Table.1 Number of co-expressed and specific DEGs in the breast cancer subtypes.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PAM50 subtype | Common | Basal-like | Her2 | LumA | LumB | Normal-like |
| UP | 4 | 25 | 34 | 5 | 9 | 3 |
| DOWN | 0 | 55 | 21 | 0 | 47 | 0 |

Table.2 Genes with consistent expression with TCGA screening results were verified via the METABRIC database and BC-GenExMiner v4.5.

|  |  |  |
| --- | --- | --- |
| PAM50 subtype | Up Gene name | Down Gene name |
| Basal-Her2-LumA-LumB-Normal-like | NEIL3/CDC25C/NEK2/HCN2 | / |
| Basal | SLCO5A1/GPR19/LCTL/MCM10/HPDL/SOX11/RAD54L/CDCA2/MSLN/GTSE1/NDC80/BUB1/COL22A1/KIF2C/PLK1/FOXM1/CDCA3/NCAPG/AUNIP/MIR4292/CCNE1 | LINC00504/TFF3/CYP4B1/TTC36/ DYNLRB2/OGN/ ACSM5/MS4A2/MIR4697HG/C16orf89/PTPRT/ MYRIP/CAPN8/AGTR1/ PFKFB1/PGR/ COL4A6/ABCC11/ DHRS2/NDNF/PLIN5/FER1L5/AZGP1P1/GRIK3/NEK10/RANBP3L/FAM198B-AS1/GFRA1/SOWAHA/CLEC3B/LRRN3/FAM162B/AK5/IQUB/SEMA3E/ ADRB2/GLDN/DACH1/LIPE/ LOC105371730 |
| Her2 | LOC105372233/SPOCD1/ IL21R/JPH3/SAMD11/ IFI30/JSRP1/ANGPTL6/IL4I1/VSTM2L/ MMP3/HES6/S100A8/ASCL2/TCHH/NXPH4/LBX2/ LOC105371849/SIX2 | LINC00173/ATRNL1/TNNI3K/PI15/FAM189A2/LOC100505635/MYZAP/SLC4A4/LRP2/NAT8L/OXTR/SLC25A27/ FGF14-AS2/LINC00639/TRMT9B |
| LumA | MISP/SMIM22 | / |
| LumB | CNTD2/NEURL1/SYCE3 | STAC2/PPP1R1A/HRCT1/AKR1C2/IL6/FREM1/HOXA4/TMOD1/PTGS2/PTGS2/FAM107A/IL33/TRIM29/TMEM220-AS1/PROX1/GFRA2/SLC28A3/HCAR2/PPARGC1A/GNG12-AS1/TDRD10/SOX8/TP63/TTYH1/PTH2R/ SLC2A12/KCNA6/PROM1/KRT17/ C2orf88/PAMR1/PPP1R14A / BCL11A |
| Normal-like | IDH1-AS1/TMEM233 | / |

(Genes annotated in yellow are those for which validation results were discordant or no data were available in the METABRIC database and BC genexminer v4.5)

Table.3 The key common and specific DEGs selected were verified in the GSE65216 dataset.

|  |  |  |
| --- | --- | --- |
| **Basal-like** | | |
| **Gene name** | **TCGA** | **GSE65216** |
| NEIL3 | Up | No change |
| HCN2 | Up | Down |
| NEK2 | Up | Up |
| CDC25C | Up | Up |
| SOX11 | Up | Up |
| PLK1 | Up | Up |
| BUB1 | Up | Up |
| OGN | Down | Down |
| AGTR1 | Down | Down |
| COL4A6 | Down | Down |
| ADRB2 | Down | Down |
| DYNLRB2 | Down | Down |
| HPDL | Up | Up |
| MCM10 | Up | Up |
| **Her2** | | |
| **Gene name** | **TCGA** | **GSE65216** |
| NEIL3 | Up | Down |
| HCN2 | Up | Down |
| NEK2 | Up | No change |
| CDC25C | Up | Down |
| ATRNL1 | Down | Down |
| FAM189A2 | Down | Down |
| IFI30 | Up | Up |
| IL21R | Up | No change |
| JPH3 | Up | Down |
| MYZAP | Down | Down |
| PI15 | Down | Down |
| SAMD11 | Up | Up |
| SPOCD1 | Up | No change |
| TNNI3K | Down | No change |
| **LumA** | | |
| **Gene name** | **TCGA** | **GSE65216** |
| NEIL3 | Up | No change |
| HCN2 | Up | Down |
| NEK2 | Up | No change |
| CDC25C | Up | No change |
| MISP | Up | Up |
| SMIM2 | Up | Up |
| **LumB** | | |
| **Gene name** | **TCGA** | **GSE65216** |
| NEIL3 | Up | No change |
| HCN2 | Up | Down |
| NEK2 | Up | Down |
| CDC25C | Up | Down |
| AKR1C2 | Down | Down |
| CNTD2 | Up | No change |
| FREM1 | Down | Down |
| HOXA4 | Down | Down |
| HRCT1 | Down | Down |
| IL6 | Down | No change |
| NEURL1 | Up | Down |
| PPP1R1A | Down | Down |
| STAC2 | Down | Down |
| SYCE3 | Up | No change |

Table. 4 Prognostic value of the key common DEGs in total and different subtype breast cancers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Basal** | **RFS** | | **OS** | |
| Gene | HR(95% CI for HR) | P | HR(95% CI for HR) | P |
| NEIL3 | 0.68(0.53-0.88) | 0.003 | 0.57(0.34-0.93) | 0.022 |
| CDC25C | 0.91(0.7-1.17) | 0.45 | 0.5(0.3-0.83) | 0.0063 |
| NEK2 | 1.35(1.03-1.79) | 0.031 | 0.55(0.34-0.9) | 0.016 |
| HCN2 | 0.77(0.58-1.03) | 0.074 | 1.36(0.83-2.23) | 0.23 |
| **HER2** | **RFS** | | **OS** | |
| NEIL3 | 0.59(0.4-0.86) | 0.006 | 1.38(0.71-2.7) | 0.34 |
| CDC25C | 0.7(0.47-1.04) | 0.078 | 0.56(0.26-1.23) | 0.14 |
| NEK2 | 1.34(0.91-1.97) | 0.13 | 0.55(0.23-1.32) | 0.17 |
| HCN2 | 1.54(0.98-2.42) | 0.057 | 1.94(0.91-4.11) | 0.079 |
| **Lum A** | **RFS** | | **OS** | |
| NEIL3 | 1.29(1.08-1.54) | 0.0041 | 1.79(1.24-2.59) | 0.0017 |
| CDC25C | 1.64(1.37-1.96) | 6e-08 | 2(1.4-2.85) | 9.2e-05 |
| NEK2 | 2.2(1.85-2.6) | <1e-16 | 2.5(1.75-3.57) | 1.6e-07 |
| HCN2 | 0.86(0.72-1.02) | 0.09 | 1.5(1.03-2.19) | 0.034 |
| **Lum B** | **RFS** | | **OS** | |
| NEIL3 | 0.81(0.67-0.98) | 0.03 | 1.73(1.11-2.69) | 0.014 |
| CDC25C | 1.19(0.99-1.45) | 0.068 | 1.49(1.03-2.15) | 0.035 |
| NEK2 | 1.71(1.37-2.14) | 1.7e-06 | 1.86(1.17-2.96) | 0.0082 |
| HCN2 | 0.74(0.6-0.91) | 0.0047 | 1.36(0.94-1.97) | 0.1 |
| **BRCA** | **RFS** | | **OS** | |
| NEIL3 | 1.12(1.07-1.38) | 0.0022 | 1.63(1.27-2.11) | 0.00014 |
| CDC25C | 1.45(1.3-1.61) | 2.6e-11 | 1.54(1.24-1.91) | 8.9e-05 |
| NEK2 | 1.91(1.7-2.14) | <1e-16 | 2.08(1.62-2.67) | 4.8e-09 |
| HCN2 | 0.83(0.74-0.94) | 0.0033 | 1.39(1.1-1.77) | 0.0064 |

Table.5 Prognostic value of the key specific DEGs in Basal subtype, Her2 subtype, LumB subtype and total breast cancers.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Basal** | **RFS** | | **OS** | |
| Gene | HR(95% CI for HR) | P | HR(95% CI for HR) | P |
| SOX11 | 1.65(1.25-2.16) | 0.00031 | 1.75(1.03-2.98) | 0.0235 |
| PLK1 | 0.82(0.63-1.08) | 0.15 | 0.56(0.34-0.91) | 0.019 |
| BUB1 | 0.69(0.53-0.89) | 0.0045 | 0.44(0.26-0.73) | 0.00096 |
| OGN | 0.67(0.49-0.93) | 0.015 | 1.48(0.76-2.86) | 0.24 |
| COL4A6 | 0.73(0.56-0.95) | 0.018 | 1.6(0.98-2.64) | 0.06 |
| AGTR1 | 0.63(0.48-0.82) | 0.00048 | 0.79(0.48-1.29) | 0.34 |
| ADRB2 | 0.56(0.43-0.74) | 2e-05 | 1.49(0.91-2.46) | 0.11 |
| **BRCA** | **RFS** | | **OS** | |
| Gene | HR(95% CI for HR) | P | HR(95% CI for HR) | P |
| SOX11 | 1.61(1.44-1.8) | <1e-16 | 1.71(1.37-2.13) | 1.2e-06 |
| PLK1 | 1.51(1.34-1.7) | 4.5e-12 | 1.56(1.25-1.94) | 6.7e-05 |
| BUB1 | 1.84(1.64-2.06) | <1e-16 | 2.12(1.64-2.74) | 4e-09 |
| OGN | 0.64(0.55-0.75) | 4e-08 | 0.57(0.41-0.8) | 0.0011 |
| COL4A6 | 0.58(0.52-0.65) | <1e-16 | 0.71(0.55-0.93) | 0.012 |
| AGTR1 | 0.61(0.54-0.68) | <1e-16 | 0.5(0.39-0.65) | 1.1e-07 |
| ADRB2 | 0.59(0.52-0.66) | <1e-16 | 0.62(0.49-0.77) | 2.4e-05 |
| **HER2** | **RFS** | | **OS** | |
| Gene | HR(95% CI for HR) | P | HR(95% CI for HR) | P |
| IL21R | 0.42(0.26-0.69) | 0.00044 | 0.34(0.15-0.79) | 0.0083 |
| IFI30 | 0.61(0.42-0.9) | 0.012 | 0.47(0.24-0.9) | 0.019 |
| PI15 | 0.57(0.38-0.83) | 0.0034 | 1.77(0.91-3.45) | 0.087 |
| FAM189A2 | 0.45(0.31-0.67) | 4.1e-05 | 0.63(0.33-1.21) | 0.16 |
| MYZAP | 1.55（0.88-2.73） | 0.13 | 5.79（1.37-24.6） | 0.007 |
| **BRCA** | **RFS** | | **OS** | |
| Gene | HR(95% CI for HR) | P | HR(95% CI for HR) | P |
| IL21R | 0.67(0.57-0.79) | 1.4e-06 | 0.58(0.39-0.86) | 0.006 |
| IFI30 | 1.37(1.2-1.56) | 1.8e-06 | 1.29(1.04-1.6) | 0.021 |
| PI15 | 0.61(0.55-0.68) | <1e-16 | 0.7(0.56-0.88) | 0.002 |
| FAM189A2 | 0.62(0.56-0.7) | 1.9e-15 | 0.71(0r.56-0.89) | 0.0026 |
| MYZAP | 0.64(0.54-0.74) | 7.8e-09 | 0.68(0.47-0.97) | 0.03 |
| LumA | **RFS** | | **OS** | |
| Gene | HR(95% CI for HR) | P | HR(95% CI for HR) | P |
| SMIM22 | 1.3(0.98-1.72) | 0.073 | 1.44(0.97-2.14) | 0.067 |
| **BRCA** | **RFS** | | **OS** | |
| Gene | HR(95% CI for HR) | P | HR(95% CI for HR) | P |
| SMIM22 | 0.86(0.73-1) | 0.054 | 1.44(0.97-2.14) | 0.067 |
| **LumB** | **RFS** | | **OS** | |
| CNTD2 | 0.64(0.53-0.78) | 4.8e-06 | 0.85(0.58-1.23) | 0.38 |
| NEURL | 0.68(0.56-0.83) | 0.00011 | 1.26(0.81-1.93) | 0.3 |
| STAC2 | 0.6(0.43-0.85) | 0.0039 | 0.39(0.15-1.01) | 0.044 |
| AKR1C2 | 0.75(0.54-1.04) | 0.088 | 2.02(1.03-3.98) | 0.038 |
| IL6 | 0.64(0.53-0.78) | 6.3e-06 | 0.79(0.55-1.16) | 0.23 |
| FREM1 | 0.44(0.32-0.61) | 3.7e-07 | 0.42(0.19-0.92) | 0.026 |
| HOXA4 | 0.71(0.58-0.86) | 0.00049 | 0.8(0.55-1.17 | 0.25 |
| **BRCA** | **RFS** | | **OS** | |
| CNTD2 | 0.6(0.53-0.67) | <1e-16 | 0.75(0.59-0.94) | 0.013 |
| NEURL | 0.62(0.56-0.7) | <1e-16 | 0.84(0.67-1.04) | 0.11 |
| STAC2 | 0.85(0.72-1) | 0.055 | 1.47(1.04-2.07) | 0.027 |
| AKR1C2 | 0.75(0.64-0.89) | 0.00074 | 1.59(1.16-2.2) | 0.004 |
| IL6 | 0.77(0.69-0.86) | 3.3e-06 | 0.86(0.69-1.07) | 0.17 |
| FREM1 | 0.42(0.36-0.49) | <1e-16 | 0.54(0.38-0.78) | 0.00068 |
| HOXA4 | 0.64(0.57-0.72) | 2.4e-14 | 0.73(0.58-0.91) | 0.0055 |