Supplementary Table 3. Top 100 differentially expressed genes in BVECyp24a1-null cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Gene name | Log2 Ratio (BVECyp24a1-null / BVECyp24a1-wt) | Gene description  | Functional role in cancer | Reference  |
| Efemp1 | -9.655083445 | EGF Containing Fibulin-Like Extracellular Matrix Protein 1  | Promotes tumor migration and invasion | ([1](#_ENREF_1), [2](#_ENREF_2)) |
| Hist2h2aa2 | -9.113742166 | Histone Cluster 2, H2aa4, | nucleosome assembly and DNA packaging |  |
| Ppp1r2-ps3 | -7.948367232 | protein phosphatase 1, regulatory (inhibitor) subunit 2, pseudogene 3 | unknown |  |
| Ripply1 | 10.01448548 | Ripply Transcriptional Repressor 1 | Plays a role in somitogenesis | ([3](#_ENREF_3)) |
| Hp | 9.098032083 | Haptoglobin | A tumor biomarker | ([4](#_ENREF_4)) |
| Cxcl15 | 8.918863237 | Chemokine (C-X-C motif) ligand 15 | A tumor-associated cytokine involved in the recruitment of myeloid-derived suppressor cells to the tumor site. May promote invasion of carcinoma cells by increasing fibroblast migration | ([5](#_ENREF_5), [6](#_ENREF_6)) |
| Tff1 | 8.87958325 | Trefoil Factor 1 | Inhibits tumorigenesis by modulating Wnt/β-catenin signaling | ([7](#_ENREF_7)) |
| Olfm4 | 8.804131021 | Olfactomedin 4 | A tumor suppressor gene (negative regulator of the Wnt/β-catenin and NF-κB pathways) | ([8](#_ENREF_8)) |
| Lypd2 | 8.761551232 | LY6/PLAUR Domain Containing 2 | unknown |  |
| Slc25a43 | 8.625708843 | Solute Carrier Family 25 Member 43 | A regulator of cell cycle progression and proliferation, which is frequently deleted in HER2-positive breast tumors. | ([9](#_ENREF_9), [10](#_ENREF_10)) |
| C130026I21Rik | 8.491853096 | RIKEN cDNA C130026I21 gene, Ortholog of SP140 | unknown |  |
| Sftpa1 | 8.22881869 | Surfactant Protein A1 | unknown |  |
| Msx1 | 8.224001674 | Msh Homeobox 1 | Inhibits cell proliferation by up-regulation of Delta-Notch pathway genes | ([11](#_ENREF_11)) |
| Gpx2-ps1 | 8.194756854 | glutathione peroxidase 2, pseudogene 1 | unknown |  |
| Sftpb | 8.164906927 | Surfactant Protein B | unknown |  |
| Msx1os | 8.011227255 | msh homeobox 1 opposite strand | unknown |  |
| Clu | 7.790333062 | Clusterin | Enhances cancer cell survival via autophagy-dependent pathways | ([12](#_ENREF_12)) |
| Prl2c2 | 7.734872821 | prolactin family 2, subfamily c, member 2 | unknown |  |
| Cd300lb | 7.693486957 | CD300 molecule like family member B | Involved in the activation of innate immune cells | ([13](#_ENREF_13)) |
| Dhh | 7.482202926 | Desert Hedgehog | Regulates development during embryogenesis. It is also involved in tumor progression, autophagy and EMT phenotype | ([14](#_ENREF_14)) |
| Cdx2 | 7.409390936 | Caudal Type Homeobox 2 | A tumor suppressor. Its down-regulation is associated with poor prognosis | ([15](#_ENREF_15)) |
| Prl2c3 | 7.25593371 | prolactin family 2, subfamily c, member 3 | unknown |  |
| Ceacam16 | 7.246570959 | Carcinoembryonic Antigen Related Cell Adhesion Molecule 16 | unknown |  |
| H2-Q9 | 7.129283017 | histocompatibility 2, Q region locus 9 | A MHC class Ib molecule that mediates protective immunity against tumor cells | ([16](#_ENREF_16)) |
| Sema7a | 7.076815597 | Semaphorin 7A (John Milton Hagen Blood Group) | Promotes metastasis via IL13RA2 signaling | ([17](#_ENREF_17)) |
| Cela1 | 7 | Chymotrypsin Like Elastase Family Member 1 | unknown |  |
| Kcnq4 | 6.87036472 | Potassium Voltage-Gated Channel Subfamily Q Member 4 | unknown |  |
| Bend5 | 6.781359714 | BEN domain containing 5 | unknown |  |
| Ffar4 | 6.672425342 | Free Fatty Acid Receptor 4 | A receptor for free fatty acids and may inhibit cancer cell mobility | ([18](#_ENREF_18)) |
| Muc5ac | 6.64385619 | Mucin 5AC, Oligomeric Mucus/Gel-Forming | Inhibits tumor progression | ([19](#_ENREF_19)) |
| Pycard | 6.62935662 | PYD And CARD Domain Containing | A tumor suppressor gene. Functions as key mediator in apoptosis and inflammation | ([20](#_ENREF_20)) |
| Csprs | 6.569855608 | component of Sp100-rs | unknown |  |
| Gm6644 | -13.16757495 | predicted gene 6644, Akr1b3 pseudogene | unknown |  |
| Ndn | -13.1067265 | Necdin, MAGE Family Member | A tumor suppressor gene | ([21](#_ENREF_21)) |
| Ripk3 | -12.33399388 | Receptor Interacting Serine/Threonine Kinase 3 | An essential kinase for necroptosis, plays a key role in inhibiting acute myeloid leukemia development. Genetic loss of Ripk3 converted murine myeloproliferation into an overt AMLin Il1r1(-/-), Pycard(-/-), and Tnfr1/2(-/-) mice. | ([22](#_ENREF_22)) |
| 1700012B09Rik | -11.17242751 | RIKEN cDNA 1700012B09 gene | unknown |  |
| Crip1 | -10.12412131 | Cysteine Rich Protein 1 | Its expression is correlated with a favorable outcome and less metastases in osteosarcoma patients | ([23](#_ENREF_23)) |
| Acp5 | -9.749869427 | Tartrate-resistant acid phosphatase 5 | Pro-invasion and metastasis driver gene | ([24](#_ENREF_24), [25](#_ENREF_25)) |
| Ctsz | -9.614300859 | Cathepsin Z | Promotes tumor metastasis by inducing epithelial-mesenchymal transition | ([26](#_ENREF_26)) |
| En1 | -9.453270634 | Engrailed homeobox 1 | Promotes tumor cell survival and resistance to chemotherapeutic agents | ([27](#_ENREF_27)) |
| Eva1b | -9.385862401 | Eva-1 Homolog B | unknown |  |
| Ppp1r14a | -9.187352073 | Protein Phosphatase 1 Regulatory Inhibitor Subunit 14A | Promote tumor transformation | ([28](#_ENREF_28)) |
| Hoxc5 | -9.131856961 | Homeobox C5 | Promote tumor transformation | ([29](#_ENREF_29)) |
| BC026585 | -9.084808388 | Quinone oxidoreductase-like protein 2 | unknown |  |
| Mall | -9.055282436 | Mal-like protein | unknown |  |
| Krt20 | -8.998355367 | Keratin 20 | Prognostic marker: high expression is associated with poor prognosis | ([30](#_ENREF_30), [31](#_ENREF_31)) |
| Tbx3os2 | -8.965784285 | T-box 3, opposite strand 2 | unknown |  |
| Cd80 | -8.857980995 | CD80 Antigen | Immune surveillance: a membrane protein found on activated B cells and monocytes that provides a costimulatory signal necessary for T cell activation and survival. It is activated by binding of CD28 (T-cell proliferation and cytokine production) or CTLA-4 (inhibits T-cell activation) | ([32](#_ENREF_32)) |
| Dlx2 | -8.816983623 | Distal-Less Homeobox 2 | Shift TGFβ from its tumor suppressive to tumor-promoting functions | ([33](#_ENREF_33)) |
| Dkkl1 | -8.77807713 | Dickkopf Like Acrosomal Protein 1 | Antagonize Wnt/beta-catenin signaling by inhibiting the Wnt coreceptors Lrp5 and 6 | ([34](#_ENREF_34)) |
| Il17b | -8.741466986 | Interleukin 17B | Tumor-promoting cytokine | ([35](#_ENREF_35)) |
| Epb41l3 | -8.62935662 | Erythrocyte Membrane Protein Band 4.1 Like 3 | Tumor suppressor gene | ([36](#_ENREF_36)) |
| Hist1h2ai | -8.503825738 | Histone Cluster 1, H2ai | nucleosome assembly and DNA packaging |  |
| Hist1h2ag | -8.463524373 | Histone Cluster 1, H2ag | nucleosome assembly and DNA packaging |  |
| 1700003F12Rik | -8.459431619 | Bcl-2-like protein | unknown |  |
| Unc93b1 | -8.271463028 | Unc-93 Homolog B1 (C. Elegans) | toll-like receptor signaling | ([37](#_ENREF_37)) |
| BC021614 | -8.243173983 | glutathione S-transferase pi 3 | promote tumor metabolism by activating glyceraldehyde-3-phosphate dehydrogenase activity | ([38](#_ENREF_38)) |
| Pcdhgb6 | -8.17990909 | Protocadherin Gamma Subfamily B, 6 | Hypermethylated in cancer | ([39](#_ENREF_39)) |
| Col13a1 | -8.108524457 | Collagen Type XIII Alpha 1 | unknown |  |
| Sept4 | -8.055282436 | Septin 4 | A conserved GTP binding protein family which is involved in multiple cellular processes | ([40](#_ENREF_40)) |
| Ldoc1l | -8.044394119 | Leucine Zipper, Down-Regulated In Cancer 1-Like | unknown |  |
| Fut4 | -8.005624549 | Fucosyltransferase 4 | Promotes EMT and invasion via EGFR activation | ([41](#_ENREF_41)) |
| Foxl2 | -7.888743249 | Forkhead Box L2 | A forkhead transcription factor, which play a role in ovarian development and function |  |
| 1810062G17Rik | -7.888743249 | RIKEN cDNA 1810062G17 gene | unknown |  |
| Lox | -7.727920455 | Lysyl Oxidase | Regulates cancer progression | ([42](#_ENREF_42)) |
| Serpina3n | -7.665335917 | serine (or cysteine) peptidase inhibitor, clade A, member 3n | Ortholog of human SERPINA3, which promotes tumor growth and metastasis | ([43](#_ENREF_43), [44](#_ENREF_44)) |
| Gpsm3 | -7.651051691 | G-Protein Signaling Modulator 3 | Regulates G-protein coupled receptor signaling | ([45](#_ENREF_45)) |
| Misp | -7.566054038 | Mitotic Spindle Positioning | Plays a key role in both spindle structure and positioning | ([46](#_ENREF_46)) |
| Csn3 | -7.46760555 | Casein Kappa | Promotes tumor growth  | ([47](#_ENREF_47)) |
| Olfr1372-ps1 | -7.409390936 | olfactory receptor 1372, pseudogene 1 | unknown |  |
| P2rx7 | -7.375039431 | Purinergic Receptor P2X 7 | A plasma membrane receptor for extracellular ATP, which promotes tumor growth  | ([48](#_ENREF_48)) |
| Npr2 | -7.333900737 | Natriuretic Peptide Receptor 2 | A negative regulator of TORC1 | ([49](#_ENREF_49)) |
| Xkrx | -7.312882955 | XK Related, X-Linked | unknown |  |
| Prss57 | -7.285402219 | Protease, Serine 57 | unknown |  |
| Creb3l4 | -7.247927513 | CAMP Responsive Element Binding Protein 3-Like 4 | A negative regulator of adipogenesis | ([50](#_ENREF_50)) |
| Vsir | -7.238404739 | V-type immunoglobulin domain-containing suppressor of T-cell activation | A negatively regulator of T cell response | ([51](#_ENREF_51)) |
| Tceal3 | -7.209453366 | Transcription Elongation Factor A Like 3 | unknown |  |
| Pm20d1 | -7.17990909 | Peptidase M20 Domain Containing 1 | Regulates energy homeostasis | ([52](#_ENREF_52)) |
| Prrx1 | -7.169925001 | Paired Related Homeobox 1 | Promotes EMT | ([53](#_ENREF_53)) |
| Pdzrn4 | -7.06608919 | PDZ Domain Containing Ring Finger 4 | A member of the LNX (Ligand of Numb Protein-X) family of RING-type ubiquitin E3 ligases, which mediates ubiquitination and subsequent proteasomal degradation of NUMB, a inhibitor of Notch signaling | ([54](#_ENREF_54)) |
| Fscn1 | -7.052209165 | Fascin Actin-Bundling Protein 1 | Promotes EMT and cancer metastasis by increasing cell motility | ([55](#_ENREF_55)) |
| Moxd1 | -7.011227255 | Monooxygenase DBH Like 1 | unknown |  |
| Cdh6 | -7.011227255 | Cadherin 6 | Promote EMT and cancer metastasis by restraining autophagy | ([56](#_ENREF_56)) |
| Sap25 | -6.988684687 | Sin3A Associated Protein 25kDa | Involved in the transcriptional repression mediated by the mSIN3A | ([57](#_ENREF_57)) |
| Pcdhgb7 | -6.930737338 | Protocadherin Gamma Subfamily A, 7 | unknown |  |
| Lnx1 | -6.885086225 | Ligand Of Numb-Protein X 1 | A member of the LNX (Ligand of Numb Protein-X) family of RING-type ubiquitin E3 ligases that mediates ubiquitination and subsequent proteasomal degradation of NUMB, a inhibitor of Notch signaling | ([54](#_ENREF_54)) |
| Gm20604 | -6.882643049 | predicted gene 20604 | unknown |  |
| Ar | -6.87036472 | Androgen Receptor | Androgen-mediated thyroid tumor growth | ([58](#_ENREF_58)) |
| Tph2 | -6.857980995 | Tryptophan Hydroxylase 2 | Catalyzes the first step in the biosynthesis of serotonin |  |
| Pax3 | -6.845490051 | Paired Box 3 | A tumor suppressor gene | ([59](#_ENREF_59)) |
| Pcdhga7 | -6.845490051 | Protocadherin Gamma Subfamily A, 7 | unknown |  |
| Cdh26 | -6.807354922 | Cadherin 26 | unknown |  |
| Serpina3i | -6.807354922 | serine (or cysteine) peptidase inhibitor, clade A, member 3I | Ortholog of human SERPINA3, which promotes tumor growth and metastasis | ([43](#_ENREF_43), [44](#_ENREF_44)) |
| Nes | -6.763084655 | Nestin | A member of the intermediate filament protein family. Promotes cell motility and invasiveness | ([60](#_ENREF_60)) |
| Fez1 | -6.695808269 | Fasciculation And Elongation Protein Zeta 1 | A tumor suppressor gene | ([61](#_ENREF_61)) |
| Serpina3h | -6.688833098 | serine (or cysteine) peptidase inhibitor, clade A, member 3H | unknown |  |
| Scnn1b | -6.672425342 | Sodium Channel Epithelial 1 Beta Subunit | A subunit of epithelial sodium channel to transfer sodium ions across the epithelial cell membrane |  |
| Cox6b2 | -6.626506272 | Cytochrome C Oxidase Subunit 6B2 | A subunit of Complex IV, the last enzyme in the mitochondrial electron transport chain |  |
| Abca1 | -6.584962501 | ATP Binding Cassette Subfamily A Member 1 | Functions as a cholesteral efflux pump in the cellular lipid removal pathway. It can potentiates metastatic behavior by increasing membrane fluidity | ([62](#_ENREF_62)) |
| Hoxd9 | -6.569855608 | Homeobox D9 | Promotes EMT and metastasis by upregulation of ZEB1 | ([63](#_ENREF_63)) |

Note: Vitamin D responsive genes are highlighted in green.

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