042631 | FAS, TNFRSF6B, MET, IL18, TNFRSF12A |
| Serine biosynthesis | Reactome | R-HSA-977347 | 0.044463 | PSPH, PSAT1, PHGDH |

Table SX. The 13 enriched pathways in phosphoproteomics analysis.

| Term | Database | ID | P-value | Protein |
|--|--------------|---------------|----------|---|
| Formation of senescence-associated heterochromatin foci (SAHF) | Reactome | R-HSA-2559584 | 0.008129 | LMNB1, H1F0, RB1, HIST1H1C, HMGA1, HIST1H1E |
| Nucleotide excision repair | KEGG PATHWAY | hsa03420 | 0.025939 | LIG1, RFC1, DDB2, CUL4A, CUL4B |
| DNA damage bypass | Reactome | R-HSA-73893 | 0.025939 | UFD1L, RFC1, DTL, CUL4A, CUL4Bss |
| p53 pathway | PANTHER | P00059 | 0.02596 | SFN, DDB2, CCNE1, WRN, GTSE1, SIRT1, HDAC1 |
| Recognition of DNA damage by PCNA-containing replication complex | Reactome | R-HSA-110314 | 0.02689 | RFC1, DTL, CUL4A, CUL4B |
| Dual incision in GG-NER | Reactome | R-HSA-5696400 | 0.02689 | RFC1, DDB2, CUL4A, CUL4B |
| Apoptotic execution phase | Reactome | R-HSA-75153 | 0.027148 | DSP, DSG2, LMNB1, H1F0, HIST1H1C, PLEC, HIST1H1E, DBNL |
| SUMOylation | Reactome | R-HSA-2990846 | 0.030686 | INCENP, TOP2B, MTA1, NUP50, TOP1, NUP93, WRN, MDC1, POM121, NOP58, NUP210 |
| SUMO E3 ligases SUMOylate target proteins | Reactome | R-HSA-3108232 | 0.030686 | INCENP, TOP2B, MTA1, NUP50, TOP1, NUP93, WRN, MDC1, POM121, NOP58, NUP210 |
| p53 signaling pathway | KEGG PATHWAY | hsa04115 | 0.030795 | SFN, DDB2, EI24, CCNE1, CHEK1, GTSE1 |
| Resolution of AP sites via the multiple-nucleotide patch replacement pathway | Reactome | R-HSA-110373 | 0.039533 | LIG1, RFC1, PARG |
| Glutamatergic synapse | KEGG PATHWAY | hsa04724 | 0.039968 | HOMER3, GNAS, PLA2G4A, SLC38A1 |
| Lipid digestion, mobilization, and transport | Reactome | R-HSA-73923 | 0.039968 | CLTC, SH3KBP1, APOA5, LIPE |