

Supplementary Table 4. Liver diseases-associated genes

AIH-associated genes	PSC-associated genes	MASLD-associated genes	ALC-associated genes	HCC-associated genes
RBM45	MST1	TM6SF2	TNF	CTNNB1
HLA-DRB1	ABCB4	PNPLA3	CXCL8	TP53
TNF	UBASH3A	CYP2E1	CCL5	AXIN1
CYP2D6	TCF4	SIRT1	STS	EGF
CTLA4	BCL2L11	FGF21	SULT1E1	PDGFRL
GPT	NOS2	LEP	DDC	PIK3CA
SEPSECS	GPR35	NFE2L2	CSF3	TSC1
IL10	HIF1A	PPARA	ALB	TSC2
AMELX	IL2RA	ADIPOQ	IL22	CASP8
IL2RA	SH2B3	NR1H4	CCL2	AFP
PSC	ACAD8	PPARD	TLR4	MIR122
ISG20	MMEL1	SREBF1	PNPLA3	SLC5A5
FOXP3	PRKD2	LDLR	FOXO1	LDHA
IFNG	PUS10	XBP1	SIRT1	TNF
VDR	RBM45	CAT	IL1A	GPC3
AIRE	SIK2	FAS	CXCR2	MIR204
HLA-DPB1	ATXN2	GNMT	IL17A	MIR33A
IL4	PHLDB1	PEMT	ITGB2	MMP9
PDCD1	BSN	CPT1A	PIK3CA	ATM
TPMT	RMI2	NR5A2	PIK3CB	MEG3
ENAM	HDAC7	TGFB1	PIK3CD	MIR503
IL2	CFTR	AHR	PIK3CG	SPP1
ACTB	HLA-DRB1	GSTM1	ACKR3	TERT
FTCD	KIAA1109	GSTP1	ACTB	VEGFA
HLA-A	MIR4435-2HG	IL1A	CCL4	MIR1247
PTPN22	RIC8B	JAK2	BRCA1	MIR1307
LGALS3BP	CD226	PRKCA	SYK	TMED7-TICAM2
HPGDS	GPBAR1	ABCC2	LINC01093	HOTTIP
HLA-DRB4	HLA-B	KLB	EBI3	LINC-ROR
HLA-DRB3	MICA	ACE	CDKN2B	PCBP2-OT1
HLA-DOA	FUT2	ALDH2	UBD	YAP1
HLA-DQB1	IL2	GSTT1	MRPL28	KAT5
CD28	TNF	PTEN	KHDRBS1	ZNRD2
IL17A	PSC	CD14	MTCO2P12	DCTN6
LOC107987479	CCR5	NQO1	SUB1	MTCO2P12
CYP1A2	DLAT	FOLR2	H3P9	HPSE
IL1B	HLA-DQA1	GSTA1	NOSTRIN	OGFR
IL6	HLA-DRB3	IL4	TRIM69	NUDT6
CD274	MET	LIF	CSF3R	CYTOR
TBX21	IL10	PKD4	TICAM1	H3P23
RETN	ALB	PRKCD	CYP7A1	CCR7

Supplementary Table 4. Continued

AIH-associated genes	PSC-associated genes	MASLD-associated genes	ALC-associated genes	HCC-associated genes
FH	HLA-C	PRKCE	AGA	ADH1C
MIR223	NR1H4	VLDLR	DNMT1	CYP2B6
GEM	GP2	ADH1A	DNMT3B	E2F1
GSTT1	FBN2	ADH1B	ECE1	EGFR
CXCR1	NLRP3	ADH4	NUP62	ALB
IL5	NOTCH1	CSF2	GAPDH	F2
CXCL10	CD28	CYP1A2	GC	ALDH1A1
MIF	MMP3	CYP17A1	GCG	FGFR4
HLA-C	CDKN2A	AHCY	SLC17A5	TPX2
IL1RN	LOC102724197	F2	NXT1	TBC1D9
KIR3DL1	GGTLC1	ALDH1A1	GTF2H1	SULF1
LGALS9	FGF19	ALDH1B1	HGF	MTOR
IFNB1	GPT	B3GAT1	HLA-B	G6PD
HAMP	LOXL2	EIF2AK1	HNF4A	BBC3
ALB	CD14	LAMA1	APOA1	GLI2
HAVCR2	PTGS2	IL3	ICAM1	ABO
FAS	HAMP	MMP1	HCAR2	H2AZ1
DLAT	STAT4	SERPINB2	IFNA1	HGF
CYP2D7	SLC17A5	ABCB4	IFNA13	HIF1A
MLKL	PYCARD	PRF1	IL1B	HLA-A
TRIM21	CXCL8	PRKACA	IL1RN	HSPA5
SH2B3	ICAM1	TRIB3	IL6	IFI27
GATA3	DEFB4B	RAG2	IL10	APRT
PPIG	HP	RDX	IRF3	TICAM2
TNFAIP8L2	IL21	TNFRSF1B	IRF7	IL2
UMOD	HLA-DQB1	IKBKG	ITPR3	IL6
YY1	FOXP3	STC2	CCL4L1	AQP9
GOLM1	IL6	ALDH4A1	UFSP1	CD82
PDC	ETS1	SCARB1	MIRLET7B	MALAT1
JAM3	HLA-A	GCKR	MIR132	KDR
CASP1	CEACAM5	ATP5F1B	MIR141	ACAT1
PDCD1LG2	IFNG	NCAN	MIR148A	MIRLET7B
KRT20	TLR4	PARVB	MIR182	MIR10B
CDR3	ARSA	SAMM50	MIR192	MIR125A
OGT	VDR	FDFT1	MIR21	MIR146A
CD40LG	CASP3	PTPRD	MIR29C	MIR149
CD200	EGFR	ZGLP1	MIR30E	MIR183
ASPH	TLR9	PPARGC1A	MIR34A	MIR20A
MS4A1	NR1I2	NLRP3	EPCAM	MIR21
NFE2L2	PNPLA3	OSBPL5	MIF	MIR23A
OCA2	STS	COL13A1	MIP	MIR29A

Supplementary Table 4. Continued

AIH-associated genes	PSC-associated genes	MASLD-associated genes	ALC-associated genes	HCC-associated genes
MSC	TNFSF10	CRP	MMP7	MIR34A
NOX4	MAPK3	DPP4	COX2	MIR34B
IL22	MIR200B	ERBB4	MYC	MIR17HG
CD1D	H3P10	FBL	MYD88	MAT1A
IL33	DEFB4A	ALB	ATF3	MCL1
TNFRSF14	TP53	EHP1L1	NAIP	MFAP1
CD74	RLN2	GCG	NM	MIR346
TSHR	NEUROG3	SLC17A5	DCTN4	COX2
NUDT15	MIR483	GGT1	TLR7	MTHFR
C4A	KRT20	GLP1R	TNFRSF12A	OGG1
ACTA1	POLR2G	GPT	UFC1	PCA3
IL21	PPARA	HFE	SIRT6	PBX3
MAP3K7	IL22	APOC3	UFM1	TMED7
KLHL12	AICDA	IGF1	PMCH	GOLM1
STXBP2	USE1	IL1B	TLR9	PDGFRA
STAT4	ABCB1	IL6	PPARG	EEF1AKNMT
RORC	RETN	KRT18	PRNP	PDK4
RPS20	PIK3CD	LEPR	PTX3	ENPP2
SLC2A3	ADGRB3	LIPA	RELA	RTEL1
S100B	PSG2	MIR122	MIR483	PGF
CXCL12	PDZK1	MIR21	S100A4	ABCB1
IL25	MAPK1	MIR34A	CCL3	SERPINA1
TRBV20OR9-2	BCL2	MTTP	CXCL11	ATR
PTPRC	WDR11	PIK3CA	CIDEA	UGT1A7
TG	BCL2L1	PIK3CB	TRA2B	UGT1A9
TRAF6	IL23A	PIK3CD	GORASP1	XAF1
NR2C2	BCL3	PIK3CG	WNK1	ASAP3
RNPC3	HLA-DPB1	PPARG	SMPD1	URGCP
WDR11	TM6SF2	GATAD2A	SPP1	PSMD9
MYDGF	CUZD1	PRKAA1	SYT1	PTGS2
TPO	S100A8	PRKAA2	ADAM17	MIR490
KLHL1	S100A12	PRKAB1	TCF4	PYCR1
TNFAIP3	CFLAR	RBP4	TGFB1	CCND1
TLR3	TNFRSF25	SCD	TLR2	BCL2
TLR2	SOCS1	SHBG	TLR3	ALX4
TGFB1	ABCB11	SLC5A2	TNFRSF1A	GAS5
S100A1	AOC3	GGTLC5P	TP53	SERPINB3
HHIP	RSPO3	SP4	POTEF	SERPINB4
ARSA	SARNP	SREBF2	UCP2	CCL2
ADA	JAM3	TLR4	CXCR4	NCAPG
KLF14	ARID1A	TNF	TFEB	BLVRA

Supplementary Table 4. Continued

AIH-associated genes	PSC-associated genes	MASLD-associated genes	ALC-associated genes	HCC-associated genes
CRP	GATD3A	GGTLC3	GSDMD	ST6GAL1
IL34	HSPB3	GGT2	CAV1	SOX1
CYP2B6	NOL3	GGTLC4P	IL18R1	SOX2
CYP2C19	KMT2B	CNBP	SQSTM1	STIM1
CYP2C9	CD68	MBOAT7	CD14	TAGLN
CYP2E1	CD47	EHMT1	CCL4L2	BTG1
CYP3A4	CD40LG	ACTR5	CD69	TGFB1
DCK	PTGES	ZNF512	CD74	HULC
DNASE1	ENTPD1	CRACR2A	CDK1	CCR2
ATN1	GRAP2	PLPP7	FGF19	VCAM1
PGAM5	MS4A1	PWWP3A	CYP2E1	VHL
FBL	DLG5	TP63	SOD2	XRCC1
FANCC	XPR1	DDX60L	MPO	DEK
KLRK1	MADCAM1	XPR1	TM6SF2	SUV39H2
SLCO6A1	AGBL2	CD36	MBOAT7	TFPI2
IL17RE	SPTBN1	CREB5	CAT	TET1
TEC	SPP1	FGF19	MIR885	PNPLA3
SYCE1L	SOD2	AHSG	MIR3615	ENC1
CD24	SLC10A2	FASN	COL3A1	RUNX3
KLRC4-KLRK1	UBE2Z	GABPA	MIR17	TNKS
ABCC4	NOD2	GH1	MIR93	EIF3I
TNIP1	SDC1	LBP	SMAD3	PROM1
FGL2	CCL25	LGALS3BP	MMP2	MTG1
BTG3	CCL21	HAMP	MIR338	SLC9A3R1
RIPK3	CCL20	REN	MIR423	KIF20B
CHRNA4	SRY	NR1H3	MIR193B	CD151
NLRP3	SLC9A3R1	CYP3A4	BCL2	FGF19
FCRL3	NEIL1	FABP1	MIR484	MET
CCR3	AIMP2	SIRT3	MIR421	SLC22A18
CCR7	VIM	HNF4A	MIR532	ALDOB
ABCC2	TXNRD1	HSD17B13	MIR589	APC
MPRIP	TXN	IL17A	MIR629	BTRC
SMUG1	CCR2	MLXIPL	TIMP1	CABIN1
GABPA	C3	CCL2	MMP13	CD34
IFNA2	TFF3	LOC102724197	PLAU	CD80
IFNA13	TERC	AGTR1	PPP1R16B	CD81
IL1A	SULT2A1	MTOR	SUGP1	CDKN1B
FASLG	CFB	FETUB	ADH1B	CXCL10
IL4R	PAEP	APOE	ADH1C	FGL1
IL7R	RNF19A	PON1	ALDH2	GRAP2
CXCL8	ABCD1	RETN	AKR1A1	GSTM1

Supplementary Table 4. Continued

AIH-associated genes	PSC-associated genes	MASLD-associated genes	ALC-associated genes	HCC-associated genes
IL13	FBL	RARRES2	GSTM1	HLA-DPB1
IDO1	AKT1	UCP2	NAT2	HLA-DQA1
INS	ERBB2	NR0B2	GPC3	HLA-DQB1
INPP5D	ELK1	GGTLC1	CXCL1	HLA-DRB1
GSTK1	JAG1	DECRI	GSTP1	IFNAR1
KIR2DS1	SLC26A3	PCSK9	HLA-A	IFNAR2
C6orf120	DNASE1	ACACA	APOE	IL12RB1
MIR143	AGA	HMGB1	AVP	IL18
IFNA1	AFP	APOB	STAT3	IL18R1
HSPD1	F3	IL10	PSC	IL1B
GATA2	PTK2B	LPL	CALCOCO2	IL2RB
GCG	KLRK1	MIR192	PIAS3	IL4
SLC17A5	TXN2	MTHFR	CEL	LTBP2
IL37	GABPA	SERPINE1	RIPK3	MASP2
IL17C	FUT3	ANGPTL8	CHI3L1	MBL2
GLI2	ABCA4	SOD1	ADH4	MT1X
GPR39	KCNH4	TP53	ADH5	MX1
NR3C1	WWC1	VDR	NCAN	NFKB1
GSTM1	TBC1D9	IRS2	CSTB	PLA2G12B
GSTM2	FOXO3	TRIB1	CTLA4	PTK2
CARD10	FOXO1	TXNIP	CTNNB1	RB1
ICOS	PDZD2	PLIN2	CYBB	SPARC
HK1	DEFB1	CNR1	CYP1A1	STAT3
HLA-B	DDC	CYBB	CYP2C19	STAT5A
HRAS	DCT	AKT1	CYP4A11	TERF1
MIR155	BTG3	ABCD1	ACE	TERF2
	CEACAM7	FOXO1	NQO1	UGT1A6
	CEACAM3	GOLGA6A	AFM	
	CCR9	APRT	ENG	
	MTCO2P12	IRS1	GABPA	
	TXNIP	MIR33A	GABRG2	
	AHSA1	MFAP1	GGT1	
	NOD1	NR3C2	GLUL	
	GATD3B	SERPINA1	GPT	
	KLRC4-KLRK1	RCBTB1	GPX1	
	CHRM3	PNPLA2	GRB2	
	KIF12	SELENOP	GSTT1	
	MGLL	SOD2	HFE	
	CX3CR1	STAT3	IFNG	
	CTNNB1	PPP1R3B	ARSH	
	CTLA4	NR112	FAS	

Supplementary Table 4. Continued

AIH-associated genes	PSC-associated genes	MASLD-associated genes	ALC-associated genes	HCC-associated genes
	CCBE1	FADS2	IL2	
	MAPK14		INSRR	
	HT		ENHO	
	DEFB104A		ARG1	
	CRK		LMNA	
	KCNH8		MAT1A	
	CTHRC1		MDM2	
	PBC2		MTHFR	
	DEFB104B		NFE2L2	
	KMT2A		NFKB1	
	MICB		NOS3	
	MEN1		SERPINA1	
	MEFV		SPHK2	
	MCL1		RARRES2	
	MIR222		RASGRF2	
	MIR21		SERPINB3	
	MIR200C		SERPINB4	
	MIR150		SELE	
	MIR122		SLC1A2	
	MME		GGTLC5P	
	MMP1		GGTLC3	
	MMP2		GGT2	
	ORM2		GGTLC4P	
	DDR2		VDR	
	NRAS		XRCC1	
	NOTCH3		ST8SIA4	
	NFE2L2		MSC	
	NCAM1		GDF15	
	COX2		F2	
	MPO		GOT1	
	MMP14		GOT2	
	MMP9		PPP1R12A	
	LSS		NOSIP	
	LGALS3BP		UBA5	
	AREG		UBA6	
	HLA-DOA		KRT18	
	HCLS1		CD79A	
	ANXA2		LBP	
	ICOS		ALPPL2	
	GSTT1		ALPP	
	CD274		ALPL	

Supplementary Table 4. Continued

AIH-associated genes	PSC-associated genes	MASLD-associated genes	ALC-associated genes	HCC-associated genes
	NR3C1		ASPH	
	GCLM		GOT1L1	
	GCLC		MDFI	
	B3GAT1		SRSF4	
	HLA-DRB5		ALLC	
	AIRE		KRT8	
	HES1		TF	
	ISG20		ALG10	
	INSRR		MARS	
	IL17A		CRP	
	IL15		ALDH1B1	
	IL13		GLUD2	
	IL12A		IL3RA	
	IL1RN		AASS	
	IL1B		ADAMTS13	
	IL1A		FAF1	
	NANOS2		ADGRL4	
	POLDIP2		EHMT1	
			ALDOC	
			GPT2	
			INS	
			TNFRSF1B	
			DGAT2	
			TSC22D3	
			BIN2	
			LMNB2	
			APOA2	
			MAPK10	
			DECR1	
			AFP	
			BCHE	
			RAF1	
			FASLG	
			GPX5	
			GPX4	
			ALDOB	
			TTR	
			CD4	
			SMTN	
			PPCS	
			ALDOA	

Supplementary Table 4. Continued

AIH-associated genes	PSC-associated genes	MASLD-associated genes	ALC-associated genes	HCC-associated genes
			THEM5	
			LARS	
			PRMT1	
			HP	
			ABCB4	
			CCL20	
			LPIN1	
			HPR	
			ADCY8	
			HVCN1	
			PDE4B	
			CXCL6	
			IL1R2	
			CHPF	
			RAP1A	
			IL18BP	
			ALDH3A2	
			CARD17	
			GRB7	
			GLUD1	
			CUL3	
			CCL1	
			AMFR	
			LIFR	
			FUT4	
			MAVS	
			GSTA3	
			TP53INP1	
			GSTA2	
			DNTT	
			GSTA4	
			GSTA1	
			SMPD2	
			F5	
			CD163	