Supplementary table 5. All pathways regulated within the carbohydrate group (FDR, q<0.05). The ratio indicates the number of regulated genes in our gene set compared to the total number of genes included in the pathway. Examples of genes included in each pathway are listed in the column to the right. All pathways are manually classified into selected biological processes (immune response, apoptosis and survival, signal transduction and others).

| **Biological processes** | **Pathways** | **Ratio** | **FDR** | **Genes in this pathway** |
| --- | --- | --- | --- | --- |
| Immune response | Apoptosis and survival\_TNF-alpha-induced Caspase-8 signaling | 8/43 | 4.645E-03 | PP2A regulatory, PP2A structural, BID, TRADD, PP2A catalytic, CASP3, AKT, Bid |
| Apoptose and survival | Apoptosis and survival\_Ceramides signaling pathway | 7/40 | 7.517E-03 | BID, HRAS, TRADD, PP2A catalytic, CASP3, AKT, Bid |
| Immune response | Immune response\_IL-16 signaling pathway | 8/55 | 7.517E-03 | IL16, Skp2, PRKCA,CASP3, PRKCA, AKT1 |
| Immune response | Development\_Notch Signaling Pathway | 7/43 | 7.517E-03 | NOTCH1, LFNG, CIR, FBXW7, NOTCH1 receptor, NOTCH1 precursor |
| Signal transduction | Development\_Prolactin receptor signaling | 8/58 | 7.517E-03 | PRKCD, CREBBP, NMI, HRAS, SOS, SOCS3, AKT, SOCS1 |
| Immune response | Aberrant production of IL-2 and IL-17 in SLE T cells | 8/58 | 7.517E-03 | NOTCH1, PP2A catalytic, CREBP, ETS1, HRAS, SOS, AKT, NOTCH1 precursor |
| Signal transduction | Development\_Thyroliberin signaling | 8/60 | 8.254E-03 | PRKCA, PRKCD, CBP, ETS1, GNAQ, HRAS, SOS |
| Immune response | Apoptosis and survival\_Caspase cascade | 6/34 | 9.867E-03 | LBR, Bid, TRADD, CASP3, AKT, Bid |
| Signal transduction | Development\_CNTF receptor signaling | 6/34 | 9.867E-03 | IL6ST, HRAS, SOS, SOCS3, RHEB2, AKT |
| Signal transduction | Transcription\_CREB signaling pathway | 7/49 | 9.867E-03 | LDHA, PRKCA, PRKC (conventional), HRAS, SOS, PP2A catalytic, AKT |
| Other | Role of Tissue factor in cancer independent of coagulation protease signaling | 6/35 | 9.867E-03 | PRKCA, LYN, HRAS, SOS, PAK1, AKT |
| Apoptose and survival | Apoptosis and survival\_HTR1A signaling | 7/50 | 9.867E-03 | PP2A regulatory, PP2A structural, HRAS, SOS, PP2A catalytic, CASP3, AKT |
| Other | Development\_Gastrin in differentiation of the gastric mucosa | 6/38 | 1.291E-02 | PRKCA, CBP, PRKC (conventional), GNAQ, PKC, GNAQ |
| Cell growth and proliferation | Translation\_Regulation of EIF4F activity | 7/54 | 1.291E-02 | IGBP1, HRAS, SOS, PP2A catalytic, RHEB2, PAK1, AKT |
| Other | Development\_Differentiation of white adipocytes  | 7/54 | 1.291E-02 | CBP, NR1H3, HRAS, SOS, VDR, CD36, INSIG1 |
| Other | Development\_Keratinocyte differentiation | 7/56 | 1.503E-02 | NOTCH1, NOTCH2, SMAD2, PRKCA, PRKCD, HRAS, GNAQ |
| Immune response | Immune response\_IL-6 signaling pathway via MEK/ERK and PI3K/AKT cascades | 8/74 | 1.503E-02 | PRKD, IL6ST, RPS6, HRAS, SRF, SOS, RHEB2, AKT |
| Immune response | Apoptosis and survival\_Apoptotic TNF-family pathways | 6/42 | 1.733E-02 | TNFRSF25, TNFRSF1B, Bid, TRADD, CASP3, Bid |
| Other | Oxidative stress\_Activation of NADPH oxidase | 7/59 | 1.774E-02 | PRKCA, PRKCD, PRKC (conventional), PAK1, NCF2, AKT |
| Apoptose and survival | Apoptosis and survival\_Anti-apoptotic action of Gastrin | 6/43 | 1.777E-02 | PRKCA, GNAQ, SRF, PAK1, AKT |
| Signal transduction | Cell adhesion\_Ephrin signaling | 6/45 | 1.979E-02 | EPHA8, EPHBs, EPHAs, HRAS, EPHB1, PAK1 |
| Other | Development\_EPO-induced MAPK pathway | 6/45 | 1.979E-02 | PRKCA, LYN, HRAS, SOS, PAK1, SOS2 |
| Cell growth and proliferation | Development\_Gastrin in cell growth and proliferation | 7/62 | 1.979E-02 | PRKCA, PRKCD, GNAQ, HRAS, SOS, PAK1 |
| Cell growth and proliferation | Development\_Endothelin-1/EDNRA transactivation of EGFR | 6/46 | 1.979E-02 | PRKCD, HRAS, SOS, RHEB2, AKT, GNAQ |
| Other | Regulation of GSK3 beta in bipolar disorder | 6/46 | 1.979E-02 | PP2A regulatory, Axin, HRAS, SOS, PP2A catalytic, AKT |
| Cell growth and proliferation | Signal transduction\_PTEN pathway | 6/46 | 1.979E-02 | TCF, HRAS, SOS, CASP3, RHEB, AKT |
| Immune response | Immune response\_MIF - the neuroendocrine-macrophage connector | 6/47 | 2.141E-02 | MIF, CBP, PRKC (conventional), ABCA1, PP2A catalytic, PRKC |
| Signal transduction | Cytoskeleton remodeling\_Reverse signaling by Ephrin-B | 5/32 | 2.143E-02 | EPHBs, Axin, HRAS, SOS, PAK1 |
| Cell growth and proliferation | Signal transduction\_ERK1/2 signaling pathway | 5/32 | 2.143E-02 | PRKCA, PRKCD, HRAS, SOS, SOS2 |
| Immune response | Apoptosis and survival\_Granzyme B signaling | 5/33 | 2.359E-02 | NOTCH1, tBid, CASP3, LMNB1, Bid |
| Immune response | Immune response\_IL-11 signaling pathway via MEK/ERK and PI3K/AKT cascades | 7/67 | 2.359E-02 | SFK, IL6ST, RPS6, HRAS, SOS, CASP3, AKT |
| Other | Development\_Thromboxane A2 signaling pathway | 6/50 | 2.429E-02 | TCF, PRKC (conventional), GNAQ, HRAS, PKC, AKT |
| Other | Rheumatoid arthritis (general schema) | 6/50 | 2.429E-02 | MHC class II beta chain, HLA-DRB, TNF-R2, HLA-DRB1, HLA-DRB4, CD86 |
| Apoptose and survival | Apoptosis and survival\_Role of CDK5 in neuronal death and survival | 5/34 | 2.429E-02 | PRKCD, HRAS, SOS, CASP3, AKT |
| Immune response | Immune response\_Gastrin in inflammatory response | 7/69 | 2.488E-02 | PRKCA, PRKCD, GNAQ, HRAS, SOS, AKT |
| Other | Some pathways of EMT in cancer cells | 6/51 | 2.488E-02 | Axin, HRAS, LEF1, TRADD, SOS, AKT |
| Immune response | Development\_TGF-beta-dependent induction of EMT via SMADs  | 5/35 | 2.555E-02 | NOTCH1, E2A, SMAD2, ETS1, LEF1 |
| Other | Development\_EPO-induced Jak-STAT pathway | 5/36 | 2.691E-02 | LYN, HRAS, SOS, SOCS3, SOCS1 |
| Signal transduction | HBV signaling via protein kinases leading to HCC | 5/36 | 2.691E-02 | PRKCA, PRKC (conventional), HRAS, SOS, PRKC |
| Immune response | Immune response\_Regulation of T cell function by CTLA-4 | 5/36 | 2.691E-02 | LYN, CD86, SOS, PP2A catalytic, AKT |
| Signal transduction | Aberrant B-Raf signaling in melanoma progression | 6/55 | 3.249E-02 | NOTCH1, CREBBP, AURKB, AKT3, RHEB2, AKT(PKB) |
| Other | Proteolysis\_Putative ubiquitin pathway | 4/23 | 3.284E-02 | UEV1A, CHIP, ATXN3, FBXW7 |
| Other | Cytoskeleton remodeling\_Regulation of actin cytoskeleton organization by the kinase effectors of Rho GTPases | 6/58 | 4.048E-02 | WRCH-1, PAK, SPTB, PAK1, CDC42, PRK1 |
| Immune response | Development\_Leptin signaling via JAK/STAT and MAPK cascades | 4/25 | 4.048E-02 | LEPR, HRAS, SOS, SOCS3 |
| Cell growth and proliferation | Apoptosis and survival\_Apoptotic Activin A signaling | 4/25 | 4.048E-02 | ALK-4, SMAD2, HRAS, AKT |
| Lipid metabolism | Regulation of lipid metabolism\_G-alpha(q) regulation of lipid metabolism | 6/59 | 4.048E-02 | ABCG1, NR1H3, GNAQ, ABCA1, PRKC |
| Immune response | Immune response\_Neurotensin-induced activation of IL-8 in colonocytes | 5/41 | 4.048E-02 | PRKCA, GNAQ, HRAS, SOS, PAK1 |
| Immune response | Signal transduction\_PTMs (phosphorylation and acetylation) in TNF-alpha-induced NF-kB signaling | 5/41 | 4.048E-02 | PRKCA, PRKCD, CBP, TRADD, DGKA |
| Cell growth and proliferation | Translation\_Insulin regulation of translation | 5/42 | 4.276E-02 | RPS6, HRAS, SOS, RHEB2, AKT |
| Immune response | Development\_NOTCH1-mediated pathway for NF-KB activity modulation | 4/26 | 4.276E-02 | NOTCH1, CIR, NOTCH1 receptor |
| Other | Neurophysiological process\_Dopamine D2 receptor transactivation of PDGFR in CNS | 4/26 | 4.276E-02 | PP2A regulatory, PP2A structural, PP2A catalytic, PRKC |
| Other | Hypoxia-induced EMT in cancer and fibrosis | 3/13 | 4.276E-02 | NOTCH1, E2A, ETS1 |
| Signal transduction | Development\_c-Kit ligand signaling pathway during hemopoiesis | 6/61 | 4.276E-02 | PRKCA, LYN, HRAS, SOS, AKT, SOCS1 |
| Immune response | Immune response\_IL-7 signaling in B lymphocytes | 5/43 | 4.288E-02 | E2A, LYN, IL7RA, HRAS, AKT |
| Other | Development\_EPO-induced PI3K/AKT pathway and Ca(2+) influx | 5/43 | 4.288E-02 | HBG1, HBB, LYN, HBA1, AKT |
| Immune response | Apoptosis and survival\_TNFR1 signaling pathway | 5/43 | 4.288E-02 | TRADD, CASP3, Bid |
| Signal transduction | Muscle contraction\_Oxytocin signaling in uterus and mammary gland | 6/62 | 4.316E-02 | PRKCA, PRKC (conventional), HRAS, PP2A catalytic, PRKC, GNAQ |
| Immune response | Apoptosis and survival\_Anti-apoptotic TNFs/NF-kB/IAP pathway | 4/27 | 4.374E-02 | TNFRSF12, TNFRSF8, TNFRSF1B, TRADD |
| Signal transduction | Development\_Angiotensin signaling via PYK2 | 5/44 | 4.443E-02 | PRKCD, HRAS, SOS, PAK1, GNAQ |
| Cell growth and proliferation | Transport\_Macropinocytosis regulation by growth factors | 6/63 | 4.443E-02 | EHD4, LEPR, HRAS, SOS, PAK1, AKT |
| Other | Development\_Role of CNTF and LIF in regulation of oligodendrocyte development | 4/28 | 4.730E-02 | IL6ST, SOCS3, CASP3, AKT |
| Signal transduction | Development\_Activation of ERK by Alpha-1 adrenergic receptors | 5/45 | 4.730E-02 | TGM2, PRKCA, PRKCD, GNAQ, HRAS |

FDR – false discovery rate