

Table S1. List of primers used for qRT-PCR

Gene	Forward primers (5'-3')	Reverse primers (5'-3')
<i>36B4</i>	CCTCGTGGAAGTGACATCGT	ATCTGCTTGGAGCCCACATT
<i>GAL3ST1</i>	AACCACATGCGCTTCCACTA	GTCTTGCAGGAAGTCGGTCA
<i>HK2</i>	AGACGAGAGTTTCCTGGTCTC	GATGGCCTTCCGGATCAGAG
<i>PGK1</i>	AGCGGGTCGTTATGAGAGTC	TGGGACAGCAGCCTTAATCC
<i>HIF1A</i>	TCACCTGAGCCTAATAGTCC	AAATGGGTTCTTTGCTTCTG
<i>ZO-1</i>	AGGGGCAGTGGTGGTTTTCTGTTCTTC	GCAGAGGTCAAAGTTCAAGGCTCAAGAGG
<i>OCN</i>	TCAGGGAATATCCACCTATCACTTCAG	CATCAGCAGCAGCCATGTACTCTTCAC
<i>E-cadherin</i>	CACCTGGAGAGAGGCCGCGT	AACGGAGGCCTGATGGGGCG
<i>CLDN-1</i>	GGGCTGCAGCTGTTGGGCTT	GGG TTG CTT GCA ATG TGC TGC T
<i>Fibronectin</i>	CAGTGGGAGACCTCGAGAAG	GTCCCTCGGAACATCAGAAA
<i>Vimentin</i>	GAGAACTTTGCCGTTGAAGC	TCCAGCAGCTTCCTGTAGGT

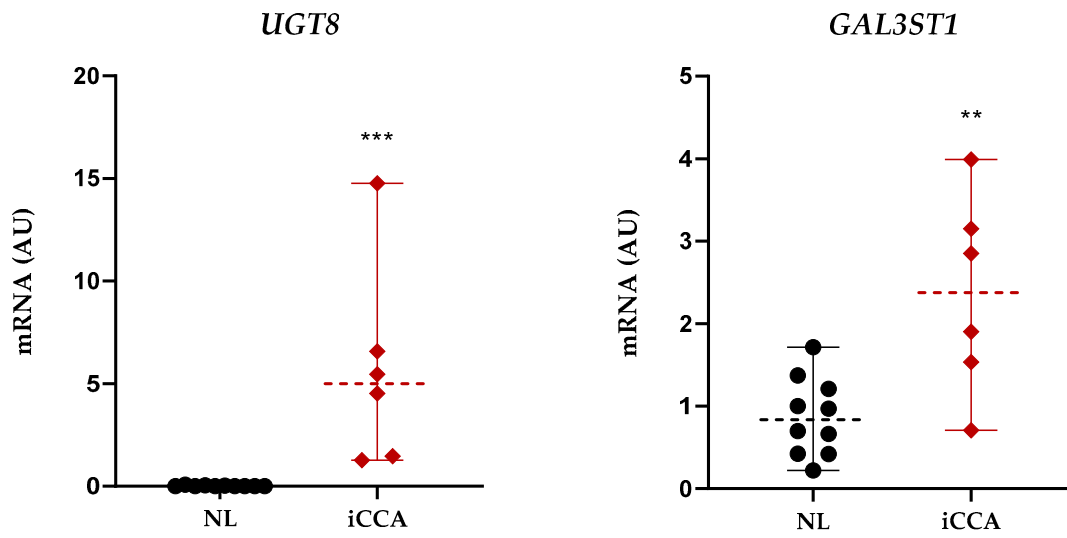


Figure S1A. UGT8 and GAL3ST1 expression in human iCCA tumor specimens. Relative mRNA levels of *UGT8* and *GAL3ST1* in intrahepatic CCA (iCCA) tissue ($n = 6$) compared to non-malignant liver (NL) tissue ($n = 10$). Data are shown as median with range ** $p < 0.01$, *** $p < 0.001$.

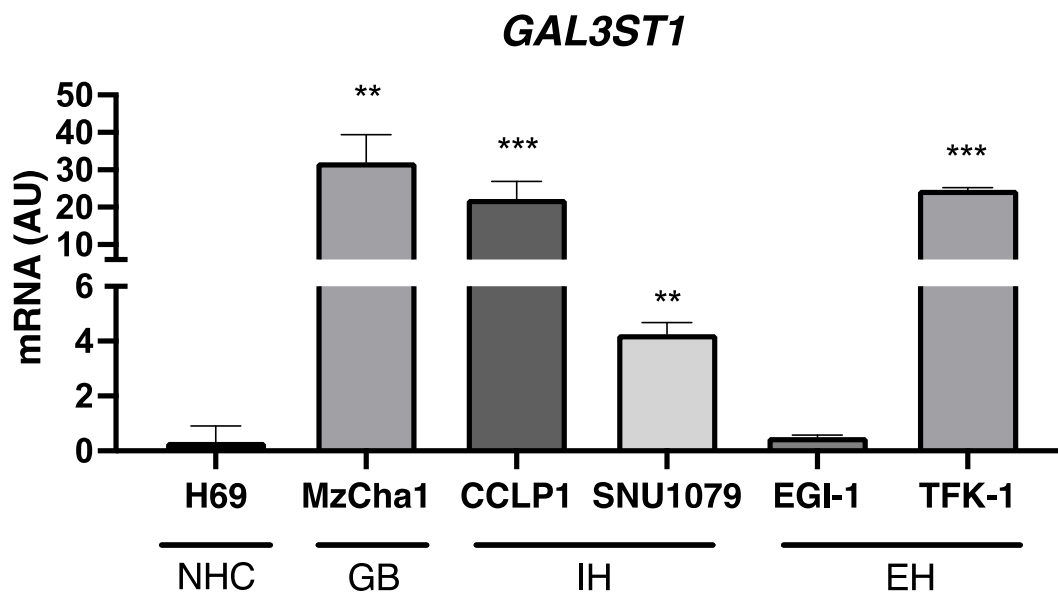
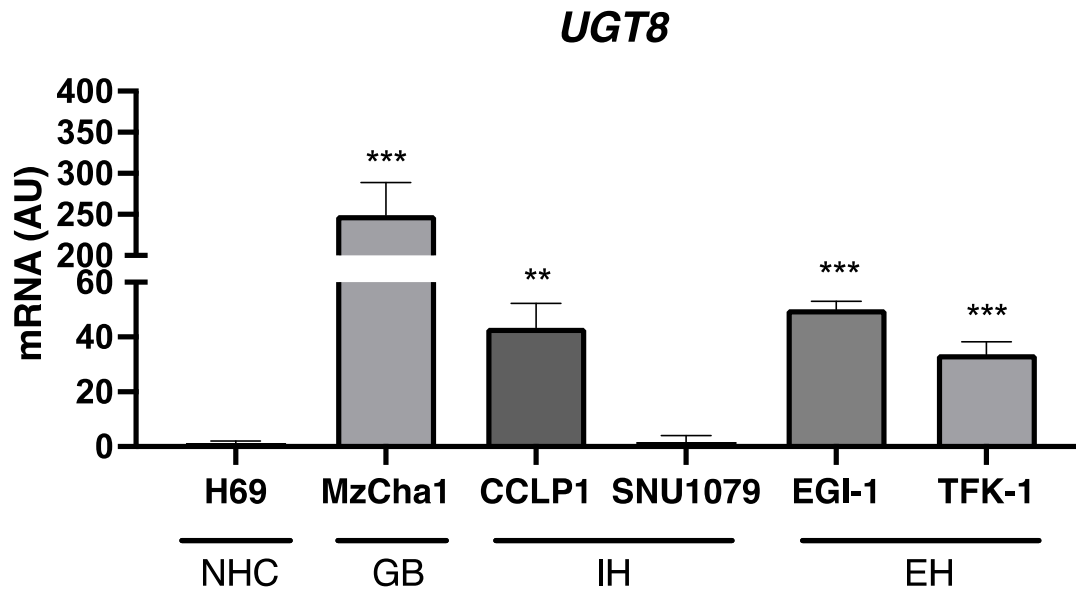


Figure S1B. *UGT8* and *GAL3ST1* expression in human CCA cell lines. Relative mRNA levels of *UGT8* and *GAL3ST1* in human CCA cell lines, including extrahepatic (EH) CCA (TFK1, EGI-1), intrahepatic (IH) CCA (CCLP1, SNU1079), and gallbladder (GB) carcinoma (Mz-Cha-1) cell lines compared to normal human cholangiocyte (NHC) cell line (H69). Data are shown as mean \pm SD. ** $p < 0.01$, *** $p < 0.001$ vs. H69.

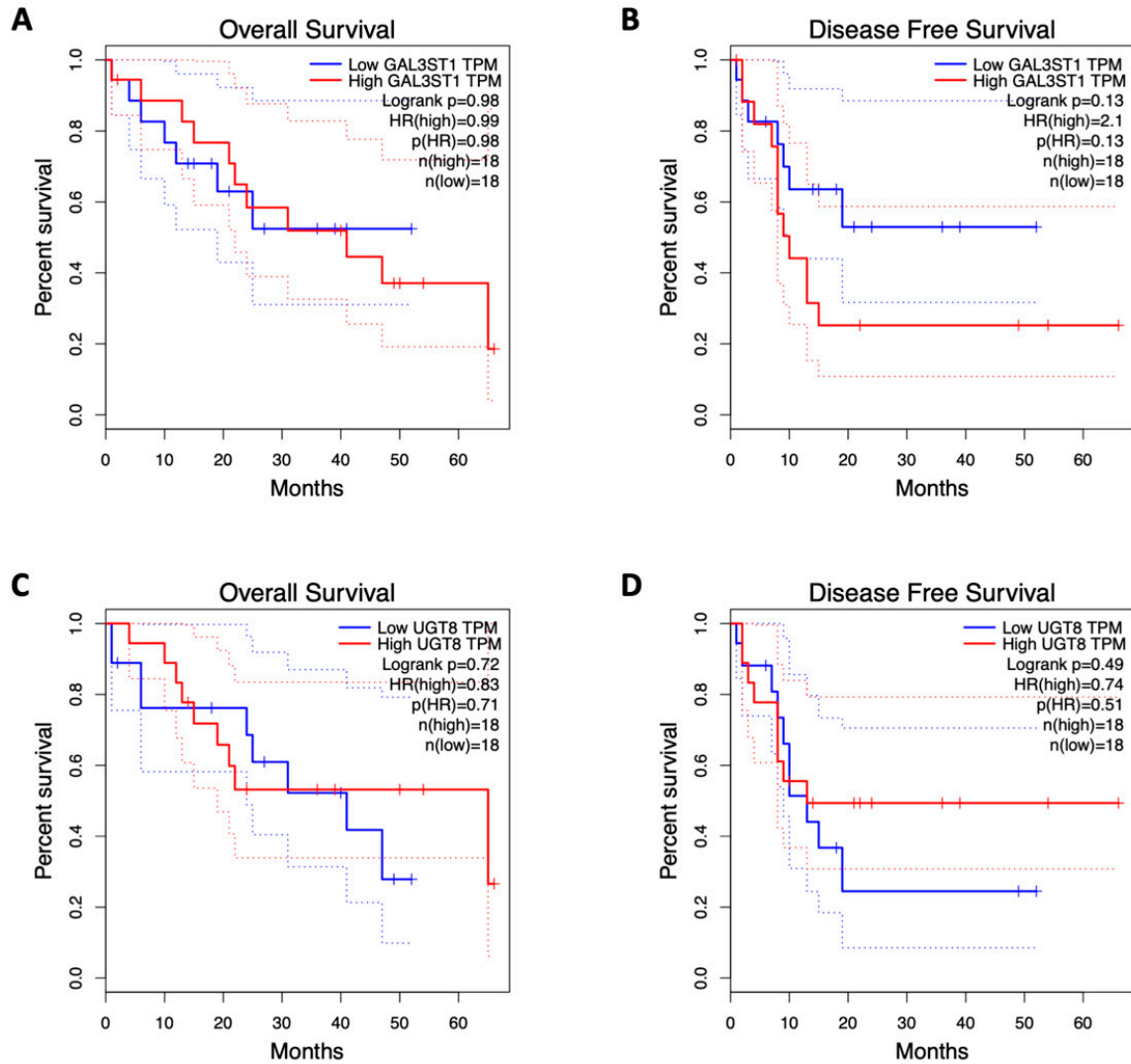


Figure S1C. Overall survival (OS) analysis and disease free survival (RFS) analysis of *GAL3ST1* (A and B) and *UGT8* (C and D) with GEPIA database. Patients were divided into high and low expression groups based on the median expression level of each gene.; Each group contains 18 patients ($n = 18$).

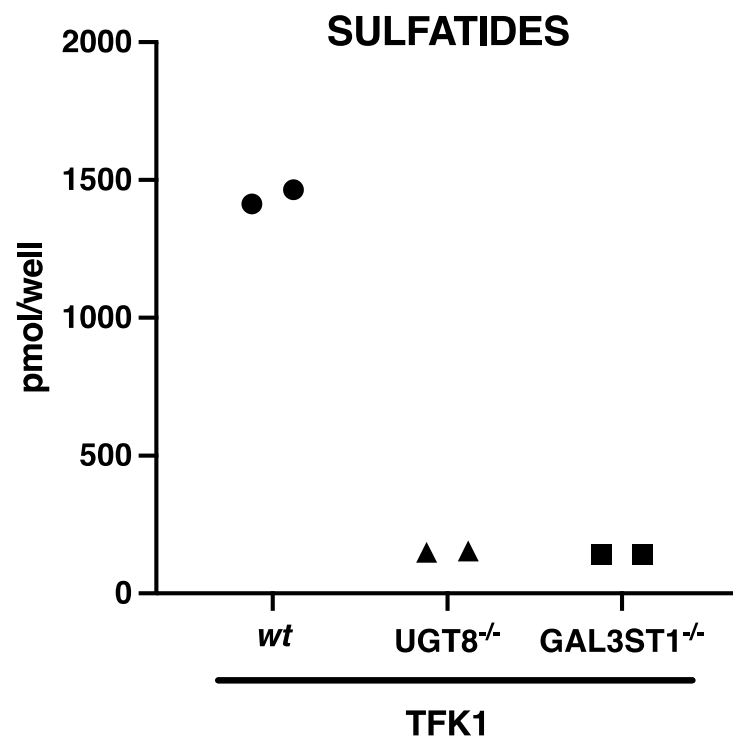


Figure S2. Sulfatide levels in TFK1 *wt*, *UGT8*^{-/-} and *GAL3ST1*^{-/-} cells. Total sulfatide levels were determined by LC-MS analysis of cell lysates of TFK1 *wt*, *UGT8*^{-/-} and *GAL3ST1*^{-/-} cells; *n* = 2.