

Supplementary data table 1: Design TLDA cart version 1

This design was used for the developmental study

Production of precursors

Tagman Assay ID	Gene symbol	Function
Mm00511302_m1	<i>Adpgk</i>	Phosphorylation of glucose into glucose-6-P
Mm00617772_g1	<i>Gale</i>	Conversion of UDP-GlcNAc to UDP-GalNAc
Mm00444182_m1	<i>Galk1</i>	Phosphorylation of Galactose into Galactose-1-P
Mm00613268_m1	<i>Galk2</i>	Phosphorylation of N-Acetylgalactosamine (GalNAc) into GalNAc-1P)
Mm00489459_g1	<i>Galt</i>	UDP-activation of Glucose-1-P and Galactose-1-P
Mm00439129_m1	<i>Gck</i>	Phosphorylation of glucose into glucose-6-P
Mm00600127_m1	<i>Gfpt1</i>	Conversion of fructose-6-P into glucosamine-6-P (Glc-6-P)
Mm00496565_m1	<i>Gfpt2</i>	Conversion of fructose-6-P into Glc-6-P
Mm00834602_mH	<i>Gnpnat1</i>	Conversion of Glc-6-P into N-Acetylglucosamine-6-P (GlcNAc-6-P)
Mm02026122_g1	<i>Gpi1</i>	Isomerisation of glucose-6-P into fructose-6-P
Mm00439344_m1	<i>Hk1</i>	Phosphorylation of glucose into glucose-6-P
Mm00443385_m1	<i>Hk2</i>	Phosphorylation of glucose into glucose-6-P
Mm00480214_m1	<i>Miox</i>	Conversion of Myo-inositol into UDP-GlcA
Mm00479878_m1	<i>Nagk</i>	Phosphorylation of GlcNAc to GlcNAc-6-P
Mm00442283_m1	<i>Papss1</i>	Synthesis of PAPS complex
Mm00442295_m1	<i>Papss2</i>	Synthesis of PAPS complex
Mm00804141_m1	<i>Pgm1</i>	Conversion of glucose-6-P into glucose-1-P
Mm00728285_s1	<i>Pgm2</i>	Conversion of glucose-6-P into glucose-1-P
Mm00459270_m1	<i>Pgm3</i>	Conversion of GlcNAc-6-P into GlcNAc-1-P
Mm00723432_m1	<i>Pgm5</i>	Conversion of glucose-6-P into glucose-1-P
Mm00490339_m1	<i>Slc13a1</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00556495_m1	<i>Slc13a4</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm01334459_m1	<i>Slc13a5</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00626632_m1	<i>Slc26a11</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00432896_m1	<i>Slc26a2</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00506742_m1	<i>Slc26a6</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00524162_m1	<i>Slc26a7</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00524836_m1	<i>Slc26a8</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00628490_m1	<i>Slc26a9</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00446504_m1	<i>Slc35a2</i>	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
Mm00523288_m1	<i>Slc35a3</i>	Transport from cytoplasm to Golgi system of UDP-GlcNAc
Mm00782997_s1	<i>Slc35a4</i>	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
Mm00450258_m1	<i>Slc35b1</i>	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
Mm01269910_m1	<i>Slc35b2</i>	Transport of PAPS complex from cytoplasm to Golgi system
Mm00506275_m1	<i>Slc35b3</i>	Transport of PAPS complex from cytoplasm to Golgi system
Mm00480588_m1	<i>Slc35b4</i>	Transport from cytoplasm to Golgi system of UDP-GlcNAc and UDP-Xylose
Mm00624959_m1	<i>Slc35d1</i>	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-GlcA
Mm01304830_m1	<i>Slc35d2</i>	Transport from cytoplasm to Golgi system of UDP-GlcNAc
Mm01717003_m1	<i>Slc35d3</i>	Paralog of Slc35d1
Mm00505476_m1	<i>Uap1</i>	UDP-activation of GlcNAc-1-P and GalNAc-1-P
Mm00447643_m1	<i>Ugdh</i>	Conversion of UDP-glucose into UDP-glucuronic acid (UDP-GlcA)
Mm00454826_m1	<i>Ugp2</i>	UDP-activation of Glucose-1-P
Mm00550735_m1	<i>Uxs1</i>	Conversion of UDP-GlcA into UDP-xylose

Core proteins

Taqman Assay ID	Gene symbol	Function
Mm01545840_m1	<i>Agrn</i>	Proteoglycan carrying HS present in ECM
Mm01277164_m1	<i>Cd44</i>	Proteoglycan carrying HS and hyaluronic acid on cell surface
Mm00487131_m1	<i>Col18a1</i>	Proteoglycan carrying HS present in basement membrane
Mm00497305_m1	<i>Gpc1</i>	Proteoglycan carrying HS present on cell surface via GPI-anchor
Mm00549650_m1	<i>Gpc2</i>	Proteoglycan carrying HS present on cell surface via GPI-anchor
Mm00516722_m1	<i>Gpc3</i>	Proteoglycan carrying HS present on cell surface via GPI-anchor
Mm00515035_m1	<i>Gpc4</i>	Proteoglycan carrying HS present on cell surface via GPI-anchor
Mm00615599_m1	<i>Gpc5</i>	Proteoglycan carrying HS present on cell surface via GPI-anchor
Mm00516235_m1	<i>Gpc6</i>	Proteoglycan carrying HS present on cell surface via GPI-anchor
Mm01181179_g1	<i>Hspg2</i>	Proteoglycan carrying HS present in ECM
Mm00448918_m1	<i>Sdc1</i>	Proteoglycan carrying HS present on cell surface
Mm00484718_m1	<i>Sdc2</i>	Proteoglycan carrying HS present on cell surface
Mm01179831_m1	<i>Sdc3</i>	Proteoglycan carrying HS present on cell surface
Mm00488527_m1	<i>Sdc4</i>	Proteoglycan carrying HS present on cell surface

Preparation of linkage region

Taqman Assay ID	Gene symbol	Function
Mm00504458_s1	<i>B3galt6</i>	Transferring UDP-galactose to galactose-xylose on proteoglycan
Mm00661499_m1	<i>B3gat1</i>	Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
Mm00549042_m1	<i>B3gat2</i>	Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
Mm00470389_m1	<i>B3gat3</i>	Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
Mm00479556_m1	<i>B4galt2</i>	Transferring UDP-galactose to GlcNAc, Glc, and Xyl.
Mm00461357_m1	<i>B4galt7</i>	Transferring UDP-galactose to xylose on proteoglycan
Mm00558690_m1	<i>Xylt1</i>	Transferring UDP-xylose to proteoglycan
Mm00461181_m1	<i>Xylt2</i>	Transferring UDP-xylose to proteoglycan

Glycosaminoglycan chain polymerisation

Taqman Assay ID	Gene symbol	Function
Mm01262239_g1	<i>Chpf</i>	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
Mm01319178_m1	<i>Chsy1</i>	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
Mm01545329_m1	<i>Chsy3</i>	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
Mm00555164_m1	<i>Csgalnact1</i>	Transferring UDP-GalNAc to GlcA at end of sugar chain (CS)
Mm00513340_m1	<i>Csgalnact2</i>	Transferring UDP-GalNAc to GlcA at end of sugar chain (CS)
Mm00468769_m1	<i>Ext1</i>	Transferring UDP-GlcNAc to GlcA at end of sugar chain (HS)
Mm00468775_m1	<i>Ext2</i>	Transferring UDP-GlcNAc to GlcA at end of sugar chain (HS)
Mm00621977_s1	<i>Extl1</i>	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
Mm00469621_m1	<i>Extl2</i>	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
Mm00516994_m1	<i>Extl3</i>	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
Mm00468496_m1	<i>Has1</i>	Polymerisation of hyaluronic acid
Mm00515089_m1	<i>Has2</i>	Polymerisation of hyaluronic acid
Mm00515091_m1	<i>Has3</i>	Polymerisation of hyaluronic acid

Glycosaminoglycan chain modification

Taqman Assay ID	Gene symbol	Function
Mm00517563_m1	<i>Chst11</i>	Sulfation at the 4-O position of GalNAc units (CS)
Mm00546416_s1	<i>Chst12</i>	Sulfation at the 4-O position of GalNAc units (CS)
Mm01186255_s1	<i>Chst13</i>	Sulfation at the 4-O position of GalNAc units (CS)
Mm00511291_s1	<i>Chst14</i>	Sulfation at the 4-O position of GalNAc units (CS)
Mm00513227_m1	<i>Chst15</i>	Sulfation at the 6-O position of GalNAc units (CS)
Mm00490018_g1	<i>Chst2</i>	Sulfation at the 6-O position of GalNAc units (CS)
Mm00489736_m1	<i>Chst3</i>	Sulfation at the 6-O position of GalNAc units (CS)
Mm00488783_s1	<i>Chst4</i>	Sulfation at the 6-O position of GalNAc units (CS)
Mm00517342_m1	<i>Chst5</i>	Sulfation at the 6-O position of GalNAc units (CS)
Mm00491466_m1	<i>Chst7</i>	Sulfation at the 6-O position of GalNAc units (CS)
Mm00558321_m1	<i>Chst8</i>	Sulfation at the 4-O position of GalNAc units (CS)
Mm01722279_m1	<i>Chst9</i>	Sulfation at the 4-O position of GalNAc units (CS)
Mm00552923_m1	<i>Dse</i>	Epimerisation of GlcA unit into iduronic acid unit (IdoA) (CS)
Mm00473667_m1	<i>Glce</i>	Epimerisation of GlcA unit into iduronic acid unit (IdoA) (HS)
Mm00478684_m1	<i>Hs2st1</i>	Sulfation at the 2-O position of GlcA and IdoA units (HS)
Mm01964038_s1	<i>Hs3st1</i>	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
Mm00616933_m1	<i>Hs3st2</i>	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
Mm00780907_s1	<i>Hs3st3a1</i>	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
Mm00479621_m1	<i>Hs3st3b1</i>	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
Mm01299930_m1	<i>Hs3st6</i>	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
Mm01229698_s1	<i>Hs6st1</i>	Sulfation at the 6-O position of GlcNAc and N-sulfated-glucuronic acid units (GlcNS) (HS)
Mm00479296_m1	<i>Hs6st2</i>	Sulfation at the 6-O position of GlcNAc and GlcNS units (HS)
Mm00479297_m1	<i>Hs6st3</i>	Sulfation at the 6-O position of GlcNAc and GlcNS units (HS)
Mm00447005_m1	<i>Ndst1</i>	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
Mm00447818_m1	<i>Ndst2</i>	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
Mm00453178_m1	<i>Ndst3</i>	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
Mm00480767_m1	<i>Ndst4</i>	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
Mm00552283_m1	<i>Sulf1</i>	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
Mm00511193_m1	<i>Sulf2</i>	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
Mm00461213_m1	<i>Sumf1</i>	Cofactor for Sulf1 and Sulf 2 (HS)
Mm01197721_m1	<i>Sumf2</i>	Cofactor for Sulf1 and Sulf 2 (HS)
Mm00616790_m1	<i>Ust</i>	Sulfation at the 2-O position of GlcA and IdoA units (CS)

Glycosaminoglycan chain degradation

Taqman Assay ID	Gene symbol	Function
Mm00802167_m1	<i>Arsb</i>	Desulfation of the 4-O position of 4-O sulfated GalNAc units (CS)
Mm00557970_m1	<i>Arsj</i>	Desulfation of the 4-O position of 4-O sulfated GalNAc units (CS)
Mm00513099_m1	<i>Arsk</i>	Desulfation of proteoglycans, paralog of IDS
Mm00489575_m1	<i>Galns</i>	Desulfation of the 6-O position of 6-O sulfated GalNAc units (CS)
Mm00659592_m1	<i>Gns</i>	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
Mm00446954_g1	<i>Gusb</i>	Hydrolysis of GlcA from sugar chain (HS and Hyaluronic acid and CS)
Mm00599877_m1	<i>Hexa</i>	Hydrolysis of GalNAc units (CS) and GlcNAc units (hyaluronic acid) from sugar chain
Mm00599880_m1	<i>Hexb</i>	Hydrolysis of GalNAc units (CS) and GlcNAc units (hyaluronic acid) from sugar chain
Mm00519485_m1	<i>Hgsnat</i>	Acetylation of desulfated GlcNS units (HS)
Mm00461768_m1	<i>Hpse</i>	Degradation of HS chains extracellularly
Mm00476206_m1	<i>Hyal1</i>	Degradation of hyaluronic acid chain
Mm00477731_m1	<i>Hyal2</i>	Degradation of hyaluronic acid chain
Mm00662097_m1	<i>Hyal3</i>	Degradation of hyaluronic acid chain
Mm00494868_m1	<i>Ids</i>	Desulfation of 2-O sulfated IdoA and GlcA units (HS and CS)
Mm00515143_m1	<i>Idua</i>	Hydrolysis of IdoA unit from sugar chain (HS and CS)
Mm00452409_m1	<i>Mgea5</i>	Degradation of hyaluronic acid chain
Mm00476274_m1	<i>Naga</i>	Hydrolysis N-GalNAc moieties from glycoconjugates.
Mm00479175_m1	<i>Naglu</i>	Hydrolysis of GlcNAc from sugar chain (HS)
Mm00450747_m1	<i>Sqsh</i>	Desulfation of GlcNS units (HS)

Growth factors

Taqman Assay ID	Gene symbol	Function
Mm00437583_m1	<i>Areg</i>	Amphiregulin **
Mm00557790_m1	<i>Bmp3</i>	Bone morphogenetic growth factor 3 **
Mm00432091_m1	<i>Bmp5</i>	Bone morphogenetic growth factor 5 **
Mm01192931_g1	<i>Ctgf</i>	Connective tissue growth factor, embryonic growth factor in skin development **
Mm00433275_m1	<i>Fgf10</i>	Fibroblast growth factor 10 **
Mm00438910_m1	<i>Fgf13</i>	Fibroblast growth factor 13 **
Mm01285715_m1	<i>Fgf2</i>	Fibroblast growth factor 2 **
Mm00748347_m1	<i>Fgf20</i>	Fibroblast growth factor 20 **
Mm00445749_m1	<i>Fgf22</i>	Fibroblast growth factor 22 **
Mm00433291_m1	<i>Fgf7</i>	Fibroblast growth factor 7 **
Mm00438921_m1	<i>Fgf8</i>	Fibroblast growth factor 8 **
Mm01131929_m1	<i>Figf</i>	C-fos induced growth factor **
Mm03024279_s1	<i>Gdf10</i>	Growth differentiation factor 10 **
Mm00439305_g1	<i>Hbegf</i>	Heparin-binding epidermal growth factor **
Mm00725733_s1	<i>Hdgf</i>	Hepatoma-derived growth factor **
Mm00439560_m1	<i>Igf1</i>	Insulin-like growth factor 1 **
Mm00439565_g1	<i>Igf2</i>	Insulin-like growth factor 2 **
Mm01297833_s1	<i>Nog</i>	Noggin **
Mm01205760_m1	<i>Pdgfa</i>	Platelet-derived growth factor a **
Mm01298578_m1	<i>Pdgfb</i>	Platelet-derived growth factor b **
Mm00480205_m1	<i>Pdgfc</i>	Platelet-derived growth factor c **
Mm00546829_m1	<i>Pdgfd</i>	Platelet-derived growth factor d **
Mm00436527_m1	<i>Shh</i>	Sonic hedgehog **
Mm01178820_m1	<i>Tgfb1</i>	Transforming growth factor beta 1 **
Mm01321739_m1	<i>Tgfb2</i>	Transforming growth factor beta 2 **
Mm01307950_m1	<i>Tgfb3</i>	Transforming growth factor beta 3 **
Mm01281447_m1	<i>Vegfa</i>	Vascular endothelial growth factor a **
Mm00442102_m1	<i>Vegfb</i>	Vascular endothelial growth factor b **
Mm00437313_m1	<i>Vegfc</i>	Vascular endothelial growth factor c **
Mm00442104_m1	<i>Wnt10b</i>	Wingless-related integration site 10b **
Mm00446420_m1	<i>Wnt16</i>	Wingless-related integration site 16 **
Mm00470018_m1	<i>Wnt2</i>	Wingless-related integration site 2 **
Mm00437330_m1	<i>Wnt2b</i>	Wingless-related integration site 2b **
Mm00437337_m1	<i>Wnt3a</i>	Wingless-related integration site 3a **
Mm00437353_m1	<i>Wnt6</i>	Wingless-related integration site 6 **
Mm00437355_m1	<i>Wnt7a</i>	Wingless-related integration site 7a **
Mm00437357_m1	<i>Wnt7b</i>	Wingless-related integration site 7b **

Putatively involved

Tagman Assay ID	Gene symbol	Function
Hs99999901_s1	<i>18S</i>	Reference gene
Mm00802173_g1	<i>Arsa</i>	Desulfation of cerebroside
Mm00546931_m1	<i>Arsg</i>	Paralog of Arsa
Mm00480272_s1	<i>B3galnt1</i>	Transferring UDP-GalNAc or UDP-GlcNAc to N-GlcNAc, Galactose or N-GalNAc
Mm01189804_m1	<i>B4galnt3</i>	Transferring UDP-GalNAc or UDP-GlcNAc to N-GlcNAc, Galactose or N-GalNAc
Mm00625968_g1	<i>B4galnt4</i>	Transferring UDP-GalNAc or UDP-GlcNAc to N-GlcNAc, Galactose or N-GalNAc
Mm00473986_m1	<i>C1galt1</i>	Transferring UDP-Gal to N-GalNAc.
Mm00480676_m1	<i>C1galt1c1</i>	C1GALT1-specific chaperone 1
Mm00517855_m1	<i>Chst1</i>	Involved in sulfation of keratin sulfate
Mm03302249_g1	<i>Gapdh</i>	Reference gene
Mm00516323_m1	<i>Gla</i>	Hydrolysis of galactose units
Mm00515342_m1	<i>Glb1</i>	Hydrolysis of galactose units
Mm00464245_m1	<i>Glb1l2</i>	Hydrolysis of galactose units
Mm01254913_g1	<i>Gnpda1</i>	Conversion of GlcNAc-6-P into fructose-6-P
Mm00503573_m1	<i>Gnpda2</i>	Conversion of GlcNAc-6-P into fructose-6-P
Mm00434647_m1	<i>Khk</i>	Phosphorylating fructose to fructose-1-P
Mm00502002_m1	<i>Kl</i>	Putative glucuronidase
Mm00473122_m1	<i>Klb</i>	Putative glucuronidase
Mm00491720_m1	<i>Renbp</i>	Concersion of N-GlcNAc to N-acetylmannosamine
Mm00555344_m1	<i>Slc17a5</i>	Transport of GlcA from lysosoom to cytoplasm
Mm00445313_m1	<i>Slc26a3</i>	Transferring chloride ions across the cell membrane in exchange for bicarbonate ions
Mm00442308_m1	<i>Slc26a4</i>	Transferring chloride ions across the cell membrane
Mm00446145_m1	<i>Slc26a5</i>	Protein functions as a molecular motor in motile outer hair cells of the cochlea
Mm00442341_m1	<i>Slc35a1</i>	Putative CMP-Sialic Acid Transporter
Mm01277045_m1	<i>Tbp</i>	Reference gene
Mm00495930_m1	<i>Ugt8a</i>	Transfere galactose to ceramide

* Glc, glucosamine; GlcNAc, N-acetylated glucosamine; Gal, galactosamine; GalNAc, N-acetylated galactosamine; GlcA, glucuronic acid; IdoA, iduronic acid.

**Uijtdewilligen *et al*, 2016.

Supplementary data table 2: Design TLDA cart version 2

This design was used for analysis of skin from *Glc* knock out and *HSP*Etg mice

Production of precursors

Tagman Assay ID	Gene symbol	Function
Mm00511302_m1	<i>Adpgk</i>	Phosphorylation of glucose into glucose-6-P
Mm00617772_g1	<i>Gale</i>	Conversion of UDP-GlcNAc to UDP-GalNAc
Mm00444182_m1	<i>Galk1</i>	Phosphorylation of Galactose into Galactose-1-P
Mm00613268_m1	<i>Galk2</i>	Phosphorylation of N-Acetylgalactosamine (GalNAc) into GalNAc-1P)
Mm00489459_g1	<i>Galt</i>	UDP-activation of Glucose-1-P and Galactose-1-P
Mm00439129_m1	<i>Gck</i>	Phosphorylation of glucose into glucose-6-P
Mm00600127_m1	<i>Gfpt1</i>	Conversion of fructose-6-P into glucosamine-6-P (Glc-6-P)
Mm00496565_m1	<i>Gfpt2</i>	Conversion of fructose-6-P into Glc-6-P
Mm00834602_mH	<i>Gnpat1</i>	Conversion of Glc-6-P into N-Acetylglucosamine-6-P (GlcNAc-6-P)
Mm02026122_g1	<i>Gpi1</i>	Isomerisation of glucose-6-P into fructose-6-P
Mm00439344_m1	<i>Hk1</i>	Phosphorylation of glucose into glucose-6-P
Mm00443385_m1	<i>Hk2</i>	Phosphorylation of glucose into glucose-6-P
Mm00480214_m1	<i>Miox</i>	Conversion of Myo-inositol into UDP-GlcA
Mm00479878_m1	<i>Nagk</i>	Phosphorylation of GlcNAc to GlcNAc-6-P
Mm00442283_m1	<i>Papss1</i>	Synthesis of PAPS complex
Mm00442295_m1	<i>Papss2</i>	Synthesis of PAPS complex
Mm00804141_m1	<i>Pgm1</i>	Conversion of glucose-6-P into glucose-1-P
Mm00728285_s1	<i>Pgm2</i>	Conversion of glucose-6-P into glucose-1-P
Mm00459270_m1	<i>Pgm3</i>	Conversion of GlcNAc-6-P into GlcNAc-1-P
Mm00723432_m1	<i>Pgm5</i>	Conversion of glucose-6-P into glucose-1-P
Mm00490339_m1	<i>Slc13a1</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00556495_m1	<i>Slc13a4</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm01334459_m1	<i>Slc13a5</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00626632_m1	<i>Slc26a11</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00432896_m1	<i>Slc26a2</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00506742_m1	<i>Slc26a6</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00524162_m1	<i>Slc26a7</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00524836_m1	<i>Slc26a8</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm00628490_m1	<i>Slc26a9</i>	Transport of sulphate from the extracellular space to cytoplasm
Mm01192270_m1	<i>Slc2a1 (new)</i>	Sugar transport across plasma membrane
Mm00453716_m1	<i>Slc2a10 (new)</i>	Sugar transport across plasma membrane
Mm00619244_m1	<i>Slc2a12 (new)</i>	Sugar transport across plasma membrane
Mm00446230_g1	<i>Slc2a2 (new)</i>	Sugar transport across plasma membrane
Mm00441483_m1	<i>Slc2a3 (new)</i>	Sugar transport across plasma membrane
Mm01245507_g1	<i>Slc2a4 (new)</i>	Sugar transport across plasma membrane
Mm00600311_m1	<i>Slc2a5 (new)</i>	Sugar transport across plasma membrane
Mm00554217_m1	<i>Slc2a6 (new)</i>	Sugar transport across plasma membrane
Mm00444634_m1	<i>Slc2a8 (new)</i>	Sugar transport across plasma membrane
Mm01211147_m1	<i>Slc2a9 (new)</i>	Sugar transport across plasma membrane
Mm00446504_m1	<i>Slc35a2</i>	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
Mm00523288_m1	<i>Slc35a3</i>	Transport from cytoplasm to Golgi system of UDP-GlcNAc
Mm00782997_s1	<i>Slc35a4</i>	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
Mm00450258_m1	<i>Slc35b1</i>	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
Mm01269910_m1	<i>Slc35b2</i>	Transport of PAPS complex from cytoplasm to Golgi system
Mm00506268_m1	<i>Slc35b3</i>	Transport of PAPS complex from cytoplasm to Golgi system
Mm00480588_m1	<i>Slc35b4</i>	Transport from cytoplasm to Golgi system of UDP-GlcNAc and UDP-Xylose
Mm00624959_m1	<i>Slc35d1</i>	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-GlcA
Mm01304830_m1	<i>Slc35d2</i>	Transport from cytoplasm to Golgi system of UDP-GlcNAc
Mm01717003_m1	<i>Slc35d3</i>	Paralog of Slc35d1
Mm00769477_m1	<i>Uap1</i>	UDP-activation of GlcNAc-1-P and GalNAc-1-P
Mm00447643_m1	<i>Ugdh</i>	Conversion of UDP-glucose into UDP-glucuronic acid (UDP-GlcA)
Mm00454826_m1	<i>Ugp2</i>	UDP-activation of Glucose-1-P
Mm00550735_m1	<i>Uxs1</i>	Conversion of UDP-GlcA into UDP-xylose

Core proteins

Taqman Assay ID	Gene symbol	Function
Mm00545807_m1	<i>Acan (new)</i>	Proteoglycan carrying CS or DS
Mm01264855_m1	<i>Agrn</i>	Proteoglycan carrying HS present in ECM
Mm00445945_m1	<i>Aspn (new)</i>	Proteoglycan carrying CS or DS
Mm00476090_m1	<i>Bcan (new)</i>	Proteoglycan carrying CS or DS
Mm00455918_m1	<i>Bgn (new)</i>	Proteoglycan carrying CS or DS
Mm01277164_m1	<i>Cd44</i>	Proteoglycan carrying HS and hyaluronic acid on cell surface
Mm00487131_m1	<i>Col18a1</i>	Proteoglycan carrying HS present in basement membrane
Mm00483872_m1	<i>Col9a2 (new)</i>	Proteoglycan carrying CS or DS
Mm00507256_m1	<i>Cspg4 (new)</i>	Proteoglycan carrying CS or DS
Mm00516549_m1	<i>Cspg5 (new)</i>	Proteoglycan carrying CS or DS
Mm03003496_s1	<i>Dcn (new)</i>	Proteoglycan carrying CS or DS
Mm00514611_m1	<i>Epyc (new)</i>	Proteoglycan carrying CS or DS
Mm00497305_m1	<i>Gpc1</i>	Proteoglycan carrying HS present on cell surface via GPI-anchor
Mm00549650_m1	<i>Gpc2</i>	Proteoglycan carrying HS present on cell surface via GPI-anchor
Mm00516722_m1	<i>Gpc3</i>	Proteoglycan carrying HS present on cell surface via GPI-anchor
Mm00515035_m1	<i>Gpc4</i>	Proteoglycan carrying HS present on cell surface via GPI-anchor
Mm00615599_m1	<i>Gpc5</i>	Proteoglycan carrying HS present on cell surface via GPI-anchor
Mm00516235_m1	<i>Gpc6</i>	Proteoglycan carrying HS present on cell surface via GPI-anchor
Mm00469183_m1	<i>Hmmer (new)</i>	Hyaluronan-Mediated Motility Receptor
Mm01181165_m1	<i>Hspg2</i>	Proteoglycan carrying HS present in ECM
Mm00484007_m1	<i>Ncan (new)</i>	Proteoglycan carrying CS or DS
Mm00448918_m1	<i>Sdc1</i>	Proteoglycan carrying HS present on cell surface
Mm00484718_m1	<i>Sdc2</i>	Proteoglycan carrying HS present on cell surface
Mm01179831_m1	<i>Sdc3</i>	Proteoglycan carrying HS present on cell surface
Mm00488527_m1	<i>Sdc4</i>	Proteoglycan carrying HS present on cell surface
Mm00484015_m1	<i>Smc3 (new)</i>	Proteoglycan carrying CS or DS
Mm01169070_m1	<i>Srgn (new)</i>	Proteoglycan carrying CS or DS
Mm01283063_m1	<i>Vcan (new)</i>	Proteoglycan carrying CS or DS

Preparation of linkage region

Taqman Assay ID	Gene symbol	Function
Mm00504458_s1	<i>B3galt6</i>	Transferring UDP-galactose to galactose-xylose on proteoglycan
Mm00661499_m1	<i>B3gat1</i>	Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
Mm00549042_m1	<i>B3gat2</i>	Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
Mm00470389_m1	<i>B3gat3</i>	Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
Mm00479556_m1	<i>B4galt2</i>	Transferring UDP-galactose to GlcNAc, Glc, and Xyl.
Mm00461357_m1	<i>B4galt7</i>	Transferring UDP-galactose to xylose on proteoglycan
Mm00558690_m1	<i>Xylt1</i>	Transferring UDP-xylose to proteoglycan
Mm00461181_m1	<i>Xylt2</i>	Transferring UDP-xylose to proteoglycan

Glycosaminoglycan chain polymerisation

Taqman Assay ID	Gene symbol	Function
Mm01262239_g1	<i>Chpf</i>	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
Mm01319178_m1	<i>Chsy1</i>	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
Mm01545329_m1	<i>Chsy3</i>	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
Mm00555164_m1	<i>Csgalnact1</i>	Transferring UDP-GalNAc to GlcA at end of sugar chain (CS)
Mm00513340_m1	<i>Csgalnact2</i>	Transferring UDP-GalNAc to GlcA at end of sugar chain (CS)
Mm00468769_m1	<i>Ext1</i>	Transferring UDP-GlcNAc to GlcA at end of sugar chain (HS)
Mm00468775_m1	<i>Ext2</i>	Transferring UDP-GlcNAc to GlcA at end of sugar chain (HS)
Mm00621977_s1	<i>Extl1</i>	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
Mm00469621_m1	<i>Extl2</i>	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
Mm00516994_m1	<i>Extl3</i>	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
Mm00468496_m1	<i>Has1</i>	Polymerisation of hyaluronic acid
Mm00515089_m1	<i>Has2</i>	Polymerisation of hyaluronic acid
Mm00515091_m1	<i>Has3</i>	Polymerisation of hyaluronic acid

Glycosaminoglycan chain modification

Taqman Assay ID	Gene symbol	Function
Mm00517563_m1	<i>Chst11</i>	Sulfation at the 4-O position of GalNAc units (CS)
Mm00546416_s1	<i>Chst12</i>	Sulfation at the 4-O position of GalNAc units (CS)
Mm01186255_s1	<i>Chst13</i>	Sulfation at the 4-O position of GalNAc units (CS)
Mm00511291_s1	<i>Chst14</i>	Sulfation at the 4-O position of GalNAc units (CS)
Mm00513227_m1	<i>Chst15</i>	Sulfation at the 6-O position of GalNAc units (CS)
Mm00490018_g1	<i>Chst2</i>	Sulfation at the 6-O position of GalNAc units (CS)
Mm00489736_m1	<i>Chst3</i>	Sulfation at the 6-O position of GalNAc units (CS)
Mm00517342_m1	<i>Chst5</i>	Sulfation at the 6-O position of GalNAc units (CS)
Mm00491466_m1	<i>Chst7</i>	Sulfation at the 6-O position of GalNAc units (CS)
Mm00558321_m1	<i>Chst8</i>	Sulfation at the 4-O position of GalNAc units (CS)
Mm01722279_m1	<i>Chst9</i>	Sulfation at the 4-O position of GalNAc units (CS)
Mm00552923_m1	<i>Dse</i>	Epimerisation of GlcA unit into iduronic acid unit (IdoA) (CS)
Mm00473667_m1	<i>Glce</i>	Epimerisation of GlcA unit into iduronic acid unit (IdoA) (HS)
Mm00478684_m1	<i>Hs2st1</i>	Sulfation at the 2-O position of GlcA and IdoA units (HS)
Mm01964038_s1	<i>Hs3st1</i>	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
Mm00616933_m1	<i>Hs3st2</i>	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
Mm00780907_s1	<i>Hs3st3a1</i>	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
Mm00479621_m1	<i>Hs3st3b1</i>	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
Mm01192940_m1	<i>Hs3st5 (new)</i>	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
Mm01299930_m1	<i>Hs3st6</i>	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
Mm01229698_s1	<i>Hs6st1</i>	Sulfation at the 6-O position of GlcNAc and N-sulfated-glucuronic acid units (GlcNS) (HS)
Mm00479296_m1	<i>Hs6st2</i>	Sulfation at the 6-O position of GlcNAc and GlcNS units (HS)
Mm00479297_m1	<i>Hs6st3</i>	Sulfation at the 6-O position of GlcNAc and GlcNS units (HS)
Mm00447005_m1	<i>Ndst1</i>	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
Mm00447818_m1	<i>Ndst2</i>	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
Mm00453178_m1	<i>Ndst3</i>	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
Mm00480767_m1	<i>Ndst4</i>	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
Mm00552283_m1	<i>Sulf1</i>	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
Mm01248026_m1	<i>Sulf2</i>	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
Mm00461213_m1	<i>Sumf1</i>	Cofactor for Sulf1 and Sulf 2 (HS)
Mm01197721_m1	<i>Sumf2</i>	Cofactor for Sulf1 and Sulf 2 (HS)
Mm00616790_m1	<i>Ust</i>	Sulfation at the 2-O position of GlcA and IdoA units (CS)

Glycosaminoglycan chain degradation

Taqman Assay ID	Gene symbol	Function
Mm00503655_s1	<i>Arsb</i>	Desulfation of the 4-O position of 4-O sulfated GalNAc units (CS)
Mm00557970_m1	<i>Arsj</i>	Desulfation of the 4-O position of 4-O sulfated GalNAc units (CS)
Mm00513099_m1	<i>Arsk</i>	Desulfation of proteoglycans, paralog of IDS
Mm00489576_m1	<i>Galns</i>	Desulfation of the 6-O position of 6-O sulfated GalNAc units (CS)
Mm00659592_m1	<i>Gns</i>	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
Mm01197698_m1	<i>Gusb</i>	Hydrolysis of GlcA from sugar chain (HS and Hyaluronic acid and CS)
Mm00599877_m1	<i>Hexa</i>	Hydrolysis of GalNAc units (CS) and GlcNAc units (hyaluronic acid) from sugar chain
Mm00599880_m1	<i>Hexb</i>	Hydrolysis of GalNAc units (CS) and GlcNAc units (hyaluronic acid) from sugar chain
Mm00519485_m1	<i>Hgsnat</i>	Acetylation of desulfated GlcNS units (HS)
Mm00461768_m1	<i>Hpse</i>	Degradation of HS chains extracellularly
Mm00477731_m1	<i>Hyal2</i>	Degradation of hyaluronic acid chain
Mm00662097_m1	<i>Hyal3</i>	Degradation of hyaluronic acid chain
Mm00494868_m1	<i>Ids</i>	Desulfation of 2-O sulfated IdoA and GlcA units (HS and CS)
Mm00515143_m1	<i>Idua</i>	Hydrolysis of IdoA unit from sugar chain (HS and CS)
Mm00452409_m1	<i>Mgea5</i>	Degradation of hyaluronic acid chain
Mm00476274_m1	<i>Naga</i>	Hydrolysis N-GalNAc moieties from glycoconjugates.
Mm00479175_m1	<i>Naglu</i>	Hydrolysis of GlcNAc from sugar chain (HS)
Mm00480053_m1	<i>Nat6;Hyal1</i>	Degradation of hyaluronic acid chain
Mm00450747_m1	<i>Sqsh</i>	Desulfation of GlcNS units (HS)

Growth factors

Taqman Assay ID	Gene symbol	Function
Mm01192933_g1	<i>Ctgf</i>	Connective tissue growth factor, embryonic growth factor in skin development **
Mm00433275_m1	<i>Fgf10</i>	Fibroblast growth factor 10 **
Mm01285715_m1	<i>Fgf2</i>	Fibroblast growth factor 2 **
Mm00438917_m1	<i>Fgf4 (new)</i>	Growth factor (Uijtdewilligen et al, 2013)**
Mm00433291_m1	<i>Fgf7</i>	Fibroblast growth factor 7 **
Mm00438921_m1	<i>Fgf8</i>	Fibroblast growth factor 8 **
Mm01131929_m1	<i>Figf</i>	C-fos induced growth factor **
Mm00439305_g1	<i>Hbegf</i>	Heparin-binding epidermal growth factor **
Mm01205760_m1	<i>Pdgfa</i>	Platelet-derived growth factor a **
Mm01298578_m1	<i>Pdgfb</i>	Platelet-derived growth factor b **
Mm03053266_s1	<i>Pdgfc</i>	Platelet-derived growth factor c **
Mm00546829_m1	<i>Pdgfd</i>	Platelet-derived growth factor d **
Mm00436527_m1	<i>Shh</i>	Sonic hedgehog **
Mm01178819_m1	<i>Tgfb1</i>	Transforming growth factor beta 1 **
Mm01321739_m1	<i>Tgfb2</i>	Transforming growth factor beta 2 **
Mm01307950_m1	<i>Tgfb3</i>	Transforming growth factor beta 3 **
Mm01281449_m1	<i>Vegfa</i>	Vascular endothelial growth factor a **
Mm00442102_m1	<i>Vegfb</i>	Vascular endothelial growth factor b **
Mm01202432_m1	<i>Vegfc</i>	Vascular endothelial growth factor c **

Putatively involved

Taqman Assay ID	Gene symbol	Function
Hs99999901_s1	<i>18S</i>	Reference gene
Mm00607939_s1	<i>Actb (new)</i>	Reference gene
Mm00802173_g1	<i>Arsa</i>	Desulfation of cerebroside
Mm00546931_m1	<i>Arsg</i>	Paralog of Arsa
Mm00473986_m1	<i>C1galt1</i>	Transferring UDP-Gal to N-GalNAc.
Mm00480676_m1	<i>C1galt1c1</i>	C1GALT1-specific chaperone 1
Mm00517855_m1	<i>Chst1</i>	Involved in sulfation of keratin sulfate
Mm03302249_g1	<i>Gapdh</i>	Reference gene
Mm00516323_m1	<i>Gla</i>	Hydrolysis of galactose units
Mm00515342_m1	<i>Glb1</i>	Hydrolysis of galactose units
Mm00464245_m1	<i>Glb1l2</i>	Hydrolysis of galactose units
Mm01254913_g1	<i>Gnpda1;Gm8615</i>	Conversion of GlcNAc-6-P into fructose-6-P
Mm00503573_m1	<i>Gnpda2</i>	Conversion of GlcNAc-6-P into fructose-6-P
Mm01324427_m1	<i>Hprt1 (new)</i>	Reference gene
Mm00502002_m1	<i>Kl</i>	Putative glucuronidase
Mm00473122_m1	<i>Klb</i>	Putative glucuronidase
Mm00555344_m1	<i>Slc17a5</i>	Transport of GlcA from lysosoom to cytoplasm
Mm00442341_m1	<i>Slc35a1</i>	Putative CMP-Sialic Acid Transporter
Mm01277042_m1	<i>Tbp</i>	Reference gene
Mm00495930_m1	<i>Ugt8a</i>	Transfere galactose to ceramide

Gene symbols marked with new are added in the second version of the TLDA cart.

* Glc, glucosamine; GlcNAc, N-acetylated glucosamine; Gal, galactosamine; GalNAc, N-acetylated galactosamine; GlcA, glucuronic acid; IdoA, iduronic acid.

**Uijtdewilligen et al, 2016.

Supplementary data table 3: Differentially expressed genes as % per category

Category	Total genes	Not measured* / Not detected **	E14vsP90		E16vsP90		P1vsP90	
			Differentially expressed	Percentage	Differentially expressed	Percentage	Differentially expressed	Percentage
<i>Preparation of precursors</i>	43	8	15	35%	6	14%	8	19%
<i>Core proteins</i>	14	1	11	79%	4	29%	5	36%
<i>Preparation of linkage region</i>	8	2	3	38%	2	25%	3	38%
<i>Sugar chain polymerisation</i>	13	3	7	54%	5	38%	5	38%
<i>Sugar chain modification</i>	32	9	14	44%	10	31%	13	41%
<i>Sugar chain degradation</i>	19	1	10	53%	9	47%	5	26%
<i>Growth factors</i>	37	6	18	49%	16	43%	16	43%
<i>Putatively involved</i>	23	5	11	48%	10	43%	3	13%

* Some genes were not available on the used exon array version.

** Genes, for which a signal was not or only partly detected at a given timepoint or multiple timepoints and therefore a fold change and/or p-value could not be calculated based on the available data, are given as 'not detected'. Gene symbol for which all timepoints were classified as 'not detected' do not show a reference gene due to lack of data for a calculation.

Supplementary data table 4: Differentially expressed genes during skin development in mice in comparison to mature mouse skin using TLDA cards

Production of precursors			E14vsP90		E16vsP90		P1vsP90		Function
Gene symbol	Taqman assay ID	Reference gene	P-value	Relative fold expression	P-value	Relative fold expression	P-value	Relative fold expression	
<i>Adpgk</i>	Mm00511302_m1	<i>Tbp</i>	0.915	1.033	0.316	1.410	0.144	1.620	Phosphorylation of glucose into glucose-6-P
<i>Gale</i>	Mm00617772_g1	<i>Tbp</i>	0.921	1.004	0.822	0.906	0.002	0.628	Conversion of UDP-GlcNAc to UDP-GalNAc
<i>Galk1</i>	Mm00444182_m1	<i>Tbp</i>	0.029	5.897	0.057	3.867	0.074	3.043	Phosphorylation of Galactose into Galactose-1-P
<i>Galk2</i>	Mm00613268_m1	<i>Tbp</i>	0.710	1.123	0.682	1.109	0.364	1.237	Phosphorylation of N-Acetylgalactosamine (GalNAc) into GalNAc-1P)
<i>Galt</i>	Mm00489459_g1	<i>Tbp</i>	0.042	0.573	0.027	0.497	0.832	0.964	UDP-activation of Glucose-1-P and Galactose-1-P
<i>Gck</i>	Mm00439129_m1		Not detected		Not detected		Not detected		Phosphorylation of glucose into glucose-6-P
<i>Gfpt1</i>	Mm00600127_m1	<i>Tbp</i>	0.002	2.378	0.160	1.273	0.282	1.481	Conversion of fructose-6-P into glucosamine-6-P (Glc-6-P)
<i>Gfpt2</i>	Mm00496565_m1	<i>Tbp</i>	0.269	0.772	0.079	0.494	0.356	0.780	Conversion of fructose-6-P into Glc-6-P
<i>Gnpnat1</i>	Mm00834602_mH	<i>Tbp</i>	0.306	0.890	0.221	0.652	0.369	0.900	Conversion of Glc-6-P into N-Acetylglucosamine-6-P (GlcNAc-6-P)
<i>Gpi1</i>	Mm02026122_g1	<i>Gapdh</i>	0.035	1.336	0.742	0.906	0.195	1.193	Isomerisation of glucose-6-P into fructose-6-P
<i>Hk1</i>	Mm00439344_m1	<i>Tbp</i>	0.196	1.163	0.598	0.837	0.447	0.741	Phosphorylation of glucose into glucose-6-P
<i>Hk2</i>	Mm00443385_m1	<i>Tbp</i>	0.027	0.652	0.253	1.390	0.586	0.904	Phosphorylation of glucose into glucose-6-P
<i>Miox</i>	Mm00480214_m1		Not detected		Not detected		Not detected		Conversion of Myo-inositol into UDP-GlcA
<i>Nagk</i>	Mm00479878_m1	<i>Tbp</i>	0.139	1.277	0.620	1.112	0.200	1.157	Phosphorylation of GlcNAc to GlcNAc-6-P
<i>Papss1</i>	Mm00442283_m1	<i>Tbp</i>	0.037	1.472	0.907	1.045	0.400	1.304	Synthesis of PAPS complex
<i>Papss2</i>	Mm00442295_m1	<i>Tbp</i>	0.015	1.993	0.383	1.380	0.283	1.453	Synthesis of PAPS complex
<i>Pgm1</i>	Mm00804141_m1	<i>Tbp</i>	0.100	0.582	0.194	0.702	0.185	0.717	Conversion of glucose-6-P into glucose-1-P
<i>Pgm2</i>	Mm00728285_s1	<i>Tbp</i>	0.238	0.721	0.940	1.022	0.475	1.161	Conversion of glucose-6-P into glucose-1-P
<i>Pgm3</i>	Mm00459270_m1	<i>Tbp</i>	0.058	1.876	0.296	1.249	0.098	1.470	Conversion of GlcNAc-6-P into GlcNAc-1-P
<i>Pgm5</i>	Mm00723432_m1	<i>Tbp</i>	0.002	4.053	0.033	2.792	0.019	2.515	Conversion of glucose-6-P into glucose-1-P
<i>Slc13a1</i>	Mm00490339_m1		Not detected		Not detected		Not detected		Transport of sulphate from the extracellular space to cytoplasm
<i>Slc13a4</i>	Mm00556495_m1	<i>Tbp</i>	0.007	11.752	Not detected	Not detected	Not detected	Not detected	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc13a5</i>	Mm01334459_m1		Not detected		Not detected		Not detected		Transport of sulphate from the extracellular space to cytoplasm
<i>Slc26a11</i>	Mm00626632_m1	<i>Tbp</i>	0.190	0.860	0.513	1.160	0.028	1.905	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc26a2</i>	Mm00432896_m1		Not detected		Not detected		Not detected		Transport of sulphate from the extracellular space to cytoplasm
<i>Slc26a6</i>	Mm00506742_m1	<i>Tbp</i>	0.412	1.221	0.291	0.656	0.733	1.082	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc26a7</i>	Mm00524162_m1	<i>Tbp</i>	0.546	0.824	0.838	0.969	0.184	1.655	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc26a8</i>	Mm00524836_m1		Not detected		Not detected		Not detected		Transport of sulphate from the extracellular space to cytoplasm
<i>Slc26a9</i>	Mm00628490_m1	<i>Tbp</i>	Not detected		0.036	0.264	0.023	0.318	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc35a2</i>	Mm00446504_m1	<i>Tbp</i>	0.016	1.577	0.311	1.287	0.678	1.142	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
<i>Slc35a3</i>	Mm00523288_m1	<i>Tbp</i>	0.008	0.444	0.060	0.567	0.455	0.811	Transport from cytoplasm to Golgi system of UDP-GlcNAc
<i>Slc35a4</i>	Mm00782997_s1	<i>Tbp</i>	0.222	1.374	0.244	1.347	0.147	1.604	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
<i>Slc35b1</i>	Mm00450258_m1	<i>Tbp</i>	0.882	0.965	0.606	0.875	0.748	1.080	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
<i>Slc35b2</i>	Mm01269910_m1	<i>Tbp</i>	0.000	1.889	0.196	1.436	0.075	1.663	Transport of PAPS complex from cytoplasm to Golgi system
<i>Slc35b3</i>	Mm00506275_m1	<i>Tbp</i>	0.832	0.947	0.251	1.097	0.293	1.258	Transport of PAPS complex from cytoplasm to Golgi system
<i>Slc35b4</i>	Mm00480588_m1	<i>Tbp</i>	0.019	1.443	0.467	0.824	0.574	1.233	Transport from cytoplasm to Golgi system of UDP-GlcNAc and UDP-Xylose
<i>Slc35d1</i>	Mm00624959_m1	<i>Tbp</i>	0.186	1.260	0.674	0.924	0.348	1.176	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-GlcA
<i>Slc35d2</i>	Mm01304830_m1		Not detected		Not detected		Not detected		Transport from cytoplasm to Golgi system of UDP-GlcNAc
<i>Slc35d3</i>	Mm01717003_m1		Not detected		Not detected		Not detected		Paralog of Slc35d1
<i>Uap1</i>	Mm00505476_m1	<i>Tbp</i>	0.185	1.324	0.557	1.149	0.081	1.635	UDP-activation of GlcNAc-1-P and GalNAc-1-P
<i>Ugdh</i>	Mm00447643_m1	<i>Tbp</i>	0.170	1.316	0.778	0.957	0.401	1.295	Conversion of UDP-glucose into UDP-glucuronic acid (UDP-GlcA)
<i>Ugp2</i>	Mm00454826_m1	<i>Tbp</i>	0.163	0.659	0.780	1.059	0.233	1.350	UDP-activation of Glucose-1-P
<i>Uxs1</i>	Mm00550735_m1	<i>Tbp</i>	0.771	1.052	0.843	1.036	0.462	1.226	Conversion of UDP-GlcA into UDP-xylose

Core proteins

Gene symbol	Taqman assay ID	Reference gene	E14vsP90		E16vsP90		P1vsP90		Function
			P-value	Relative fold expression	P-value	Relative fold expression	P-value	Relative fold expression	
<i>Agrn</i>	Mm01545840_m1	<i>Tbp</i>	0.042	1.517	0.710	1.100	0.208	1.295	Proteoglycan carrying HS present in ECM
<i>Cd44</i>	Mm01277164_m1	<i>Gapdh</i>	0.018	0.536	0.171	0.637	0.223	1.385	Proteoglycan carrying HS and hyaluronic acid on cell surface
<i>Col18a1</i>	Mm00487131_m1	<i>Tbp</i>	0.498	1.152	0.958	1.011	0.532	1.199	Proteoglycan carrying HS present in basement membrane
<i>Gpc1</i>	Mm00497305_m1	<i>Tbp</i>	0.027	1.500	0.172	1.164	0.013	1.721	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc2</i>	Mm00549650_m1	<i>Tbp</i>	0.005	11.686	0.638	1.294	0.369	1.249	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc3</i>	Mm00516722_m1	<i>Gapdh</i>	0.000	6.765	0.019	3.734	0.013	8.044	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc4</i>	Mm00515035_m1	<i>Tbp</i>	0.033	1.339	0.799	1.041	0.185	1.707	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc5</i>	Mm00615599_m1		Not detected		Not detected		Not detected		Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc6</i>	Mm00516235_m1	<i>Tbp</i>	0.027	2.880	0.275	1.376	0.130	1.926	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Hspg2</i>	Mm01181179_g1	<i>Tbp</i>	0.030	1.504	0.064	1.959	0.007	3.325	Proteoglycan carrying HS present in ECM
<i>Sdc1</i>	Mm00448918_m1	<i>Tbp</i>	0.012	0.293	0.107	0.313	0.069	0.403	Proteoglycan carrying HS present on cell surface
<i>Sdc2</i>	Mm00484718_m1	<i>Tbp</i>	0.078	1.281	0.159	0.739	0.554	1.204	Proteoglycan carrying HS present on cell surface
<i>Sdc3</i>	Mm01179831_m1	<i>Tbp</i>	0.210	1.333	0.051	0.523	0.590	0.863	Proteoglycan carrying HS present on cell surface
<i>Sdc4</i>	Mm00488527_m1	<i>Gapdh</i>	0.002	0.201	0.039	0.240	0.065	0.471	Proteoglycan carrying HS present on cell surface

Preparation of linkage region

Gene symbol	Taqman assay ID	Reference gene	E14vsP90		E16vsP90		P1vsP90		Function
			P-value	Relative fold expression	P-value	Relative fold expression	P-value	Relative fold expression	
<i>B3galt6</i>	Mm00504458_s1	<i>Tbp</i>	0.917	1.018	0.822	1.054	0.171	1.360	Transferring UDP-galactose to galactose-xylose on proteoglycan
<i>B3gat1</i>	Mm00661499_m1		Not detected		Not detected		Not detected		Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
<i>B3gat2</i>	Mm00549042_m1		Not detected		Not detected		Not detected		Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
<i>B3gat3</i>	Mm00470389_m1	<i>Tbp</i>	0.140	1.254	0.438	1.099	0.199	1.223	Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
<i>B4galt2</i>	Mm00479556_m1	<i>Tbp</i>	0.023	4.562	0.059	2.679	0.038	3.384	Transferring UDP-galactose to GlcNAc, Glc, and Xyl.
<i>B4galt7</i>	Mm00461357_m1	<i>Tbp</i>	0.013	1.824	0.394	1.144	0.078	1.469	Transferring UDP-galactose to xylose on proteoglycan
<i>Xylt1</i>	Mm00558690_m1	<i>Tbp</i>	0.113	1.258	0.020	0.614	0.114	1.391	Transferring UDP-xylose to proteoglycan
<i>Xylt2</i>	Mm00461181_m1	<i>Tbp</i>	0.017	1.209	0.882	0.983	0.054	1.587	Transferring UDP-xylose to proteoglycan

GAG chain polymerisation

Gene symbol	Taqman assay ID	Reference gene	E14vsP90		E16vsP90		P1vsP90		Function
			P-value	Relative fold expression	P-value	Relative fold expression	P-value	Relative fold expression	
<i>Chpf</i>	Mm01262239_g1	<i>Tbp</i>	0.000	2.991	0.059	1.865	0.050	2.401	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
<i>Chsy1</i>	Mm01319178_m1	<i>Tbp</i>	0.013	3.900	0.024	2.282	0.072	2.229	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
<i>Chsy3</i>	Mm01545329_m1	<i>Tbp</i>	0.026	4.006	0.075	2.184	0.101	2.013	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
<i>Csgalnact1</i>	Mm00555164_m1	<i>Tbp</i>	0.099	0.496	0.098	0.475	0.634	1.128	Transferring UDP-GalNAc to GlcA at end of sugar chain (CS)
<i>Csgalnact2</i>	Mm00513340_m1	<i>Tbp</i>	0.063	0.599	0.490	0.886	0.033	1.382	Transferring UDP-GalNAc to GlcA at end of sugar chain (CS)
<i>Ext1</i>	Mm00468769_m1	<i>Tbp</i>	0.491	1.076	0.897	1.013	0.236	1.180	Transferring UDP-GlcNAc to GlcA at end of sugar chain (HS)
<i>Ext2</i>	Mm00468775_m1		Not detected		Not detected		Not detected		Transferring UDP-GlcNAc to GlcA at end of sugar chain (HS)
<i>Extl1</i>	Mm00621977_s1	<i>Tbp</i>	Not detected		Not detected		Not detected		Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
<i>Extl2</i>	Mm00469621_m1	<i>Tbp</i>	0.007	2.043	0.660	1.220	0.106	1.765	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
<i>Extl3</i>	Mm00516994_m1	<i>Tbp</i>	0.042	1.154	0.746	0.982	0.047	1.488	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
<i>Has1</i>	Mm00468496_m1	<i>Tbp</i>	Not detected		0.071	1.920	0.076	1.892	Polymerisation of hyaluronic acid
<i>Has2</i>	Mm00515089_m1	<i>Tbp</i>	0.188	1.933	0.235	1.705	0.410	1.577	Polymerisation of hyaluronic acid
<i>Has3</i>	Mm00515091_m1		Not detected		Not detected		Not detected		Polymerisation of hyaluronic acid

GAG chain modification

Gene symbol	Taqman assay ID	Reference gene	E14vsP90		E16vsP90		P1vsP90		Function
			P-value	Relative fold expression	P-value	Relative fold expression	P-value	Relative fold expression	
<i>Chst11</i>	Mm00517563_m1	<i>Tbp</i>	0.002	3.000	0.087	1.195	0.087	1.957	Sulfation at the 4-O position of GalNAc untis (CS)
<i>Chst12</i>	Mm00546416_s1	<i>Tbp</i>	0.168	0.806	0.698	0.936	0.270	1.433	Sulfation at the 4-O position of GalNAc untis (CS)
<i>Chst13</i>	Mm01186255_s1	<i>Tbp</i>	0.371	0.490	Not detected		Not detected		Sulfation at the 4-O position of GalNAc untis (CS)
<i>Chst14</i>	Mm00511291_s1	<i>Tbp</i>	0.026	2.459	0.156	1.513	0.203	1.707	Sulfation at the 4-O position of GalNAc untis (CS)
<i>Chst15</i>	Mm00513227_m1	<i>Tbp</i>	0.007	1.850	0.016	1.724	0.005	1.512	Sulfation at the 6-O position of GalNAc untis (CS)
<i>Chst2</i>	Mm00490018_g1	<i>Tbp</i>	0.014	3.664	0.010	3.145	0.006	2.773	Sulfation at the 6-O position of GalNAc untis (CS)
<i>Chst3</i>	Mm00489736_m1	<i>Tbp</i>	0.041	3.241	0.152	1.941	0.028	3.550	Sulfation at the 6-O position of GalNAc untis (CS)
<i>Chst4</i>	Mm00488783_s1		Not detected		Not detected		Not detected		Sulfation at the 6-O position of GalNAc untis (CS)
<i>Chst5</i>	Mm00517342_m1		Not detected		Not detected		Not detected		Sulfation at the 6-O position of GalNAc untis (CS)
<i>Chst7</i>	Mm00491466_m1	<i>Tbp</i>	0.777	1.107	0.381	1.420	Not detected		Sulfation at the 6-O position of GalNAc untis (CS)
<i>Chst8</i>	Mm00558321_m1	<i>Tbp</i>	0.089	2.587	0.221	0.591	0.139	2.280	Sulfation at the 4-O position of GalNAc untis (CS)
<i>Chst9</i>	Mm01722279_m1		Not detected		Not detected		Not detected		Sulfation at the 4-O position of GalNAc untis (CS)
<i>Dse</i>	Mm00552923_m1	<i>Tbp</i>	0.275	1.092	0.197	0.838	0.723	1.076	Epimerisation of GlcA unit into iduronic acid unit (IdoA) (CS)
<i>Glce</i>	Mm00473667_m1	<i>Tbp</i>	0.146	1.381	0.636	0.918	0.094	1.632	Epimerisation of GlcA unit into iduronic acid unit (IdoA) (HS)
<i>Hs2st1</i>	Mm00478684_m1	<i>Tbp</i>	0.120	1.335	0.780	1.071	0.179	1.633	Sulfation at the 2-O position of GlcA and IdoA units (HS)
<i>Hs3st1</i>	Mm01964038_s1	<i>Tbp</i>	0.051	1.796	0.039	1.937	0.027	2.809	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st2</i>	Mm00616933_m1		Not detected		Not detected		Not detected		Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st3a1</i>	Mm00780907_s1		Not detected		Not detected		Not detected		Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st3b1</i>	Mm00479621_m1	<i>Tbp</i>	0.004	3.204	0.028	2.511	0.002	2.629	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st6</i>	Mm01299930_m1	<i>Tbp</i>	0.006	0.208	0.089	0.664	0.041	1.765	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs6st1</i>	Mm01229698_s1	<i>Tbp</i>	0.437	1.180	0.670	1.068	0.110	1.570	Sulfation at the 6-O position of GlcNAc and N-sulfated-glucuronic acid units (GlcNS) (HS)
<i>Hs6st2</i>	Mm00479296_m1		Not detected		Not detected		Not detected		Sulfation at the 6-O position of GlcNAc and GlcNS units (HS)
<i>Hs6st3</i>	Mm00479297_m1		Not detected		Not detected		Not detected		Sulfation at the 6-O position of GlcNAc and GlcNS units (HS)
<i>Ndst1</i>	Mm00447005_m1	<i>Tbp</i>	0.118	1.487	0.140	1.449	0.054	2.202	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
<i>Ndst2</i>	Mm00447818_m1	<i>Tbp</i>	0.008	1.347	0.001	2.017	0.002	2.021	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
<i>Ndst3</i>	Mm00453178_m1	<i>Tbp</i>	0.004	4.708	0.041	7.910	0.004	12.034	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
<i>Ndst4</i>	Mm00480767_m1	<i>Tbp</i>	Not detected		Not detected		Not detected		N-de-acetylation and N-sulfation of GlcNAc unit (HS)
<i>Sulf1</i>	Mm00552283_m1	<i>Tbp</i>	0.004	4.644	0.079	2.674	0.089	2.077	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
<i>Sulf2</i>	Mm00511193_m1		Not detected		Not detected		Not detected		Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
<i>Sumf1</i>	Mm00461213_m1	<i>Tbp</i>	0.021	0.784	0.023	0.573	0.960	0.987	Cofactor for Sulf1 and Sulf 2 (HS)
<i>Sumf2</i>	Mm01197721_m1	<i>Tbp</i>	0.008	2.657	0.104	2.023	0.038	1.857	Cofactor for Sulf1 and Sulf 2 (HS)
<i>Ust</i>	Mm00616790_m1	<i>Tbp</i>	0.359	0.940	0.864	1.021	0.106	1.109	Sulfation at the 2-O position of GlcA and IdoA units (CS)

GAG chain degradation

Gene symbol	Taqman assay ID	Reference gene	E14vsP90		E16vsP90		P1vsP90		Function
			P-value	Relative fold expression	P-value	Relative fold expression	P-value	Relative fold expression	
<i>Arsb</i>	Mm00802167_m1	<i>Tbp</i>	0.049	1.403	0.745	0.944	0.979	0.987	Desulfation of the 4-O position of 4-O sulfated GalNAc units (CS)
<i>Arsj</i>	Mm00557970_m1	<i>Tbp</i>	0.013	7.805	0.010	12.075	0.014	7.146	Desulfation of the 4-O position of 4-O sulfated GalNAc units (CS)
<i>Arsk</i>	Mm00513099_m1	<i>Tbp</i>	0.306	0.801	0.059	0.466	0.143	0.678	Desulfation of proteoglycans, paralog of IDS
<i>Galns</i>	Mm00489575_m1	<i>Tbp</i>	0.000	2.648	0.066	1.674	0.091	1.584	Desulfation of the 6-O position of 6-O sulfated GalNAc units (CS)
<i>Gns</i>	Mm00659592_m1	<i>Tbp</i>	0.103	0.540	0.153	0.532	0.668	0.842	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
<i>Gusb</i>	Mm00446954_g1	<i>Tbp</i>	0.057	1.145	0.592	0.909	0.549	1.182	Hydrolysis of GlcA from sugar chain (HS and Hyaluronic acid and CS)
<i>Hexa</i>	Mm00599877_m1	<i>Tbp</i>	0.104	0.552	0.140	0.568	0.261	0.735	Hydrolysis of GalNAc units (CS) and GlcNAc units (hyaluronic acid) from sugar chain
<i>Hexb</i>	Mm00599880_m1	<i>Tbp</i>	0.010	0.540	0.039	0.705	0.015	0.616	Hydrolysis of GalNAc units (CS) and GlcNAc units (hyaluronic acid) from sugar chain
<i>Hgsnat</i>	Mm00519485_m1	<i>Tbp</i>	0.135	0.792	0.456	0.880	0.004	1.851	Acetylation of desulfated GlcNS units (HS)
<i>Hpse</i>	Mm00461768_m1	<i>Tbp</i>	0.044	0.304	0.342	1.450	0.169	0.578	Degradation of HS chains extracellularly
<i>Hyal1</i>	Mm00476206_m1	<i>Tbp</i>	0.001	0.198	0.008	0.288	0.006	0.607	Degradation of hyaluronic acid chain
<i>Hyal2</i>	Mm00477731_m1	<i>Tbp</i>	Not detected		0.692	1.129	0.436	1.332	Degradation of hyaluronic acid chain
<i>Hyal3</i>	Mm00662097_m1		Not detected		Not detected		Not detected		Degradation of hyaluronic acid chain
<i>Ids</i>	Mm00494868_m1	<i>Tbp</i>	0.035	0.722	0.031	0.612	0.517	0.871	Desulfation of 2-O sulfated IdoA and GlcA units (HS and CS)
<i>Idua</i>	Mm00515143_m1	<i>Tbp</i>	0.509	0.887	0.092	0.646	0.773	1.093	Hydrolysis of IdoA unit from sugar chain (HS and CS)
<i>Mgea5</i>	Mm00452409_m1	<i>Tbp</i>	0.113	1.074	0.054	0.824	0.122	1.077	Degradation of hyaluronic acid chain
<i>Naga</i>	Mm00476274_m1	<i>Tbp</i>	0.069	0.703	0.175	0.744	0.408	1.205	Hydrolysis N-GalNAc moieties from glycoconjugates.
<i>Naglu</i>	Mm00479175_m1	<i>Tbp</i>	0.130	0.746	0.105	0.583	0.758	0.898	Hydrolysis of GlcNAc from sugar chain (HS)
<i>Sgsh</i>	Mm00450747_m1	<i>Tbp</i>	0.055	0.647	0.002	0.435	0.644	0.897	Desulfation of GlcNS units (HS)

Growth factors

Gene symbol	Taqman assay ID	Reference gene	E14vsP90		E16vsP90		P1vsP90		Function
			P-value	Relative fold expression	P-value	Relative fold expression	P-value	Relative fold expression	
<i>Areg</i>	Mm00437583_m1		Not detected		Not detected		0.656	0.834	Amphiregulin **
<i>Bmp3</i>	Mm00557790_m1	<i>Tbp</i>	0.007	4.270	0.004	7.240	0.002	11.628	Bone morphogenetic growth factor 3 **
<i>Bmp5</i>	Mm00432091_m1	<i>Tbp</i>	0.022	12.051	0.303	1.788	0.587	1.300	Bone morphogenetic growth factor 5 **
<i>Ctgf</i>	Mm01192931_g1	<i>Tbp</i>	0.668	1.079	0.011	0.232	0.076	0.580	Connective tissue growth factor, embryonic growth factor in skin development **
<i>Fgf10</i>	Mm00433275_m1	<i>Tbp</i>	0.063	1.649	0.050	1.801	0.093	2.262	Fibroblast growth factor 10 **
<i>Fgf13</i>	Mm00438910_m1	<i>Tbp</i>	0.002	3.205	0.059	1.750	0.181	1.544	Fibroblast growth factor 13 **
<i>Fgf2</i>	Mm01285715_m1	<i>Tbp</i>	0.277	0.651	0.166	0.539	0.382	1.446	Fibroblast growth factor 2 **
<i>Fgf20</i>	Mm00748347_m1		Not detected		Not detected		Not detected		Fibroblast growth factor 20 **
<i>Fgf22</i>	Mm00445749_m1	<i>Tbp</i>	Not detected		0.386	0.632	0.060	0.614	Fibroblast growth factor 22 **
<i>Fgf7</i>	Mm00433291_m1	<i>Tbp</i>	0.045	0.606	0.002	0.394	0.087	0.630	Fibroblast growth factor 7 **
<i>Fgf8</i>	Mm00438921_m1		Not detected		Not detected		Not detected		Fibroblast growth factor 8 **
<i>Figf</i>	Mm01131929_m1	<i>Tbp</i>	0.081	1.397	0.030	1.787	0.545	0.834	C-fos induced growth factor **
<i>Gdf10</i>	Mm03024279_s1	<i>Tbp</i>	0.015	3.181	0.454	1.143	0.166	1.519	Growth differentiation factor 10 **
<i>Hbegf</i>	Mm00439305_g1	<i>Tbp</i>	Not detected		0.015	0.347	0.016	0.423	Heparin-binding epidermal growth factor **
<i>Hdgf</i>	Mm00725733_s1	<i>Gapdh</i>	0.257	1.221	0.737	0.911	0.975	1.008	Hepatoma-derived growth factor **
<i>Igf1</i>	Mm00439560_m1	<i>Tbp</i>	0.320	1.207	0.217	0.705	0.364	0.790	Insulin-like growth factor 1 **
<i>Igf2</i>	Mm00439565_g1	<i>Gapdh</i>	0.000	592.335	0.002	338.094	0.001	416.096	Insulin-like growth factor 2 **
<i>Nog</i>	Mm01297833_s1	<i>Tbp</i>	0.054	2.945	0.019	2.935	0.021	3.067	Noggin **
<i>Pdgfa</i>	Mm01205760_m1	<i>Tbp</i>	0.021	3.005	Not detected		0.016	3.669	Platelet-derived growth factor a **
<i>Pdgfb</i>	Mm01298578_m1	<i>Tbp</i>	0.321	1.098	0.033	1.468	0.010	2.096	Platelet-derived growth factor b **
<i>Pdgfc</i>	Mm00480205_m1	<i>Tbp</i>	Not detected		0.016	2.362	Not detected		Platelet-derived growth factor c **
<i>Pdgfd</i>	Mm00546829_m1	<i>Tbp</i>	Not detected		0.288	0.709	0.139	1.644	Platelet-derived growth factor d **
<i>Shh</i>	Mm00436527_m1		Not detected		Not detected		Not detected		Sonic hedgehog **
<i>Tgfb1</i>	Mm01178820_m1	<i>Tbp</i>	0.027	0.540	0.488	0.817	0.157	1.372	Transforming growth factor beta 1 **
<i>Tgfb2</i>	Mm01321739_m1	<i>Tbp</i>	0.039	2.697	0.757	1.081	0.127	1.809	Transforming growth factor beta 2 **
<i>Tgfb3</i>	Mm01307950_m1	<i>Tbp</i>	0.033	2.420	0.094	1.854	0.034	2.517	Transforming growth factor beta 3 **
<i>Vegfa</i>	Mm01281447_m1	<i>Tbp</i>	0.394	1.108	0.112	1.613	0.461	1.358	Vascular endothelial growth factor a **
<i>Vegfb</i>	Mm00442102_m1		Not detected		Not detected		Not detected		Vascular endothelial growth factor b **
<i>Vegfc</i>	Mm00437313_m1	<i>Tbp</i>	0.024	1.839	0.303	1.250	0.015	1.996	Vascular endothelial growth factor c **
<i>Wnt10b</i>	Mm00442104_m1	<i>Tbp</i>	0.180	5.829	0.122	9.688	0.105	11.748	Wingless-related integration site 10b **
<i>Wnt16</i>	Mm00446420_m1	<i>Tbp</i>	0.066	2.094	0.016	4.809	0.014	4.362	Wingless-related integration site 16 **
<i>Wnt2</i>	Mm00470018_m1	<i>Tbp</i>	0.054	3.144	0.090	3.555	0.074	3.760	Wingless-related integration site 2 **
<i>Wnt2b</i>	Mm00437330_m1		Not detected		Not detected		Not detected		Wingless-related integration site 2b **
<i>Wnt3a</i>	Mm00437337_m1	<i>Tbp</i>	0.394	1.610	0.441	1.520	0.840	1.106	Wingless-related integration site 3a **
<i>Wnt6</i>	Mm00437353_m1	<i>Tbp</i>	0.015	11.709	0.018	10.400	0.016	10.758	Wingless-related integration site 6 **
<i>Wnt7a</i>	Mm00437355_m1		Not detected		Not detected		Not detected		Wingless-related integration site 7a **
<i>Wnt7b</i>	Mm00437357_m1	<i>Tbp</i>	0.003	4.180	0.056	6.076	0.003	4.181	Wingless-related integration site 7b **

Putatively involved

Gene symbol	Taqman assay ID	Reference gene	E14vsP90		E16vsP90		P1vsP90		Function
			P-value	Relative fold expression	P-value	Relative fold expression	P-value	Relative fold expression	
<i>18S</i>	Hs99999901_s1		Reference gene		Reference gene		Reference gene		Reference gene
<i>Arsa</i>	Mm00802173_g1	<i>Tbp</i>	0.253	0.820	0.840	0.934	0.730	1.083	Desulfation of cerebroside
<i>Arsg</i>	Mm00546931_m1	<i>Tbp</i>	0.004	0.705	0.003	0.408	0.275	1.329	Paralog of Arsa
<i>B3galnt1</i>	Mm00480272_s1	<i>Tbp</i>	0.003	2.976	0.020	1.713	0.059	1.852	Transferring UDP-GalNAc or UDP-GlcNAc to N-GlcNAc, Galactose or N-GalNAc
<i>B4galnt3</i>	Mm01189804_m1	<i>Tbp</i>	0.020	0.319	0.030	0.417	0.403	0.874	Transferring UDP-GalNAc or UDP-GlcNAc to N-GlcNAc, Galactose or N-GalNAc
<i>B4galnt4</i>	Mm00625968_g1	<i>Tbp</i>	0.055	8.732	0.532	1.484	0.216	2.604	Transferring UDP-GalNAc or UDP-GlcNAc to N-GlcNAc, Galactose or N-GalNAc
<i>C1galt1</i>	Mm00473986_m1	<i>Tbp</i>	0.017	0.503	0.016	0.458	0.149	0.675	Transferring UDP-Gal to N-GalNAc.
<i>C1galt1c1</i>	Mm00480676_m1	<i>Tbp</i>	0.321	0.862	0.712	1.042	0.878	0.972	C1GALT1-specific chaperone 1
<i>Chst1</i>	Mm00517855_m1	<i>Tbp</i>	0.006	1.723	0.019	2.637	0.012	2.241	Involved in sulfation of keratan sulfate
<i>Gapdh</i>	Mm03302249_g1		Reference gene		Reference gene		Reference gene		Reference gene
<i>Gla</i>	Mm00516323_m1	<i>Tbp</i>	0.422	0.913	0.018	0.494	0.900	0.946	Hydrolysis of galactose units
<i>Glb1</i>	Mm00515342_m1	<i>Tbp</i>	0.030	1.606	0.152	1.578	0.338	1.403	Hydrolysis of galactose units
<i>Glb1l2</i>	Mm00464245_m1	<i>Tbp</i>	0.011	0.039	0.056	0.319	0.164	0.539	Hydrolysis of galactose units
<i>Gnpda1</i>	Mm01254913_g1	<i>Tbp</i>	0.046	0.702	0.045	0.548	0.374	0.821	Conversion of GlcNAc-6-P into fructose-6-P
<i>Gnpda2</i>	Mm00503573_m1	<i>Tbp</i>	0.112	0.772	0.453	0.857	0.135	1.355	Conversion of GlcNAc-6-P into fructose-6-P
<i>Khk</i>	Mm00434647_m1		Not detected		Not detected		Not detected		Phosphorylating fructose to fructose-1-P
<i>Kl</i>	Mm00502002_m1		Not detected		Not detected		Not detected		Putative glucuronidase
<i>Klb</i>	Mm00473122_m1	<i>Tbp</i>	Not detected		0.311	1.268	0.141	2.593	Putative glucuronidase
<i>Renbp</i>	Mm00491720_m1	<i>Tbp</i>	0.175	0.690	0.847	0.963	0.575	1.095	Concersion of N-GlcNAc to N-acetylmannosamine
<i>Slc17a5</i>	Mm00555344_m1	<i>Tbp</i>	0.073	0.758	0.050	0.767	0.078	1.350	Transport of GlcA from lysosome to cytoplasm
<i>Slc26a3</i>	Mm00445313_m1		Not detected		Not detected		Not detected		Transferring chloride ions across the cell membrane in exchange for bicarbonate ions
<i>Slc26a4</i>	Mm00442308_m1		Not detected		Not detected		Not detected		Transferring chloride ions across the cell membrane
<i>Slc26a5</i>	Mm00446145_m1		Not detected		Not detected		Not detected		Protein functions as a molecular motor in motile outer hair cells of the cochlea
<i>Slc35a1</i>	Mm00442341_m1	<i>Tbp</i>	0.019	1.514	0.425	1.088	0.536	0.920	Putative CMP-Sialic Acid Transporter
<i>Tbp</i>	Mm01277045_m1	<i>Tbp</i>	0.293	1.000	0.423	1.000	0.423	1.000	Reference gene
<i>Ugt8a</i>	Mm00495930_m1	<i>Tbp</i>	0.996	1.001	0.049	0.293	0.227	0.670	Transfere galactose to ceramide

* Glc, glucosamine; GlcNAc, N-acetylated glucosamine; Gal, galactosamine; GalNAc, N-acetylated galactosamine; GlcA, glucuronic acid; IdoA, iduronic acid. **Uijtdewilligen *et al.*, 2016.

Genes, for which a signal was not or only partly detected at a given timepoint or multiple timepoints and therefore a fold change and/or p-value could not be calculated based on the available data, are given as 'not detected'. Gene symbol for which all timepoints were classified as 'not detected' do not show a reference gene due to lack of data for a calculation.

Supplementary data table 5: Differentially expressed genes during skin development in mice in comparison to mature mouse skin using EXON arrays

Gene symbol	Taqman assay ID	Affymetrix ID	Present on		E14vsP90		E16vsP90		P1vsP90		Function
			Cart V1	Cart V2	Stepup	Fold change	Stepup	Fold change	Stepup	Fold change	
					P-value		P-value		P-value		
<i>Adpgk</i>	Mm00511302_m1	6989534	Yes	Yes	0.047	1.641	0.083	1.614	0.233	1.384	Phosphorylation of glucose into glucose-6-P
<i>Gale</i>	Mm00617772_g1	6917794	Yes	Yes	0.674	0.858	0.612	0.834	0.244	0.555	Conversion of UDP-GlcNAc to UDP-GalNAc
<i>Galk1</i>	Mm00444182_m1	6792485	Yes	Yes	0.030	4.242	0.126	2.483	0.231	2.194	Phosphorylation of Galactose into Galactose-1-P
<i>Galk2</i>	Mm00613268_m1	6880899	Yes	Yes	0.447	1.188	0.434	0.832	0.709	0.881	Phosphorylation of N-Acetylgalactosamine (GalNAc) into GalNAc-1P)
<i>Galt</i>	Mm00489459_g1	6912944	Yes	Yes	0.664	0.814	0.231	1.864	0.665	1.340	UDP-activation of Glucose-1-P and Galactose-1-P
<i>Gck</i>	Mm00439129_m1	6785753	Yes	Yes	0.045	0.640	0.489	1.125	0.305	0.787	Phosphorylation of glucose into glucose-6-P
<i>Gfpt1</i>	Mm00600127_m1	6947679	Yes	Yes	0.020	2.110	0.077	1.682	0.801	1.081	Conversion of fructose-6-P into glucosamine-6-P (Glc-6-P)
<i>Gfpt2</i>	Mm00496565_m1	6780767	Yes	Yes	0.176	0.610	0.087	0.426	0.229	0.547	Conversion of fructose-6-P into Glc-6-P
<i>Gnpnat1</i>	Mm00834602_mH	Not available*	Yes	Yes	Not available*		Not available*		Not available*		Conversion of Glc-6-P into N-Acetylglucosamine-6-P (GlcNAc-6-P)
<i>Gpi1</i>	Mm02026122_g1	6966425	Yes	Yes	0.277	1.220	0.429	1.160	0.485	1.194	Isomerisation of glucose-6-P into fructose-6-P
<i>Hk1</i>	Mm00439344_m1	6774391	Yes	Yes	0.469	0.824	0.549	0.849	0.185	0.588	Phosphorylation of glucose into glucose-6-P
<i>Hk2</i>	Mm00443385_m1	6954982	Yes	Yes	0.003	0.451	0.040	1.375	0.039	0.655	Phosphorylation of glucose into glucose-6-P
<i>Miox</i>	Mm00480214_m1	6832572	Yes	Yes	0.795	1.042	0.234	1.212	0.825	0.950	Conversion of Myo-inositol into UDP-GlcA
<i>Nagk</i>	Mm00479878_m1	6947460	Yes	Yes	0.900	1.055	0.468	0.763	0.652	0.787	Phosphorylation of GlcNAc to GlcNAc-6-P
<i>Papss1</i>	Mm00442283_m1	6901413	Yes	Yes	0.696	1.238	0.786	0.861	0.997	1.004	Synthesis of PAPS complex
<i>Papss2</i>	Mm00442295_m1	6889216	Yes	Yes	0.040	2.474	0.203	1.605	0.643	1.241	Synthesis of PAPS complex
<i>Pgm1</i>	Mm00804141_m1	6931181	Yes	Yes	0.088	0.689	0.050	0.535	0.109	0.605	Conversion of glucose-6-P into glucose-1-P
<i>Pgm2</i>	Mm00728285_s1	6915791	Yes	Yes	0.401	0.816	0.538	1.165	0.762	1.120	Conversion of glucose-6-P into glucose-1-P
<i>Pgm3</i>	Mm00459270_m1	6997513	Yes	Yes	0.083	2.193	0.676	1.178	0.654	1.286	Conversion of GlcNAc-6-P into GlcNAc-1-P
<i>Pgm5</i>	Mm00723432_m1	6872290	Yes	Yes	0.058	2.338	0.104	2.209	0.291	1.696	Conversion of glucose-6-P into glucose-1-P
<i>Slc13a1</i>	Mm00490339_m1	6952151	Yes	Yes	0.474	0.897	0.363	1.156	0.939	1.021	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc13a4</i>	Mm00556495_m1	6952679	Yes	Yes	0.482	1.144	0.581	1.113	0.652	1.134	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc13a5</i>	Mm01334459_m1	6789531	Yes	Yes	0.003	2.588	0.059	1.322	0.576	1.075	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc26a11</i>	Mm00626632_m1	6785369	Yes	Yes	0.068	0.755	0.184	0.820	0.970	1.009	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc26a2</i>	Mm00432896_m1	6865971	Yes	Yes	0.164	1.260	0.077	1.509	0.242	0.770	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc26a6</i>	Mm00506742_m1	6992374	Yes	Yes	0.475	0.921	0.158	0.818	0.608	0.918	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc26a7</i>	Mm00524162_m1	6919879	Yes	Yes	0.843	1.082	0.444	1.319	0.220	1.872	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc26a8</i>	Mm00524836_m1	6854619	Yes	Yes	0.884	0.977	0.133	1.309	0.818	1.052	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc26a9</i>	Mm00628490_m1	6753079	Yes	Yes	0.012	0.227	0.090	0.471	0.091	0.392	Transport of sulphate from the extracellular space to cytoplasm
<i>Slc2a1</i>	Mm01192270_m1	6916748	No	Yes	0.277	1.613	0.311	1.605	0.254	0.491	Sugar transport across plasma membrane
<i>Slc2a10</i>	Mm00453716_m1	6883184	No	Yes	0.059	1.836	0.173	1.523	0.083	2.266	Sugar transport across plasma membrane
<i>Slc2a12</i>	Mm00619244_m1	6766491	No	Yes	0.007	0.263	0.016	0.258	0.032	0.315	Sugar transport across plasma membrane
<i>Slc2a2</i>	Mm00446230_g1	6896428	No	Yes	0.461	1.176	0.257	1.318	0.811	1.087	Sugar transport across plasma membrane
<i>Slc2a3</i>	Mm00441483_m1	6957051	No	Yes	0.063	15.969	0.334	3.430	0.947	0.868	Sugar transport across plasma membrane
<i>Slc2a4</i>	Mm01245507_g1	6789367	No	Yes	0.006	0.298	0.044	0.525	0.857	1.054	Sugar transport across plasma membrane
<i>Slc2a5</i>	Mm00600311_m1	6918858	No	Yes	0.077	0.691	0.365	0.847	0.344	0.794	Sugar transport across plasma membrane
<i>Slc2a6</i>	Mm00554217_m1	6885514	No	Yes	0.021	0.667	0.740	0.964	0.168	0.799	Sugar transport across plasma membrane
<i>Slc2a8</i>	Mm00444634_m1	6885923	No	Yes	0.087	0.702	0.323	0.830	0.878	0.955	Sugar transport across plasma membrane
<i>Slc2a9</i>	Mm01211147_m1	Not available*	No	Yes	Not available*		Not available*		Not available*		Sugar transport across plasma membrane
<i>Slc35a2</i>	Mm00446504_m1	7009796	Yes	Yes	0.266	1.396	0.747	1.104	0.960	0.973	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
<i>Slc35a3</i>	Mm00523288_m1	6908510	Yes	Yes	0.105	0.767	0.596	0.925	0.572	0.890	Transport from cytoplasm to Golgi system of UDP-GlcNAc
<i>Slc35a4</i>	Mm00782997_s1	6860121	Yes	Yes	0.270	1.425	0.847	1.068	0.744	1.171	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
<i>Slc35b1</i>	Mm00450258_m1	6783740	Yes	Yes	0.723	0.903	0.184	0.651	0.716	0.863	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
<i>Slc35b2</i>	Mm01269910_m1	6850646	Yes	Yes	0.336	1.341	0.478	1.247	0.868	1.089	Transport of PAPS complex from cytoplasm to Golgi system
<i>Slc35b3</i>	Mm00506275_m1	6812534	Yes	Yes	0.021	1.270	0.877	0.990	0.227	1.117	Transport of PAPS complex from cytoplasm to Golgi system
<i>Slc35b4</i>	Mm00480588_m1	6952601	Yes	Yes	0.482	1.129	0.687	1.074	0.907	1.035	Transport from cytoplasm to Golgi system of UDP-GlcNAc and UDP-Xylose
<i>Slc35d1</i>	Mm00624959_m1	6924027	Yes	Yes	0.229	1.372	0.440	1.226	0.709	1.153	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-GlcA
<i>Slc35d2</i>	Mm01304830_m1	6813876	Yes	Yes	0.067	0.867	0.101	0.866	0.051	0.763	Transport from cytoplasm to Golgi system of UDP-GlcNAc
<i>Slc35d3</i>	Mm01717003_m1	6772476	Yes	Yes	0.133	1.509	0.078	1.932	0.344	1.391	Paralog of Slc35d1
<i>Uap1</i>	Mm00505476_m1	6764011	Yes	Yes	0.168	1.335	0.758	1.065	0.785	1.088	UDP-activation of GlcNAc-1-P and GalNAc-1-P

<i>Ugdh</i>	Mm00447643_m1	6938704	Yes	Yes	0.100	1.282	0.451	0.903	0.558	1.117	Conversion of UDP-glucose into UDP-glucuronic acid (UDP-GlcA)
<i>Ugp2</i>	Mm00454826_m1	6786561	Yes	Yes	0.203	1.203	0.956	0.991	0.215	1.287	UDP-activation of Glucose-1-P
<i>Uxs1</i>	Mm00550735_m1	6758325	Yes	Yes	0.595	1.160	0.692	0.894	0.865	0.925	Conversion of UDP-GlcA into UDP-xylose

Core proteins

Gene symbol	Taqman assay ID	Affymetrix ID	Present on		E14vsP90		E16vsP90		P1vsP90		Function
			Cart V1	Cart V2	Stepup P-value	Fold change	Stepup P-value	Fold change	Stepup P-value	Fold change	
<i>Acan</i>	Mm00545807_m1	6961912	No	Yes	0.007	17.401	0.744	0.857	0.890	1.114	Proteoglycan carrying CS or DS
<i>Agrn</i>	Mm01545840_m1	6927362	Yes	Yes	0.682	1.082	0.272	1.252	0.892	1.044	Proteoglycan carrying HS present in ECM
<i>Aspn</i>	Mm00445945_m1	6806958	No	Yes	0.074	2.199	0.406	1.373	0.088	3.129	Proteoglycan carrying CS or DS
<i>Bcan</i>	Mm00476090_m1	6906694	No	Yes	0.663	1.097	0.255	1.297	0.919	0.964	Proteoglycan carrying CS or DS
<i>Bgn</i>	Mm00455918_m1	7011936	No	Yes	0.017	0.721	0.054	0.776	0.061	1.352	Proteoglycan carrying CS or DS
<i>Cd44</i>	Mm01277164_m1	6889258	Yes	Yes	0.009	0.370	0.144	0.728	0.873	0.955	Proteoglycan carrying HS and hyaluronic acid on cell surface
<i>Col18a1</i>	Mm00487131_m1	6775201	Yes	Yes	0.440	0.885	0.324	0.847	0.359	0.818	Proteoglycan carrying HS present in basement membrane
<i>Col9a2</i>	Mm00483872_m1	6916849	No	Yes	0.012	5.104	0.292	1.462	0.997	1.003	Proteoglycan carrying CS or DS
<i>Cspg4</i>	Mm00507256_m1	6989349	No	Yes	0.693	0.918	0.636	0.905	0.693	1.130	Proteoglycan carrying CS or DS
<i>Cspg5</i>	Mm00516549_m1	6992428	No	Yes	0.015	2.593	0.099	1.639	0.506	1.225	Proteoglycan carrying CS or DS
<i>Dcn</i>	Mm03003496_s1	6770064	No	Yes	0.221	0.705	0.252	0.703	0.399	0.723	Proteoglycan carrying CS or DS
<i>Epyc</i>	Mm00514611_m1	6770076	No	Yes	0.001	21.280	0.365	1.162	0.597	0.886	Proteoglycan carrying CS or DS
<i>Gpc1</i>	Mm00497305_m1	6751634	Yes	Yes	0.404	1.111	0.305	1.150	0.312	1.197	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc2</i>	Mm00549650_m1	Not available*	Yes	Yes	Not available*		Not available*		Not available*		Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc3</i>	Mm00516722_m1	7016826	Yes	Yes	0.003	4.339	0.013	3.305	0.015	4.721	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc4</i>	Mm00515035_m1	7016823	Yes	Yes	0.667	1.117	0.723	0.913	0.694	1.157	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc5</i>	Mm00615599_m1	6821935	Yes	Yes	0.342	1.092	0.461	1.073	0.411	0.899	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc6</i>	Mm00516235_m1	6821985	Yes	Yes	0.019	2.767	0.109	1.747	0.193	1.640	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Hmmer</i>	Mm00469183_m1	6787469	No	Yes	0.059	3.525	0.191	2.263	0.987	0.984	Hyaluronan-Mediated Motility Receptor
<i>Hspg2</i>	Mm01181179_g1	6917933	Yes	Yes	0.309	1.183	0.075	1.554	0.042	2.230	Proteoglycan carrying HS present in ECM
<i>Ncan</i>	Mm00484007_m1	6983162	No	Yes	0.001	8.732	0.101	1.213	0.908	1.017	Proteoglycan carrying CS or DS
<i>Sdc1</i>	Mm00448918_m1	6793226	Yes	Yes	0.031	0.380	0.067	0.413	0.103	0.424	Proteoglycan carrying HS present on cell surface
<i>Sdc2</i>	Mm00484718_m1	6829598	Yes	Yes	0.479	1.406	0.545	0.744	0.669	1.356	Proteoglycan carrying HS present on cell surface
<i>Sdc3</i>	Mm01179831_m1	6917389	Yes	Yes	0.987	1.006	0.107	0.539	0.240	0.622	Proteoglycan carrying HS present on cell surface
<i>Sdc4</i>	Mm00488527_m1	6892905	Yes	Yes	0.017	0.341	0.094	0.536	0.215	0.621	Proteoglycan carrying HS present on cell surface
<i>Smc3</i>	Mm00484015_m1	6870470	No	Yes	0.007	1.969	0.049	1.438	0.112	1.329	Proteoglycan carrying CS or DS
<i>Srgn</i>	Mm01169070_m1	6774400	No	Yes	0.224	0.671	0.856	1.064	0.631	0.799	Proteoglycan carrying CS or DS
<i>Vcan</i>	Mm01283063_m1	6814956	No	Yes	0.006	3.673	0.023	2.792	0.029	3.226	Proteoglycan carrying CS or DS

Preparation of linkage region

Gene symbol	Taqman assay ID	Affymetrix ID	Present on		E14vsP90		E16vsP90		P1vsP90		Function
			Cart V1	Cart V2	Stepup P-value	Fold change	Stepup P-value	Fold change	Stepup P-value	Fold change	
<i>B3galt6</i>	Mm00504458_s1	6927341	Yes	Yes	0.764	1.202	0.764	0.837	0.708	1.373	Transferring UDP-galactose to galactose-xylose on proteoglycan
<i>B3gat1</i>	Mm00661499_m1	6987632	Yes	Yes	0.008	3.467	0.256	1.302	0.828	0.929	Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
<i>B3gat2</i>	Mm00549042_m1	6748174	Yes	Yes	0.009	3.241	0.286	1.269	0.690	1.129	Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
<i>B3gat3</i>	Mm00470389_m1	6867978	Yes	Yes	0.672	0.954	0.295	0.886	0.349	0.870	Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
<i>B4galt2</i>	Mm00479556_m1	6924869	Yes	Yes	0.039	1.726	0.053	1.865	0.176	1.477	Transferring UDP-galactose to GlcNAc, Glc, and Xyl.
<i>B4galt7</i>	Mm00461357_m1	6807252	Yes	Yes	0.135	1.221	0.701	1.049	0.710	0.935	Transferring UDP-galactose to xylose on proteoglycan
<i>Xylt1</i>	Mm00558690_m1	6963793	Yes	Yes	0.957	1.005	0.390	0.935	0.108	1.224	Transferring UDP-xylose to proteoglycan
<i>Xylt2</i>	Mm00461181_m1	6790972	Yes	Yes	0.801	0.950	0.957	0.988	0.820	1.070	Transferring UDP-xylose to proteoglycan

GAG chain polymerisation

Gene symbol	Taqman assay ID	Affymetrix ID	Present on		E14vsP90		E16vsP90		P1vsP90		Function
			Cart V1	Cart V2	Stepup	Fold change	Stepup	Fold change	Stepup	Fold change	
					P-value		P-value		P-value		
<i>Chpf</i>	Mm01262239_g1	6759816	Yes	Yes	0.071	1.679	0.182	1.459	0.309	1.403	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
<i>Chsy1</i>	Mm01319178_m1	Not available*	Yes	Yes	Not available*		Not available*		Not available*		Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
<i>Chsy3</i>	Mm01545329_m1	6861281	Yes	Yes	0.429	1.153	0.056	1.769	0.849	1.058	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
<i>Csgalnact1</i>	Mm00555164_m1	6983073	Yes	Yes	0.137	0.512	0.202	0.541	0.974	0.975	Transferring UDP-GalNAc to GlcA at end of sugar chain (CS)
<i>Csgalnact2</i>	Mm00513340_m1	6956864	Yes	Yes	0.475	0.819	0.734	1.103	0.407	1.382	Transferring UDP-GalNAc to GlcA at end of sugar chain (CS)
<i>Ext1</i>	Mm00468769_m1	6835692	Yes	Yes	0.881	1.024	0.351	0.873	0.936	0.980	Transferring UDP-GlcNAc to GlcA at end of sugar chain (HS)
<i>Ext2</i>	Mm00468775_m1	6888925	Yes	Yes	0.086	1.336	0.319	1.166	0.358	1.202	Transferring UDP-GlcNAc to GlcA at end of sugar chain (HS)
<i>Extl1</i>	Mm00621977_s1	6926017	Yes	Yes	0.025	0.407	0.149	0.625	0.114	0.505	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
<i>Extl2</i>	Mm00469621_m1	6900659	Yes	Yes	0.085	1.702	0.819	1.066	0.518	1.272	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
<i>Extl3</i>	Mm00516994_m1	6825402	Yes	Yes	0.895	1.024	0.723	0.944	0.312	1.250	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
<i>Has1</i>	Mm00468496_m1	6854042	Yes	Yes	0.465	0.793	0.226	1.548	0.278	1.628	Polymerisation of hyaluronic acid
<i>Has2</i>	Mm00515089_m1	6835856	Yes	Yes	0.095	2.107	0.157	1.969	0.537	1.403	Polymerisation of hyaluronic acid
<i>Has3</i>	Mm00515091_m1	6978932	Yes	Yes	0.861	1.149	0.128	3.994	0.202	3.726	Polymerisation of hyaluronic acid

GAG chain modification

Gene symbol	Taqman assay ID	Affymetrix ID	Present on		E14vsP90		E16vsP90		P1vsP90		Function
			Cart V1	Cart V2	Stepup	Fold change	Stepup	Fold change	Stepup	Fold change	
					P-value		P-value		P-value		
<i>Chst11</i>	Mm00517563_m1	6769366	Yes	Yes	0.049	1.922	0.465	1.208	0.239	1.531	Sulfation at the 4-O position of GalNAc units (CS)
<i>Chst12</i>	Mm00546416_s1	6935275	Yes	Yes	0.448	0.646	0.632	0.756	0.995	0.993	Sulfation at the 4-O position of GalNAc units (CS)
<i>Chst13</i>	Mm01186255_s1	Not available*	Yes	Yes	Not available*		Not available*		Not available*		Sulfation at the 4-O position of GalNAc units (CS)
<i>Chst14</i>	Mm00511291_s1	6880476	Yes	Yes	0.151	1.491	0.506	1.191	0.773	1.122	Sulfation at the 4-O position of GalNAc units (CS)
<i>Chst15</i>	Mm00513227_m1	6971656	Yes	Yes	0.027	1.831	0.039	1.991	0.207	1.396	Sulfation at the 6-O position of GalNAc units (CS)
<i>Chst2</i>	Mm00490018_g1	6997990	Yes	Yes	0.035	2.302	0.072	2.160	0.207	1.682	Sulfation at the 6-O position of GalNAc units (CS)
<i>Chst3</i>	Mm00489736_m1	6774295	Yes	Yes	0.885	1.034	0.108	1.545	0.162	1.530	Sulfation at the 6-O position of GalNAc units (CS)
<i>Chst4</i>	Mm00488783_s1	6985292	Yes	No	0.197	0.696	0.254	1.407	0.912	0.951	Sulfation at the 6-O position of GalNAc units (CS)
<i>Chst5</i>	Mm00517342_m1	6985414	Yes	Yes	0.069	1.794	0.130	1.677	0.642	1.196	Sulfation at the 6-O position of GalNAc units (CS)
<i>Chst7</i>	Mm00491466_m1	7010308	Yes	Yes	0.928	1.056	0.971	1.023	0.998	0.997	Sulfation at the 6-O position of GalNAc units (CS)
<i>Chst8</i>	Mm00558321_m1	6966453	Yes	Yes	0.945	1.007	0.569	1.054	0.420	1.108	Sulfation at the 4-O position of GalNAc units (CS)
<i>Chst9</i>	Mm01722279_m1	6863607	Yes	Yes	0.122	1.172	0.122	1.209	0.562	1.080	Sulfation at the 4-O position of GalNAc units (CS)
<i>Dse</i>	Mm00552923_m1	6773174	Yes	Yes	0.916	1.028	0.407	0.826	0.837	0.928	Epimerisation of GlcA unit into iduronic acid unit (IdoA) (CS)
<i>Glce</i>	Mm00473667_m1	6996191	Yes	Yes	0.059	1.280	0.189	1.175	0.086	1.385	Epimerisation of GlcA unit into iduronic acid unit (IdoA) (HS)
<i>Hs2st1</i>	Mm00478684_m1	6910088	Yes	Yes	0.080	1.553	0.453	1.178	0.195	1.504	Sulfation at the 2-O position of GlcA and IdoA units (HS)
<i>Hs3st1</i>	Mm01964038_s1	6937654	Yes	Yes	0.074	1.658	0.105	1.688	0.119	1.824	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st2</i>	Mm00616933_m1	6963989	Yes	Yes	0.951	1.017	0.215	1.380	0.934	0.967	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st3a1</i>	Mm00780907_s1	6781689	Yes	Yes	0.878	1.068	0.910	1.047	0.945	0.955	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st3b1</i>	Mm00479621_m1	6788991	Yes	Yes	0.683	1.178	0.253	1.634	0.511	1.432	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st5</i>	Mm01192940_m1	Not available*	No	Yes	Not available*		Not available*		Not available*		Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st6</i>	Mm01299930_m1	6849317	Yes	Yes	0.019	0.406	0.291	0.771	0.721	1.130	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs6st1</i>	Mm01229698_s1	6748605	Yes	Yes	0.610	1.095	0.808	1.046	0.982	1.007	Sulfation at the 6-O position of GlcNAc and N-sulfated-glucuronic acid units (GlcNS) (HS)
<i>Hs6st2</i>	Mm00479296_m1	7016808	Yes	Yes	0.004	6.417	0.012	5.609	0.041	3.080	Sulfation at the 6-O position of GlcNAc and GlcNS units (HS)
<i>Hs6st3</i>	Mm00479297_m1	6822138	Yes	Yes	0.170	1.305	0.197	1.319	0.897	1.041	Sulfation at the 6-O position of GlcNAc and GlcNS units (HS)
<i>Ndst1</i>	Mm00447005_m1	6865926	Yes	Yes	0.090	1.363	0.056	1.649	0.067	1.763	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
<i>Ndst2</i>	Mm00447818_m1	6823122	Yes	Yes	0.822	1.044	0.059	1.697	0.083	1.733	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
<i>Ndst3</i>	Mm00453178_m1	6908958	Yes	Yes	0.173	2.472	0.111	3.856	0.122	4.860	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
<i>Ndst4</i>	Mm00480767_m1	6901119	Yes	Yes	0.005	1.667	0.438	1.059	0.913	0.987	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
<i>Sulf1</i>	Mm00552283_m1	6747641	Yes	Yes	0.010	4.522	0.051	2.546	0.232	1.627	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
<i>Sulf2</i>	Mm00511193_m1	6893057	Yes	Yes	0.229	1.232	0.580	0.909	0.101	1.609	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
<i>Sumf1</i>	Mm00461213_m1	6956297	Yes	Yes	0.487	0.744	0.281	0.607	0.785	0.834	Cofactor for Sulf1 and Sulf2 (HS)
<i>Sumf2</i>	Mm01197721_m1	Not available*	Yes	Yes	Not available*		Not available*		Not available*		Cofactor for Sulf1 and Sulf2 (HS)
<i>Ust</i>	Mm00616790_m1	6771995	Yes	Yes	0.875	0.926	0.927	1.044	0.884	1.110	Sulfation at the 2-O position of GlcA and IdoA units (CS)

GAG chain degradation

Gene symbol	Taqman assay ID	Affymetrix ID	Present on		E14vsP90		E16vsP90		P1vsP90		Function
			Cart V1	Cart V2	Stepup	Fold change	Stepup	Fold change	Stepup	Fold change	
					P-value		P-value		P-value		
<i>Arsb</i>	Mm00802167_m1	6809030	Yes	Yes	0.519	1.139	0.360	1.214	0.808	0.925	Desulfation of the 4-O position of 4-O sulfated GalNAc units (CS)
<i>Arsj</i>	Mm00557970_m1	6901136	Yes	Yes	0.003	2.498	0.006	3.164	0.031	1.702	Desulfation of the 4-O position of 4-O sulfated GalNAc units (CS)
<i>Arsk</i>	Mm00513099_m1	6814451	Yes	Yes	0.368	0.784	0.102	0.543	0.514	0.779	Desulfation of proteoglycans, paralog of IDS
<i>Galns</i>	Mm00489575_m1	6985943	Yes	Yes	0.087	1.671	0.322	1.311	0.786	1.115	Desulfation of the 6-O position of 6-O sulfated GalNAc units (CS)
<i>Gns</i>	Mm00659592_m1	6771224	Yes	Yes	0.057	0.586	0.111	0.622	0.429	0.784	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
<i>Gusb</i>	Mm00446954_g1	6942192	Yes	Yes	0.923	0.971	0.499	0.832	0.843	0.918	Hydrolysis of GlcA from sugar chain (HS and Hyaluronic acid and CS)
<i>Hexa</i>	Mm00599877_m1	6989553	Yes	Yes	0.262	0.619	0.204	0.535	0.358	0.583	Hydrolysis of GalNAc units (CS) and GlcNAc units (hyaluronic acid) from sugar chain
<i>Hexb</i>	Mm00599880_m1	6815345	Yes	Yes	0.204	0.611	0.130	0.480	0.287	0.570	Hydrolysis of GalNAc units (CS) and GlcNAc units (hyaluronic acid) from sugar chain
<i>Hgsnat</i>	Mm00519485_m1	6981182	Yes	Yes	0.425	0.826	0.355	0.791	0.290	1.432	Acetylation of desulfated GlcNS units (HS)
<i>Hpse</i>	Mm00461768_m1	6940363	Yes	Yes	0.021	0.267	0.540	1.244	0.095	0.360	Degradation of HS chains extracellularly
<i>Hyal1</i>	Mm00476206_m1	6992224	Yes	Yes	0.003	0.154	0.011	0.222	0.041	0.402	Degradation of hyaluronic acid chain
<i>Hyal2</i>	Mm00477731_m1	6992221	Yes	Yes	0.410	1.167	0.653	0.918	0.610	1.149	Degradation of hyaluronic acid chain
<i>Hyal3</i>	Mm00662097_m1	6992228	Yes	Yes	0.499	0.892	0.166	1.329	0.599	1.137	Degradation of hyaluronic acid chain
<i>Ids</i>	Mm00494868_m1	7017419	Yes	Yes	0.292	0.752	0.161	0.630	0.629	0.826	Desulfation of 2-O sulfated IdoA and GlcA units (HS and CS)
<i>Idua</i>	Mm00515143_m1	6933337	Yes	Yes	0.089	0.689	0.259	0.790	0.721	0.904	Hydrolysis of IdoA unit from sugar chain (HS and CS)
<i>Mgea5</i>	Mm00452409_m1	6873365	Yes	Yes	0.893	0.935	0.973	1.017	0.968	0.969	Degradation of hyaluronic acid chain
<i>Naga</i>	Mm00476274_m1	6837368	Yes	Yes	0.071	0.544	0.110	0.550	0.531	0.782	Hydrolysis N-GalNAc moieties from glycoconjugates.
<i>Naglu</i>	Mm00479175_m1	6784237	Yes	Yes	0.182	0.569	0.202	0.551	0.537	0.704	Hydrolysis of GlcNAc from sugar chain (HS)
<i>Sgsh</i>	Mm00450747_m1	6792702	Yes	Yes	0.017	0.458	0.052	0.537	0.201	0.699	Desulfation of GlcNS units (HS)

Growth factors

Gene symbol	Taqman assay ID	Affymetrix ID	Present on		E14vsP90		E16vsP90		P1vsP90		Function
			Cart V1	Cart V2	Stepup	Fold change	Stepup	Fold change	Stepup	Fold change	
					P-value		P-value		P-value		
<i>Areg</i>	Mm00437583_m1	6932394	Yes	No	0.016	0.157	0.043	0.200	0.333	0.550	Amphiregulin **
<i>Bmp3</i>	Mm00557790_m1	6932718	Yes	No	0.280	1.392	0.067	2.381	0.100	2.365	Bone morphogenetic growth factor 3 **
<i>Bmp5</i>	Mm00432091_m1	6990569	Yes	No	0.001	7.247	0.141	1.191	0.688	1.057	Bone morphogenetic growth factor 5 **
<i>Ctgf</i>	Mm01192931_g1	6766623	Yes	Yes	0.148	0.729	0.025	0.366	0.068	0.485	Connective tissue growth factor, embryonic growth factor in skin development **
<i>Fgf10</i>	Mm00433275_m1	6810592	Yes	Yes	0.138	1.521	0.057	2.250	0.094	2.142	Fibroblast growth factor 10 **
<i>Fgf13</i>	Mm00438910_m1	7017134	Yes	Yes	0.012	2.998	0.075	1.824	0.296	1.391	Fibroblast growth factor 13 **
<i>Fgf2</i>	Mm01285715_m1	6896850	Yes	Yes	0.201	0.664	0.279	0.696	0.952	0.967	Fibroblast growth factor 2 **
<i>Fgf20</i>	Mm00748347_m1	6981854	Yes	No	0.659	1.228	0.125	2.483	0.777	1.220	Fibroblast growth factor 20 **
<i>Fgf22</i>	Mm00445749_m1	6769141	Yes	Yes	0.005	0.329	0.972	0.994	0.097	0.646	Fibroblast growth factor 22 **
<i>Fgf4</i>	Mm00438917_m1	Not available*	No	Yes	Not available*		Not available*		Not available*		Growth factor (Uijtdewilligen et al, 2013)**
<i>Fgf7</i>	Mm00433291_m1	6880900	Yes	Yes	0.531	0.740	0.078	0.286	0.212	0.418	Fibroblast growth factor 7 **
<i>Fgf8</i>	Mm00438921_m1	6873363	Yes	Yes	0.492	0.883	0.655	1.085	0.682	0.895	Fibroblast growth factor 8 **
<i>Fgf</i>	Mm01131929_m1	7015007	Yes	Yes	0.051	1.734	0.062	1.909	0.548	0.832	C-fos induced growth factor **
<i>Gdf10</i>	Mm03024279_s1	6818153	Yes	No	0.028	2.334	0.757	1.086	0.894	1.060	Growth differentiation factor 10 **
<i>Hbegf</i>	Mm00439305_g1	6864680	Yes	Yes	0.037	0.551	0.063	0.547	0.087	0.530	Heparin-binding epidermal growth factor **
<i>Hdgf</i>	Mm00725733_s1	6899028	Yes	No	0.104	1.246	0.575	1.070	0.409	1.147	Hepatoma-derived growth factor **
<i>Igf1</i>	Mm00439560_m1	6769597	Yes	No	0.235	0.631	0.173	0.537	0.398	0.641	Insulin-like growth factor 1 **
<i>Igf2</i>	Mm00439565_g1	6972317	Yes	Yes	0.001	59.615	0.002	55.864	0.002	52.364	Insulin-like growth factor 2 **
<i>Nog</i>	Mm01297833_s1	6790670	Yes	No	0.275	2.605	0.517	1.773	0.677	1.712	Noggin **
<i>Pdgfa</i>	Mm01205760_m1	6942654	Yes	Yes	0.028	2.013	0.035	2.347	0.057	2.338	Platelet-derived growth factor a **
<i>Pdgfb</i>	Mm01298578_m1	6837144	Yes	Yes	0.037	0.704	0.199	1.197	0.157	1.298	Platelet-derived growth factor b **
<i>Pdgfc</i>	Mm00480205_m1	6898686	Yes	Yes	0.019	2.152	0.035	2.207	0.902	1.042	Platelet-derived growth factor c **
<i>Pdgfd</i>	Mm00546829_m1	6986677	Yes	Yes	0.925	0.952	0.191	0.504	0.790	1.205	Platelet-derived growth factor d **
<i>Shh</i>	Mm00436527_m1	6936889	Yes	Yes	0.448	0.595	0.308	2.117	0.152	4.571	Sonic hedgehog **
<i>Tgfb1</i>	Mm01178820_m1	6959236	Yes	Yes	0.106	0.552	0.241	0.653	0.975	0.981	Transforming growth factor beta 1 **
<i>Tgfb2</i>	Mm01321739_m1	6764953	Yes	Yes	0.057	2.441	0.448	1.335	0.264	1.802	Transforming growth factor beta 2 **
<i>Tgfb3</i>	Mm01307950_m1	6802449	Yes	Yes	0.026	2.386	0.238	1.408	0.100	2.077	Transforming growth factor beta 3 **
<i>Vegfa</i>	Mm01281447_m1	6855659	Yes	Yes	0.779	0.875	0.721	1.174	0.940	1.061	Vascular endothelial growth factor a **
<i>Vegfb</i>	Mm00442102_m1	6871273	Yes	Yes	0.008	1.461	0.031	1.318	0.060	1.277	Vascular endothelial growth factor b **
<i>Vegfc</i>	Mm00437313_m1	6976200	Yes	Yes	0.088	2.120	0.477	1.316	0.316	1.700	Vascular endothelial growth factor c **
<i>Wnt10b</i>	Mm00442104_m1	6838399	Yes	No	0.629	1.280	0.120	2.812	0.240	2.325	Wingless-related integration site 10b **
<i>Wnt16</i>	Mm00446420_m1	6944581	Yes	No	0.358	1.180	0.026	2.402	0.093	1.710	Wingless-related integration site 16 **
<i>Wnt2</i>	Mm00470018_m1	6951974	Yes	No	0.057	3.047	0.082	3.260	0.122	3.219	Wingless-related integration site 2 **
<i>Wnt2b</i>	Mm00437330_m1	6907887	Yes	No	0.009	2.189	0.024	2.030	0.077	1.590	Wingless-related integration site 2b **
<i>Wnt3a</i>	Mm00437337_m1	6788662	Yes	No	0.457	1.199	0.103	1.728	0.684	1.159	Wingless-related integration site 3a **
<i>Wnt6</i>	Mm00437353_m1	6750567	Yes	No	0.011	3.166	0.032	2.668	0.064	2.352	Wingless-related integration site 6 **
<i>Wnt7a</i>	Mm00437355_m1	6955539	Yes	No	0.060	2.117	0.131	1.865	0.395	1.456	Wingless-related integration site 7a **
<i>Wnt7b</i>	Mm00437357_m1	6837582	Yes	No	0.072	2.297	0.050	3.623	0.237	1.912	Wingless-related integration site 7b **

Putatively involved

Gene symbol	Taqman assay ID	Affymetrix ID	Present on		E14vsP90		E16vsP90		P1vsP90		Function
			Cart V1	Cart V2	Stepup P-value	Fold change	Stepup P-value	Fold change	Stepup P-value	Fold change	
<i>Arsa</i>	Mm00802173_g1	6837827	Yes	Yes	0.445	0.741	0.876	0.936	0.710	0.805	Desulfation of cerebroside
<i>Arsrg</i>	Mm00546931_m1	6784787	Yes	Yes	0.041	0.616	0.094	0.665	0.885	1.043	Paralog of Arsa
<i>B3galnt1</i>	Mm00480272_s1	6905897	Yes	No	0.069	2.109	0.411	1.331	0.629	1.269	Transferring UDP-GalNAc or UDP-GlcNAc to N-GlcNAc, Galactose or N-GalNAc
<i>B4galnt3</i>	Mm01189804_m1	6956937	Yes	No	0.012	0.411	0.064	0.591	0.111	0.619	Transferring UDP-GalNAc or UDP-GlcNAc to N-GlcNAc, Galactose or N-GalNAc
<i>B4galnt4</i>	Mm00625968_g1	6965153	Yes	No	0.018	3.370	0.519	1.221	0.739	1.166	Transferring UDP-GalNAc or UDP-GlcNAc to N-GlcNAc, Galactose or N-GalNAc
<i>C1galt1</i>	Mm00473986_m1	6943991	Yes	Yes	0.296	0.634	0.176	0.494	0.519	0.674	Transferring UDP-Gal to N-GalNAc.
<i>C1galt1c1</i>	Mm00480676_m1	7016427	Yes	Yes	0.845	1.117	0.533	0.727	0.706	0.753	C1GALT1-specific chaperone 1
<i>Chst1</i>	Mm00517855_m1	6879140	Yes	Yes	0.207	1.301	0.034	2.281	0.143	1.591	Involved in sulfation of keratan sulfate
<i>Gla</i>	Mm00516323_m1	7019519	Yes	Yes	0.290	0.548	0.149	0.361	0.520	0.598	Hydrolysis of galactose units
<i>Glb1</i>	Mm00515342_m1	6992632	Yes	Yes	0.411	1.327	0.393	1.359	0.973	0.979	Hydrolysis of galactose units
<i>Glb1l2</i>	Mm00464245_m1	6994133	Yes	Yes	0.011	0.128	0.069	0.319	0.100	0.319	Hydrolysis of galactose units
<i>Gnpda1</i>	Mm01254913_g1	6864789	Yes	Yes	0.545	0.817	0.545	0.815	0.633	0.793	Conversion of GlcNAc-6-P into fructose-6-P
<i>Gnpda2</i>	Mm00503573_m1	6938963	Yes	Yes	0.991	1.006	0.237	0.609	0.939	1.053	Conversion of GlcNAc-6-P into fructose-6-P
<i>Khk</i>	Mm00434647_m1	6929655	Yes	No	0.424	0.814	0.427	0.809	0.739	1.140	Phosphorylating fructose to fructose-1-P
<i>Kl</i>	Mm00502002_m1	6935777	Yes	Yes	0.489	1.055	0.031	1.411	0.977	1.004	Putative glucuronidase
<i>Klb</i>	Mm00473122_m1	6931257	Yes	Yes	0.013	0.341	0.988	0.996	0.113	1.827	Putative glucuronidase
<i>Renbp</i>	Mm00491720_m1	7017604	Yes	No	0.717	0.778	0.394	0.557	0.853	0.818	Concersion of N-GlcNAc to N-acetylmannosamine
<i>Slc17a5</i>	Mm00555344_m1	6997114	Yes	Yes	0.013	0.738	0.028	0.733	0.165	0.870	Transport of GlcA from lysosome to cytoplasm
<i>Slc26a3</i>	Mm00445313_m1	6794219	Yes	No	0.036	0.818	0.411	0.944	0.166	0.867	Transferring chloride ions across the cell membrane in exchange for bicarbonate ions
<i>Slc26a4</i>	Mm00442308_m1	6799842	Yes	No	0.042	0.861	0.153	1.101	0.368	0.935	Transferring chloride ions across the cell membrane
<i>Slc26a5</i>	Mm00446145_m1	6936587	Yes	Yes	0.929	0.984	0.194	1.258	0.703	1.089	Protein functions as a molecular motor in motile outer hair cells of the cochlea
<i>Slc35a1</i>	Mm00442341_m1	6920732	Yes	Yes	0.034	1.984	0.960	0.987	0.602	0.843	Putative CMP-Sialic Acid Transporter
<i>Ugt8a</i>	Mm00495930_m1	6909083	Yes	Yes	0.961	1.005	0.107	0.840	0.298	0.890	Transferring galactose to ceramide

* Some genes were *not available* on the used exon array version.

Supplementary data table 6: Differentially expressed genes found using Taqman low density arrays for the *Glce* knockout and HSP β Tg mouse compared to wildtype.

Production of precursors

Gene symbol	Taqman Assay ID	GLCE knockout mouse			HPSEtg mouse			Function	
		Reference gene	P-value	Relative fold expression	Reference gene	P-value	Relative fold expression		
<i>Adpgk</i>	Mm00511302_m1	<i>18SRNA</i>	0.629	0.718	<i>Tbp</i>	0.409	0.318	Phosphorylation of glucose into glucose-6-P	
<i>Gale</i>	Mm00617772_g1	<i>18SRNA</i>	0.742	0.887	<i>Tbp</i>	0.503	1.628	Conversion of UDP-GlcNAc to UDP-GalNAc	
<i>Galk1</i>	Mm00444182_m1	<i>18SRNA</i>	0.700	0.838	<i>Tbp</i>	0.314	1.495	Phosphorylation of Galactose into Galactose-1-P	
<i>Galk2</i>	Mm00613268_m1	<i>18SRNA</i>	0.552	0.772	<i>Tbp</i>	0.964	1.023	Phosphorylation of N-Acetylgalactosamine (GalNAc) into GalNAc-1P)	
<i>Galt</i>	Mm00489459_g1	<i>18SRNA</i>	0.299	1.485	<i>Tbp</i>	0.616	0.744	UDP-activation of Glucose-1-P and Galactose-1-P	
<i>Gck</i>	Mm00439129_m1		<i>Not detected</i>			<i>Not detected</i>		Phosphorylation of glucose into glucose-6-P	
<i>Gfpt1</i>	Mm00600127_m1	<i>18SRNA</i>	0.130	0.611	<i>Tbp</i>	0.768	0.800	Conversion of fructose-6-P into glucosamine-6-P (Glc-6-P)	
<i>Gfpt2</i>	Mm00496565_m1	<i>18SRNA</i>	<i>0.080</i>	<i>1.629</i>	<i>Tbp</i>	0.433	0.701	Conversion of fructose-6-P into Glc-6-P	
<i>Gnpnat1</i>	Mm00834602_mH	<i>18SRNA</i>	0.033	0.468	<i>Tbp</i>	0.295	0.713	Conversion of Glc-6-P into N-Acetylglucosamine-6-P (GlcNAc-6-P)	
<i>Gpi1</i>	Mm02026122_g1	<i>18SRNA</i>	0.438	1.286	<i>ActB</i>	0.530	1.406	Isomerisation of glucose-6-P into fructose-6-P	
<i>Hk1</i>	Mm00439344_m1	<i>18SRNA</i>	0.563	0.857	<i>Tbp</i>	0.475	0.625	Phosphorylation of glucose into glucose-6-P	
<i>Hk2</i>	Mm00443385_m1	<i>18SRNA</i>	0.369	1.420	<i>Tbp</i>	0.345	0.342	Phosphorylation of glucose into glucose-6-P	
<i>Miox</i>	Mm00480214_m1		<i>Not detected</i>			<i>Not detected</i>		Conversion of Myo-inositol into UDP-GlcA	
<i>Nagk</i>	Mm00479878_m1	<i>18SRNA</i>	0.554	0.818	<i>Tbp</i>	0.683	1.221	Phosphorylation of GlcNAc to GlcNAc-6-P	
<i>Papss1</i>	Mm00442283_m1	<i>18SRNA</i>	0.319	0.646	<i>Tbp</i>	0.873	1.068	Synthesis of PAPS complex	
<i>Papss2</i>	Mm00442295_m1	<i>18SRNA</i>	0.100	0.566	<i>Tbp</i>	0.492	0.641	Synthesis of PAPS complex	
<i>Pgm1</i>	Mm00804141_m1	<i>18SRNA</i>	<i>0.011</i>	<i>0.681</i>	<i>Tbp</i>	0.145	0.292	Conversion of glucose-6-P into glucose-1-P	
<i>Pgm2</i>	Mm00728285_s1	<i>18SRNA</i>	0.114	2.758	<i>ActB</i>	0.977	1.034	Conversion of glucose-6-P into glucose-1-P	
<i>Pgm3</i>	Mm00459270_m1	<i>18SRNA</i>	0.210	0.631	<i>Tbp</i>	0.763	0.840	Conversion of GlcNAc-6-P into GlcNAc-1-P	
<i>Pgm5</i>	Mm00723432_m1	<i>18SRNA</i>	0.703	0.867	<i>Tbp</i>	0.617	0.596	Conversion of glucose-6-P into glucose-1-P	
<i>Slc13a1</i>	Mm00490339_m1		<i>Not detected</i>			<i>Not detected</i>		Transport of sulphate from the extracellular space to cytoplasm	
<i>Slc13a4</i>	Mm00556495_m1		<i>Not detected</i>			<i>Not detected</i>		Transport of sulphate from the extracellular space to cytoplasm	
<i>Slc13a5</i>	Mm01334459_m1		<i>Not detected</i>			<i>Not detected</i>		Transport of sulphate from the extracellular space to cytoplasm	
<i>Slc26a11</i>	Mm00626632_m1	<i>18SRNA</i>	0.762	1.069	<i>Tbp</i>	0.679	1.511	Transport of sulphate from the extracellular space to cytoplasm	
<i>Slc26a2</i>	Mm00432896_m1		<i>Not detected</i>			<i>Not detected</i>		Transport of sulphate from the extracellular space to cytoplasm	
<i>Slc26a6</i>	Mm00506742_m1	<i>18SRNA</i>	0.803	0.953	<i>Tbp</i>	0.236	2.217	Transport of sulphate from the extracellular space to cytoplasm	
<i>Slc26a7</i>	Mm00524162_m1	<i>18SRNA</i>	0.269	0.465	<i>Tbp</i>	0.751	1.509	Transport of sulphate from the extracellular space to cytoplasm	
<i>Slc26a8</i>	Mm00524836_m1		<i>Not detected</i>			<i>Not detected</i>		Transport of sulphate from the extracellular space to cytoplasm	
<i>Slc26a9</i>	Mm00628490_m1	<i>18SRNA</i>	0.726	0.898		<i>Not detected</i>		Transport of sulphate from the extracellular space to cytoplasm	
<i>Slc2a1</i>	Mm01192270_m1	<i>18SRNA</i>	0.413	1.423	<i>Tbp</i>	0.439	0.476	Sugar transport across plasma membrane	
<i>Slc2a10</i>	Mm00453716_m1	<i>18SRNA</i>	0.684	0.619	<i>Tbp</i>	0.927	0.912	Sugar transport across plasma membrane	
<i>Slc2a12</i>	Mm00619244_m1	<i>18SRNA</i>	0.888	1.072	<i>Tbp</i>	0.872	0.820	Sugar transport across plasma membrane	
<i>Slc2a2</i>	Mm00446230_g1		<i>Not detected</i>			<i>Not detected</i>		Sugar transport across plasma membrane	
<i>Slc2a3</i>	Mm00441483_m1	<i>18SRNA</i>	0.581	1.493		<i>Not detected</i>		Sugar transport across plasma membrane	
<i>Slc2a4</i>	Mm01245507_g1	<i>18SRNA</i>	0.086	2.526	<i>Tbp</i>	0.656	0.540	Sugar transport across plasma membrane	
<i>Slc2a5</i>	Mm00600311_m1		<i>Not detected</i>			<i>Tbp</i>	0.961	1.065	Sugar transport across plasma membrane
<i>Slc2a6</i>	Mm00554217_m1	<i>18SRNA</i>	0.553	0.596	<i>Tbp</i>	0.892	0.875	Sugar transport across plasma membrane	
<i>Slc2a8</i>	Mm00444634_m1	<i>18SRNA</i>	<i>0.078</i>	<i>1.981</i>	<i>Tbp</i>	0.411	0.435	Sugar transport across plasma membrane	
<i>Slc2a9</i>	Mm01211147_m1	<i>18SRNA</i>	0.185	0.499	<i>Tbp</i>	0.775	1.122	Sugar transport across plasma membrane	

<i>Slc35a2</i>	Mm00446504_m1	<i>18SRNA</i>	0.600	0.867	<i>Tbp</i>	0.992	1.008	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
<i>Slc35a3</i>	Mm00523288_m1	<i>18SRNA</i>	0.240	0.584	<i>Tbp</i>	0.408	0.502	Transport from cytoplasm to Golgi system of UDP-GlcNAc
<i>Slc35a4</i>	Mm00782997_s1	<i>18SRNA</i>	0.600	1.277	<i>Tbp</i>	0.527	1.312	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
<i>Slc35b1</i>	Mm00450258_m1	<i>18SRNA</i>	0.615	0.879	<i>Tbp</i>	0.883	1.067	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-Galactose
<i>Slc35b2</i>	Mm01269910_m1	<i>18SRNA</i>	0.912	0.970	<i>Tbp</i>	0.388	0.661	Transport of PAPS complexes from cytoplasm to Golgi system
<i>Slc35b3</i>	Mm00506268_m1	<i>18SRNA</i>	0.299	0.337	<i>Tbp</i>	0.256	2.218	Transport of PAPS complexes from cytoplasm to Golgi system
<i>Slc35b4</i>	Mm00480588_m1	<i>18SRNA</i>	0.074	0.507	<i>Tbp</i>	0.437	0.391	Transport from cytoplasm to Golgi system of UDP-GlcNAc and UDP-Xylose
<i>Slc35d1</i>	Mm00624959_m1	<i>18SRNA</i>	0.153	0.738	<i>Tbp</i>	0.868	1.097	Transport from cytoplasm to Golgi system of UDP-GalNAc and UDP-GlcA
<i>Slc35d2</i>	Mm01304830_m1	<i>18SRNA</i>	0.971	0.975	<i>Tbp</i>	0.406	1.235	Transport from cytoplasm to Golgi system of UDP-GlcNAc
<i>Slc35d3</i>	Mm01717003_m1		<i>Not detected</i>			<i>Not detected</i>		Paralog of <i>Slc35d1</i>
<i>Uap1</i>	Mm00769477_m1	<i>18SRNA</i>	0.777	1.107	<i>Tbp</i>	0.952	1.043	UDP-activation of GlcNAc-1-P and GalNAc-1-P
<i>Ugdh</i>	Mm00447643_m1	<i>18SRNA</i>	0.499	0.682	<i>Tbp</i>	0.578	1.451	Conversion of UDP-glucose into UDP-glucuronic acid (UDP-GlcA)
<i>Ugp2</i>	Mm00454826_m1	<i>18SRNA</i>	0.650	0.848	<i>Tbp</i>	0.979	1.021	UDP-activation of Glucose-1-P
<i>Uxs1</i>	Mm00550735_m1	<i>18SRNA</i>	0.163	0.584	<i>Tbp</i>	0.577	0.825	Conversion of UDP-GlcA into UDP-xylose

Core proteins

Gene symbol	Taqman Assay ID	GLCE knockout mouse			HPSEtg mouse			Function
		Reference gene	P-value	Relative fold expression	Reference gene	P-value	Relative fold expression	
<i>Acan</i>	Mm00545807_m1	<i>18SRNA</i>	0.005	0.242	<i>Tbp</i>	0.055	2.478	Proteoglycan carrying CS or DS
<i>Agrn</i>	Mm01264855_m1	<i>18SRNA</i>	0.639	0.885	<i>Tbp</i>	0.834	1.145	Proteoglycan carrying HS present in ECM
<i>Aspn</i>	Mm00445945_m1	<i>18SRNA</i>	0.010	0.382	<i>Tbp</i>	0.704	0.709	Proteoglycan carrying CS or DS
<i>Bcan</i>	Mm00476090_m1		<i>Not detected</i>			<i>Not detected</i>		Proteoglycan carrying CS or DS
<i>Bgn</i>	Mm00455918_m1	<i>18SRNA</i>	0.721	0.802	<i>Tbp</i>	0.564	0.640	Proteoglycan carrying CS or DS
<i>Cd44</i>	Mm01277164_m1	<i>18SRNA</i>	0.337	0.567	<i>Tbp</i>	0.609	0.818	Proteoglycan carrying HS and hyaluronic acid on cell surface
<i>Col18a1</i>	Mm00487131_m1	<i>18SRNA</i>	0.893	1.029	<i>Tbp</i>	0.344	0.563	Proteoglycan carrying HS present in basement membrane
<i>Col9a2</i>	Mm00483872_m1	<i>18SRNA</i>	0.444	2.241		<i>Not detected</i>		Proteoglycan carrying CS or DS
<i>Cspg4</i>	Mm00507256_m1	<i>18SRNA</i>	0.707	0.870	<i>Tbp</i>	0.718	0.740	Proteoglycan carrying CS or DS
<i>Cspg5</i>	Mm00516549_m1	<i>18SRNA</i>	0.469	0.670	<i>Tbp</i>	0.369	0.001	Proteoglycan carrying CS or DS
<i>Dcn</i>	Mm03003496_s1	<i>18SRNA</i>	0.561	0.680	<i>ActB</i>	0.517	1.547	Proteoglycan carrying CS or DS
<i>Epyc</i>	Mm00514611_m1		<i>Not detected</i>			<i>Not detected</i>		Proteoglycan carrying CS or DS
<i>Gpc1</i>	Mm00497305_m1	<i>18SRNA</i>	0.662	0.855	<i>Tbp</i>	0.326	0.373	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc2</i>	Mm00549650_m1	<i>18SRNA</i>	0.959	0.960		<i>Not detected</i>		Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc3</i>	Mm00516722_m1	<i>18SRNA</i>	0.740	0.883	<i>Tbp</i>	0.876	1.086	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc4</i>	Mm00515035_m1	<i>18SRNA</i>	0.517	0.777	<i>Tbp</i>	0.516	0.708	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc5</i>	Mm00615599_m1		<i>Not detected</i>					Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Gpc6</i>	Mm00516235_m1	<i>18SRNA</i>	0.140	0.628	<i>Tbp</i>	0.345	0.605	Proteoglycan carrying HS present on cell surface via GPI-anchor
<i>Hmmr</i>	Mm00469183_m1	<i>18SRNA</i>	0.271	0.507	<i>Tbp</i>	0.230	0.739	Hyaluronan-Mediated Motility Receptor
<i>Hspg2</i>	Mm01181165_m1	<i>18SRNA</i>	0.934	1.029	<i>Tbp</i>	0.629	0.679	Proteoglycan carrying HS present in ECM
<i>Ncan</i>	Mm00484007_m1		<i>Not detected</i>			<i>Not detected</i>		Proteoglycan carrying CS or DS
<i>Sdc1</i>	Mm00448918_m1	<i>18SRNA</i>	0.435	0.691	<i>Tbp</i>	0.448	0.452	Proteoglycan carrying HS present on cell surface
<i>Sdc2</i>	Mm00484718_m1	<i>18SRNA</i>	0.145	0.624	<i>Tbp</i>	0.909	0.929	Proteoglycan carrying HS present on cell surface
<i>Sdc3</i>	Mm01179831_m1	<i>18SRNA</i>	0.851	1.065	<i>Tbp</i>	0.534	0.682	Proteoglycan carrying HS present on cell surface
<i>Sdc4</i>	Mm00488527_m1	<i>18SRNA</i>	0.513	0.779	<i>ActB</i>	0.032	1.291	Proteoglycan carrying HS present on cell surface
<i>Smc3</i>	Mm00484015_m1	<i>18SRNA</i>	0.681	0.692	<i>Tbp</i>	0.788	1.244	Proteoglycan carrying CS or DS
<i>Srgn</i>	Mm01169070_m1	<i>18SRNA</i>	0.417	0.680	<i>Tbp</i>	0.809	0.846	Proteoglycan carrying CS or DS
<i>Vcan</i>	Mm01283063_m1	<i>18SRNA</i>	0.928	1.023	<i>Tbp</i>	0.641	0.875	Proteoglycan carrying CS or DS

Preparation of linkage region

Gene symbol	Taqman Assay ID	GLCE knockout mouse			HPSEtg mouse			Function
		Reference gene	P-value	Relative fold expression	Reference gene	P-value	Relative fold expression	
<i>B3galt6</i>	Mm00504458_s1	<i>18SRNA</i>	0.472	0.688	<i>Tbp</i>	0.291	0.630	Transferring UDP-galactose to galactose-xylose on proteoglycan
<i>B3gat1</i>	Mm00661499_m1		<i>Not detected</i>			<i>Not detected</i>		Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
<i>B3gat2</i>	Mm00549042_m1		<i>Not detected</i>			<i>Not detected</i>		Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
<i>B3gat3</i>	Mm00470389_m1	<i>18SRNA</i>	0.287	1.317	<i>Tbp</i>	0.755	0.850	Transferring UDP-GlcA to galactose-galactose-xylose on proteoglycan
<i>B4galt2</i>	Mm00479556_m1	<i>18SRNA</i>	0.865	0.948	<i>Tbp</i>	0.858	0.913	Transferring UDP-galactose to GlcNAc, Glc, and Xyl.
<i>B4galt7</i>	Mm00461357_m1	<i>18SRNA</i>	0.989	1.004	<i>Tbp</i>	0.834	0.816	Transferring UDP-galactose to xylose on proteoglycan
<i>Xylt1</i>	Mm00558690_m1	<i>18SRNA</i>	0.976	0.982	<i>Tbp</i>	0.990	1.007	Transferring UDP-xylose to proteoglycan
<i>Xylt2</i>	Mm00461181_m1	<i>18SRNA</i>	0.814	0.957	<i>Tbp</i>	0.879	0.912	Transferring UDP-xylose to proteoglycan

Glycosaminoglycan chain polymerisation

Gene symbol	Taqman Assay ID	GLCE knockout mouse			HPSEtg mouse			Function
		Reference gene	P-value	Relative fold expression	Reference gene	P-value	Relative fold expression	
<i>Chpf</i>	Mm01262239_g1	<i>18SRNA</i>	0.711	1.153	<i>Tbp</i>	0.941	0.942	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
<i>Chsy1</i>	Mm01319178_m1	<i>18SRNA</i>	0.983	1.005	<i>Tbp</i>	0.944	1.022	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
<i>Chsy3</i>	Mm01545329_m1	<i>18SRNA</i>	0.995	0.997	<i>Tbp</i>	0.869	1.086	Transferring UDP-GlcA to GalNAc at end of sugar chain (CS)
<i>Csgalnact1</i>	Mm00555164_m1	<i>18SRNA</i>	0.661	0.783	<i>Tbp</i>	0.203	0.506	Transferring UDP-GalNAc to GlcA at end of sugar chain (CS)
<i>Csgalnact2</i>	Mm00513340_m1	<i>18SRNA</i>	0.049	0.431	<i>Tbp</i>	0.845	0.858	Transferring UDP-GalNAc to GlcA at end of sugar chain (CS)
<i>Ext1</i>	Mm00468769_m1	<i>18SRNA</i>	0.590	0.826	<i>Tbp</i>	0.943	1.024	Transferring UDP-GlcNAc to GlcA at end of sugar chain (HS)
<i>Ext2</i>	Mm00468775_m1	<i>18SRNA</i>	0.634	0.852	<i>Tbp</i>	0.579	0.626	Transferring UDP-GlcNAc to GlcA at end of sugar chain (HS)
<i>Extl1</i>	Mm00621977_s1	<i>18SRNA</i>	0.519	1.269	<i>Tbp</i>	0.347	1.426	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
<i>Extl2</i>	Mm00469621_m1	<i>18SRNA</i>	0.377	0.703	<i>Tbp</i>	0.819	0.773	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
<i>Extl3</i>	Mm00516994_m1	<i>18SRNA</i>	0.467	0.825	<i>Tbp</i>	0.318	0.482	Transferring UDP-GlcA to GlcNAc at end of sugar chain (HS)
<i>Has1</i>	Mm00468496_m1	<i>18SRNA</i>	0.996	0.999	<i>Tbp</i>	0.395	0.000	Polymerisation of hyaluronic acid
<i>Has2</i>	Mm00515089_m1	<i>18SRNA</i>	0.158	0.538	<i>Tbp</i>	0.900	0.871	Polymerisation of hyaluronic acid
<i>Has3</i>	Mm00515091_m1	<i>18SRNA</i>	0.800	0.745		<i>Not detected</i>		Polymerisation of hyaluronic acid

Glycosaminoglycan chain modification

Gene symbol	Taqman Assay ID	GLCE knockout mouse			HPSEtg mouse			Function
		Reference gene	P-value	Relative fold expression	Reference gene	P-value	Relative fold expression	
<i>Chst11</i>	Mm00517563_m1	<i>18SRNA</i>	0.273	0.815	<i>Tbp</i>	0.789	0.794	Sulfation at the 4-O position of GalNAc units (CS)
<i>Chst12</i>	Mm00546416_s1	<i>18SRNA</i>	0.593	1.273	<i>Tbp</i>	0.938	0.948	Sulfation at the 4-O position of GalNAc units (CS)
<i>Chst13</i>	Mm01186255_s1		<i>Not detected</i>			<i>Not detected</i>		Sulfation at the 4-O position of GalNAc units (CS)
<i>Chst14</i>	Mm00511291_s1	<i>18SRNA</i>	0.633	0.812	<i>Tbp</i>	0.784	1.146	Sulfation at the 4-O position of GalNAc units (CS)
<i>Chst15</i>	Mm00513227_m1	<i>18SRNA</i>	0.946	0.982	<i>Tbp</i>	0.560	0.555	Sulfation at the 6-O position of GalNAc units (CS)
<i>Chst2</i>	Mm00490018_g1	<i>18SRNA</i>	0.774	1.228	<i>Tbp</i>	0.692	1.809	Sulfation at the 6-O position of GalNAc units (CS)
<i>Chst3</i>	Mm00489736_m1	<i>18SRNA</i>	0.674	1.266	<i>Tbp</i>	0.864	0.784	Sulfation at the 6-O position of GalNAc units (CS)
<i>Chst5</i>	Mm00517342_m1		<i>Not detected</i>			<i>Not detected</i>		Sulfation at the 6-O position of GalNAc units (CS)
<i>Chst7</i>	Mm00491466_m1	<i>18SRNA</i>	0.952	1.030	<i>Tbp</i>	0.991	1.011	Sulfation at the 6-O position of GalNAc units (CS)
<i>Chst8</i>	Mm00558321_m1	<i>18SRNA</i>	0.737	0.805		<i>Not detected</i>		Sulfation at the 4-O position of GalNAc units (CS)
<i>Chst9</i>	Mm01722279_m1		<i>Not detected</i>			<i>Not detected</i>		Sulfation at the 4-O position of GalNAc units (CS)
<i>Dse</i>	Mm00552923_m1	<i>18SRNA</i>	0.249	0.566	<i>Tbp</i>	0.454	0.559	Epimerisation of GlcA unit into iduronic acid unit (IdoA) (CS)
<i>Glce</i>	Mm00473667_m1	<i>18SRNA</i>	0.013	0.079	<i>Tbp</i>	0.550	0.700	Epimerisation of GlcA unit into iduronic acid unit (IdoA) (HS)
<i>Hs2st1</i>	Mm00478684_m1	<i>18SRNA</i>	0.072	0.530	<i>Tbp</i>	0.605	0.803	Sulfation at the 2-O position of GlcA and IdoA units (HS)
<i>Hs3st1</i>	Mm01964038_s1	<i>18SRNA</i>	0.019	0.571	<i>Tbp</i>	0.335	0.679	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st2</i>	Mm00616933_m1		<i>Not detected</i>			<i>Not detected</i>		Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st3a1</i>	Mm00780907_s1	<i>18SRNA</i>	0.032	1.742	<i>Tbp</i>	0.868	1.108	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st3b1</i>	Mm00479621_m1	<i>18SRNA</i>	0.673	0.883	<i>Tbp</i>	0.672	0.675	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st5</i>	Mm01192940_m1		<i>Not detected</i>			<i>Not detected</i>		Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs3st6</i>	Mm01299930_m1	<i>18SRNA</i>	0.409	0.655	<i>Tbp</i>	0.174	1.727	Sulfation at the 3-O position of GlcNAc and GlcNS units sulfated at the 6-O position (HS)
<i>Hs6st1</i>	Mm01229698_s1	<i>18SRNA</i>	0.981	0.983	<i>Tbp</i>	0.791	1.076	Sulfation at the 6-O position of GlcNAc and N-sulfated-glucuronic acid units (GlcNS) (HS)
<i>Hs6st2</i>	Mm00479296_m1	<i>18SRNA</i>	0.492	1.316	<i>Tbp</i>	0.309	0.606	Sulfation at the 6-O position of GlcNAc and GlcNS units (HS)
<i>Hs6st3</i>	Mm00479297_m1		<i>Not detected</i>			<i>Not detected</i>		Sulfation at the 6-O position of GlcNAc and GlcNS units (HS)
<i>Ndst1</i>	Mm00447005_m1	<i>18SRNA</i>	0.445	0.831	<i>Tbp</i>	0.420	0.507	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
<i>Ndst2</i>	Mm00447818_m1	<i>18SRNA</i>	0.916	1.052	<i>Tbp</i>	0.643	0.689	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
<i>Ndst3</i>	Mm00453178_m1	<i>18SRNA</i>	0.773	0.877	<i>Tbp</i>	0.503	2.028	N-de-acetylation and N-sulfation of GlcNAc unit (HS)
<i>Ndst4</i>	Mm00480767_m1		<i>Not detected</i>			<i>Not detected</i>		N-de-acetylation and N-sulfation of GlcNAc unit (HS)
<i>Sulf1</i>	Mm00552283_m1	<i>18SRNA</i>	0.324	1.358	<i>Tbp</i>	0.883	1.140	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
<i>Sulf2</i>	Mm01248026_m1	<i>18SRNA</i>	0.380	0.642	<i>Tbp</i>	0.770	1.107	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
<i>Sumf1</i>	Mm00461213_m1	<i>18SRNA</i>	0.311	0.638	<i>Tbp</i>	0.758	0.859	Cofactor for Sulf1 and Sulf 2 (HS)
<i>Sumf2</i>	Mm01197721_m1	<i>18SRNA</i>	0.993	1.004	<i>Tbp</i>	0.763	0.850	Cofactor for Sulf1 and Sulf 2 (HS)
<i>Ust</i>	Mm00616790_m1	<i>18SRNA</i>	0.447	0.684	<i>Tbp</i>	0.754	1.382	Sulfation at the 2-O position of GlcA and IdoA units (CS)

Glycosaminoglycan chain degradation

Gene symbol	Taqman Assay ID	GLCE knockout mouse			HPSEtg mouse			Function
		Reference gene	P-value	Relative fold expression	Reference gene	P-value	Relative fold expression	
<i>Arsb</i>	Mm00503655_s1	<i>18SRNA</i>	0.840	0.904	<i>Tbp</i>	0.703	1.340	Desulfation of the 4-O position of 4-O sulfated GalNAc units (CS)
<i>Arsj</i>	Mm00557970_m1	<i>18SRNA</i>	0.788	0.916		<i>Not detected</i>		Desulfation of the 4-O position of 4-O sulfated GalNAc units (CS)
<i>Arsk</i>	Mm00513099_m1	<i>18SRNA</i>	0.417	0.556	<i>Tbp</i>	0.776	1.330	Desulfation of proteoglycans, paralog of IDS
<i>Galns</i>	Mm00489576_m1	<i>18SRNA</i>	0.795	0.920	<i>Tbp</i>	0.589	0.566	Desulfation of the 6-O position of 6-O sulfated GalNAc units (CS)
<i>Gns</i>	Mm00659592_m1	<i>18SRNA</i>	0.889	0.935	<i>Tbp</i>	0.572	0.657	Desulfation of the 6-O position of 6-O sulfated GlcNAc and GlcNS units (HS)
<i>Gusb</i>	Mm01197698_m1	<i>18SRNA</i>	0.404	0.747	<i>Tbp</i>	0.876	0.886	Hydrolysis of GlcA from sugar chain (HS and Hyaluronic acid and CS)
<i>Hexa</i>	Mm00599877_m1	<i>18SRNA</i>	0.850	0.894	<i>Tbp</i>	0.667	1.542	Hydrolysis of GalNAc units (CS) and GlcNAc units (hyaluronic acid) from sugar chain
<i>Hexb</i>	Mm00599880_m1	<i>18SRNA</i>	0.536	0.831	<i>Tbp</i>	0.251	0.591	Hydrolysis of GalNAc units (CS) and GlcNAc units (hyaluronic acid) from sugar chain
<i>Hgsnat</i>	Mm00519485_m1	<i>18SRNA</i>	0.850	1.077	<i>Tbp</i>	0.717	0.869	Acetylation of desulfated GlcNS units (HS)
<i>Hpse</i>	Mm00461768_m1	<i>18SRNA</i>	0.622	0.850	<i>Tbp</i>	0.310	0.479	Degradation of HS chains extracellularly
<i>Hyal2</i>	Mm00477731_m1	<i>18SRNA</i>	0.936	1.040	<i>Tbp</i>	0.411	0.429	Degradation of hyaluronic acid chain
<i>Hyal3</i>	Mm00662097_m1		<i>Not detected</i>		<i>Not detected</i>			Degradation of hyaluronic acid chain
<i>Ids</i>	Mm00494868_m1	<i>18SRNA</i>	0.880	0.949	<i>Tbp</i>	0.433	0.497	Desulfation of 2-O sulfated IdoA and GlcA units (HS and CS)
<i>Idua</i>	Mm00515143_m1	<i>18SRNA</i>	0.662	1.309	<i>Tbp</i>	0.512	0.535	Hydrolysis of IdoA unit from sugar chain (HS and CS)
<i>Mgea5</i>	Mm00452409_m1	<i>18SRNA</i>	0.287	0.687	<i>Tbp</i>	0.525	0.633	Degradation of hyaluronic acid chain
<i>Naga</i>	Mm00476274_m1	<i>18SRNA</i>	0.562	1.215	<i>Tbp</i>	0.802	0.877	Hydrolysis N-GalNAc moieties from glycoconjugates.
<i>Naglu</i>	Mm00479175_m1	<i>18SRNA</i>	0.820	0.880	<i>Tbp</i>	0.462	0.393	Hydrolysis of GlcNAc from sugar chain (HS)
<i>Nat6;Hyal1</i>	Mm00480053_m1	<i>18SRNA</i>	0.743	0.871	<i>Tbp</i>	0.444	0.440	Degradation of hyaluronic acid chain
<i>Sgsh</i>	Mm00450747_m1	<i>18SRNA</i>	0.400	0.715	<i>Tbp</i>	0.297	0.524	Desulfation of GlcNS units (HS)

Growth factors

Gene symbol	Taqman Assay ID	GLCE knockout mouse			HPSEtg mouse			Function
		Reference gene	P-value	Relative fold expression	Reference gene	P-value	Relative fold expression	
<i>Ctgf</i>	Mm01192933_g1	18SRNA	0.172	0.508	<i>Tbp</i>	0.693	0.810	Connective tissue growth factor, embryonic growth factor in skin development **
<i>Fgf10</i>	Mm00433275_m1	18SRNA	0.121	1.291	<i>Tbp</i>	0.606	0.797	Fibroblast growth factor 10 **
<i>Fgf2</i>	Mm01285715_m1	18SRNA	0.139	0.908	<i>Tbp</i>	0.983	0.980	Fibroblast growth factor 2 **
<i>Fgf4</i>	Mm00438917_m1		Not detected		Not detected			Growth factor (Uijtewilligen et al, 2013)**
<i>Fgf7</i>	Mm00433291_m1	18SRNA	0.151	0.725	<i>Tbp</i>	0.539	0.681	Fibroblast growth factor 7 **
<i>Fgf8</i>	Mm00438921_m1		Not detected		Not detected			Fibroblast growth factor 8 **
<i>Figf</i>	Mm01131929_m1	18SRNA	0.117	1.412	<i>Tbp</i>	0.777	0.796	C-fos induced growth factor **
<i>Hbegf</i>	Mm00439305_g1	18SRNA	0.150	0.719	<i>Tbp</i>	0.652	0.633	Heparin-binding epidermal growth factor **
<i>Pdgfa</i>	Mm01205760_m1	18SRNA	0.129	1.081	<i>Tbp</i>	0.202	1.459	Platelet-derived growth factor a **
<i>Pdgfb</i>	Mm01298578_m1	18SRNA	0.122	1.267	<i>Tbp</i>	0.986	0.987	Platelet-derived growth factor b **
<i>Pdgfc</i>	Mm03053266_s1	18SRNA	0.139	0.919	<i>Tbp</i>	0.831	0.811	Platelet-derived growth factor c **
<i>Pdgfd</i>	Mm00546829_m1	18SRNA	0.114	1.579	<i>Tbp</i>	0.344	0.592	Platelet-derived growth factor d **
<i>Shh</i>	Mm00436527_m1	18SRNA	0.139	0.918	<i>Tbp</i>	0.506	2.393	Sonic hedgehog **
<i>Tgfb1</i>	Mm01178819_m1	18SRNA	0.157	0.704	<i>Tbp</i>	0.924	0.956	Transforming growth factor beta 1 **
<i>Tgfb2</i>	Mm01321739_m1	18SRNA	0.161	0.627	<i>Tbp</i>	0.808	0.832	Transforming growth factor beta 2 **
<i>Tgfb3</i>	Mm01307950_m1	18SRNA	0.133	1.019	<i>Tbp</i>	0.588	0.706	Transforming growth factor beta 3 **
<i>Vegfa</i>	Mm01281449_m1	18SRNA	0.108	1.683	<i>Tbp</i>	0.810	1.233	Vascular endothelial growth factor a **
<i>Vegfb</i>	Mm00442102_m1	18SRNA	0.105	1.693	<i>Tbp</i>	0.746	1.376	Vascular endothelial growth factor b **
<i>Vegfc</i>	Mm01202432_m1	18SRNA	0.135	0.981	<i>Tbp</i>	0.758	0.771	Vascular endothelial growth factor c **

Putatively involved

Gene symbol	Taqman Assay ID	GLCE knockout mouse			HPSEtg mouse			Function
		Reference gene	P-value	Relative fold expression	Reference gene	P-value	Relative fold expression	
<i>18S</i>	Hs99999901_s1	Reference gene			Reference gene			Reference gene
<i>Actb</i>	Mm00607939_s1	Reference gene			Reference gene			Reference gene
<i>Arsa</i>	Mm00802173_g1	<i>18SRNA</i>	0.336	1.195	<i>Tbp</i>	0.775	0.738	Desulfation of cerebroside
<i>Arsq</i>	Mm00546931_m1	<i>18SRNA</i>	0.945	0.982	<i>Tbp</i>	0.895	1.079	Paralog of Arsa
<i>C1galt1</i>	Mm00473986_m1	<i>18SRNA</i>	0.046	0.521	<i>Tbp</i>	0.549	0.736	Transferring UDP-Gal to N-GalNAc.
<i>C1galt1c1</i>	Mm00480676_m1	<i>18SRNA</i>	0.176	0.510	<i>Tbp</i>	0.841	0.899	C1GALT1-specific chaperone 1
<i>Chst1</i>	Mm00517855_m1	<i>18SRNA</i>	0.817	1.043	<i>Tbp</i>	0.512	0.496	Involved in sulfation of keratan sulfate
<i>Gapdh</i>	Mm03302249_g1	Reference gene			Reference gene			Reference gene
<i>Gla</i>	Mm00516323_m1	<i>18SRNA</i>	0.156	0.753	<i>Tbp</i>	0.127	0.536	Hydrolysis of galactose units
<i>Glb1</i>	Mm00515342_m1	<i>18SRNA</i>	0.518	1.169	<i>Tbp</i>	0.447	0.578	Hydrolysis of galactose units
<i>Glb1l2</i>	Mm00464245_m1	<i>18SRNA</i>	0.548	1.180	<i>Tbp</i>	0.435	0.357	Hydrolysis of galactose units
<i>Gnpda1;Gm8615</i>	Mm01254913_g1	<i>18SRNA</i>	0.402	1.218	<i>Tbp</i>	0.324	0.455	Conversion of GlcNAc-6-P into fructose-6-P
<i>Gnpda2</i>	Mm00503573_m1	<i>18SRNA</i>	0.001	0.641	<i>Tbp</i>	0.174	0.485	Conversion of GlcNAc-6-P into fructose-6-P
<i>Hprt1</i>	Mm01324427_m1	Reference gene			Reference gene			Reference gene
<i>Kl</i>	Mm00502002_m1	<i>18SRNA</i>	0.488	1.579	Not detected			Putative glucuronidase
<i>Klb</i>	Mm00473122_m1	<i>18SRNA</i>	0.557	4.164	<i>Tbp</i>	0.455	1.714	Putative glucuronidase
<i>Slc17a5</i>	Mm00555344_m1	<i>18SRNA</i>	0.827	0.939	<i>Tbp</i>	0.662	0.758	Transport of GlcA from lysosome to cytoplasm
<i>Slc35a1</i>	Mm00442341_m1	<i>18SRNA</i>	0.008	0.536	<i>Tbp</i>	0.840	0.901	Putative CMP-Sialic Acid Transporter
<i>Tbp</i>	Mm01277042_m1	Reference gene			Reference gene			Reference gene
<i>Ugt8a</i>	Mm00495930_m1	<i>18SRNA</i>	0.411	0.628	<i>Tbp</i>	0.312	2.966	Transferring galactose to ceramide

* Glc, glucosamine; GlcNAc, N-acetylated glucosamine; Gal, galactosamine; GalNAc, N-acetylated galactosamine; GlcA, glucuronic acid; IdoA, iduronic acid. **Uijtdewilligen *et al.*, 2016.

Genes, for which a signal was not or only partly detected at a given timepoint or multiple timepoints and therefore a fold change and/or p-value could not be calculated based on the available data, are given as 'not detected'. Gene symbol for which all timepoints were classified as 'not detected' do not show a reference gene due to lack of data for a calculation.