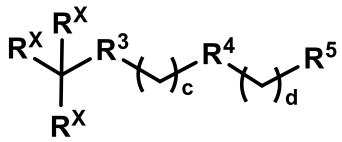
WHAT IS CLAIMED IS

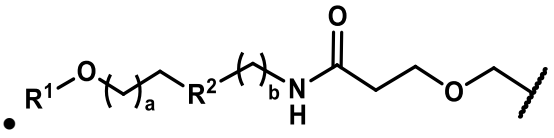
1. A compound of Formula (I):



Formula **(I)**

or a pharmaceutically acceptable salt thereof, wherein:

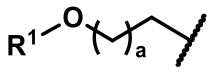
each $\mathbf{R^X}$ is independently selected from the group consisting of:

- H; and
- $-CH_2O\mathbf{R^{X2}}$, wherein $\mathbf{R^{X2}}$ is H, C_{1-6} alkyl, or a hydroxyl protecting group;
-  **(A1)**,

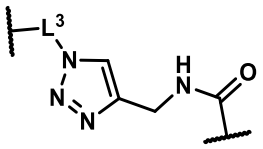
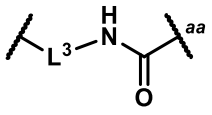
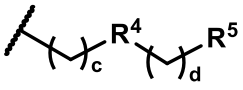
provided that at least one $\mathbf{R^X}$ is a group of Formula **(A1)**;

each $\mathbf{R^1}$ is an independently selected moiety capable of binding an asialoglycoproteinreceptor (ASGPR);

each $\mathbf{R^2}$ is independently selected from the group consisting of: $-C(\mathbf{R^6})_2-$; $-OC(\mathbf{R^6})_2C(\mathbf{R^6})_2O-$; $-C(\mathbf{R^6})(OH)-C(\mathbf{R^6})(OH)-$; *-C(=O)N$\mathbf{R^7}$-; *-N$\mathbf{R^7}$C(=O)-; C_{6-10} arylene; C_{2-6} alkenylene; and C_{2-6} alkynylene,

wherein the C_{6-10} arylene, C_{2-6} alkenylene, and C_{2-6} alkynylene are each optionally substituted with 1-4 independently selected $\mathbf{R^a}$, and the * represents the point of attachment to ;

$\mathbf{R^3}$ is selected from the group consisting of:

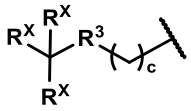
- ; , wherein ***aa*** represents the point of attachment to ;

- -(C**R**^{6}**R**^{6})$_{x}$-O-(C**R**^{6}**R**^{6})$_{y}$-, wherein **x** and **y** are independently 0, 1, 2, or 3; and

- -**L**^{3}-**L**^{3C}-, wherein **L**^{3C} is selected from the group consisting of: C_{3-10} cycloalkylene, C_{6-10} arylene, 5-10 membered heteroarylene, and 4-10 membered heterocyclylene, each of which is optionally substituted with 1-4 independently selected **R**^{a};

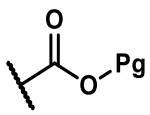
L^{3} is –C(**R**^{6})$_{2}$-,

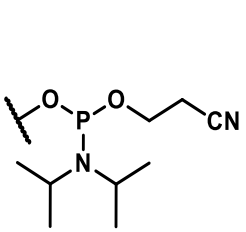
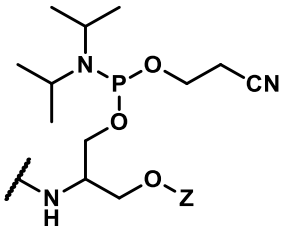
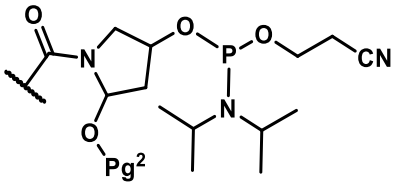
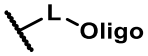
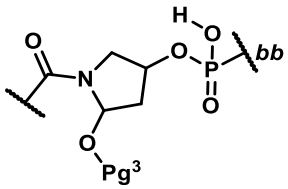
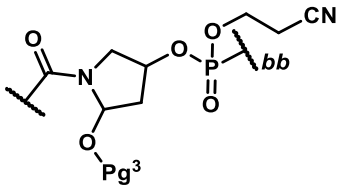
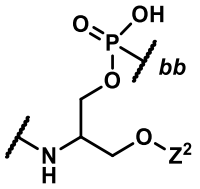
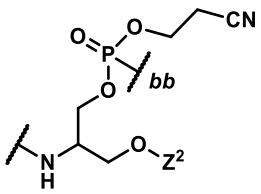
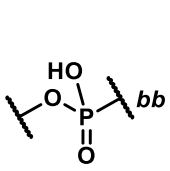
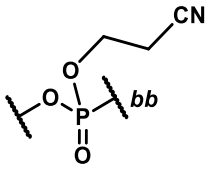
R^{4} is selected from the group consisting of: -C(**R**^{6})$_{2}$-; -OC(**R**^{6})$_{2}$C(**R**^{6})$_{2}$O-; -C(**R**^{6})(OH)-C(**R**^{6})(OH)-; *-C(=O)N**R**^{7}-; *-N**R**^{7}C(=O)-; C_{6-10} arylene, C_{3-10} cycloalkylene, 5-10 membered heteroarylene, and 4-10 membered heterocyclylene, wherein the C_{6-10} arylene, C_{3-10} cycloalkylene, 5-10 membered heteroarylene, and 4-10 membered heterocyclylene are each optionally substituted with 1-4 independently selected **R**^{a}, and

wherein the * represents the point of attachment to ;

R^{5} is selected from the group consisting of:

- hydroxyl; C(O)OH;

-  wherein **Pg** is a carboxyl activating group or a carboxyl protecting group;

-  ;  wherein **Z** is a hydroxyl protecting group;
- , wherein **Pg²** is a hydroxyl protecting group; and
- , wherein: **L** is a bond or a divalent group selected from the group consisting of:
  - **-R²-**, **-R³-**, **-R⁴-**, -O-, -C(=O)-, -C(=O)O-, -OC(=O)-,
  - , , wherein **Pg³** is H or **Pg²**;
  - , , wherein **Z²** is H or a hydroxyl protecting group; and
  -  or  ;

    wherein ***bb*** represents the point of attachment to **Oligo**, and
  - **Oligo** is an oligonucleotide;

each **R⁶** is independently selected from the group consisting of: H; C_{1-3} alkyl; C_{1-3} haloalkyl; and halo;

each $\mathbf{R^7}$ is independently selected from the group consisting of: H; and C_{1-3} alkyl.

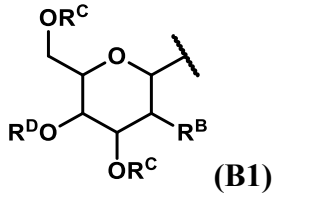
a and **b** are each independently selected integers from 1 to 10;

c and **d** are each independently selected integers from 0 to 10; and

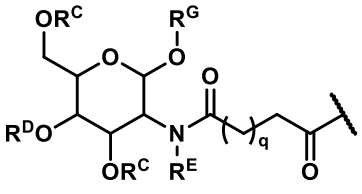
each occurrence of $\mathbf{R^a}$ is independently selected from the group consisting of: halo, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy, and C_{1-6} haloalkoxy.

2. The compound of claim 1, wherein at least two $\mathbf{R^X}$ are each independently a group of Formula **(A1);**preferably, each $\mathbf{R^X}$ is independently a group of Formula **(A1**).

3. The compound of any one of claims 1-2, wherein each $\mathbf{R^1}$ is independently a group of Formula **(B1)** or **(B2)**:

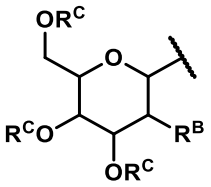


(B1)



(B2)

wherein:

$\mathbf{R^D}$ is selected from the group consisting of: $\mathbf{R^C}$ and 

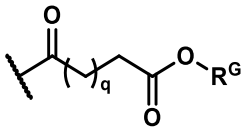
;

each $\mathbf{R^B}$ is independently selected from the group consisting of: -N$\mathbf{R^E R^F}$ and -O$\mathbf{R^C}$;

each $\mathbf{R^C}$ is independently selected from the group consisting of: H and -C(=O)C_{1-6} alkyl;

each $\mathbf{R^E}$ is independently C(=O)C_{1-6} alkyl;

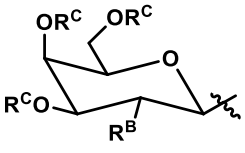
each $\mathbf{R^F}$ is independently selected from the group consisting of: H

and  ;

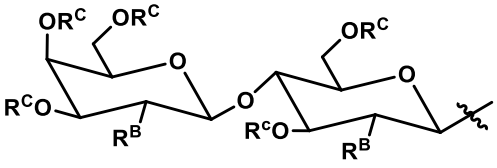
$\mathbf{R^G}$ is $C_{1\text{-}6}$ alkyl; and

each **q** is independently an integer selected from 1 to 10;

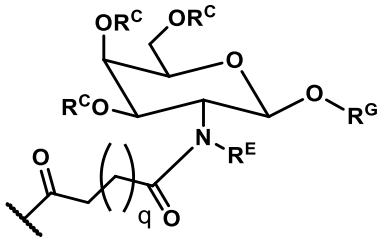
preferably, each $\mathbf{R^1}$ is independently a group having Formula **(B1-a)**, **(B1-b)**, or **(B2-a**):



Formula **(B1-a)**



Formula **(B1-b**)



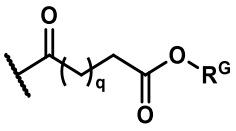
Formula **(B2-a);**

preferably, each $\mathbf{R^B}$ is independently $N\mathbf{R^E}\mathbf{R^F}$;

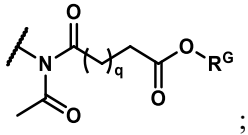
preferably, each $\mathbf{R^E}$ is independently -C(=O)$C_{1\text{-}6}$ alkyl;

preferably, each $\mathbf{R^E}$ is -C(=O)CH_3;

preferably, each $\mathbf{R^F}$ is H;

preferably, each $\mathbf{R^F}$ is  ;

preferably, each $\mathbf{R^B}$ is $NHC(=O)CH_3$;

preferably, each $\mathbf{R^B}$ is  ;

preferably, each $\mathbf{R^B}$ is independently $-O\mathbf{R^C}$;

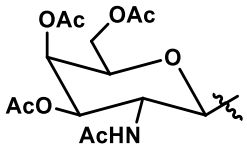
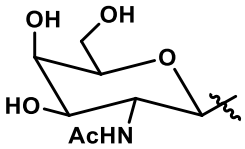
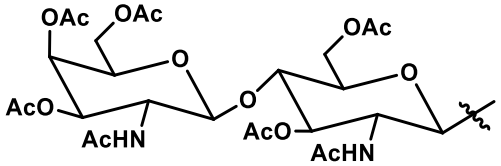
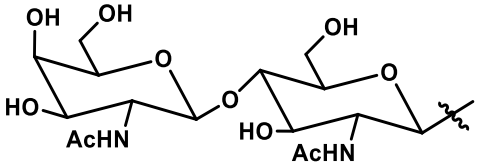
preferably, each $\mathbf{R^C}$ is independently $C(=O)C_{1\text{-}6}$ alkyl;

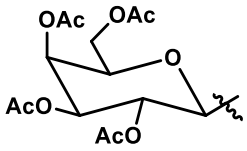
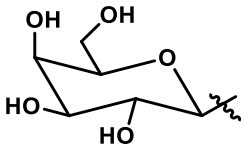
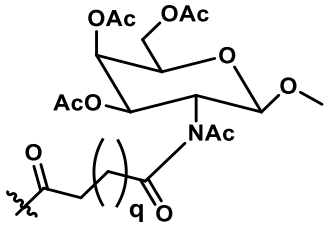
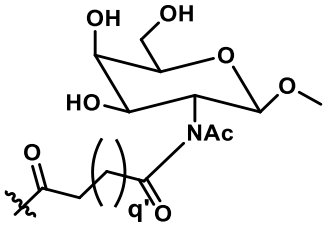
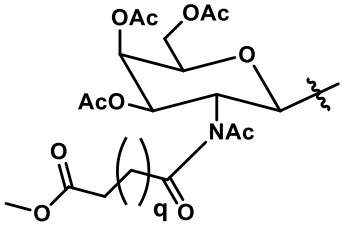
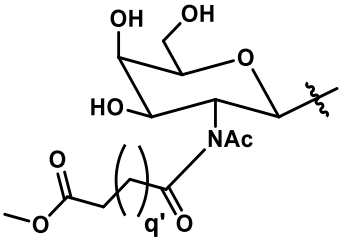
preferably, each $\mathbf{R^C}$ is $C(=O)CH_3$;

preferably, each $\mathbf{R^C}$ is H;

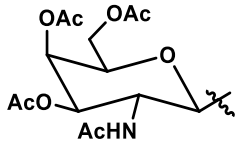
preferably, each $\mathbf{R^G}$ is CH_3.

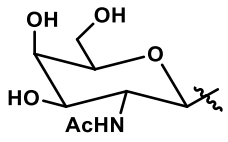
4. The compound of any one of claims 1-3, wherein each $\mathbf{R^1}$ is selected from the group consisting of the following:

	
 wherein, **q** is an integer selected from 1 to 10;	 wherein, **q'** is an integer selected from 1 to 10;
 wherein, **q** is an integer selected from 1 to 10;	 wherein, **q'** is an integer selected from 1 to 10.

5. The compound of any one of claims 1-4, wherein each $\mathbf{R^1}$ is the same;

preferably, each $\mathbf{R^1}$ is ;

preferably, each $\mathbf{R^1}$ is ;

preferably, each $\mathbf{R^2}$ is independently *-C(=O)N$\mathbf{R^7}$- or *-N$\mathbf{R^7}$C(=O)-;

preferably, each $\mathbf{R^2}$ is independently *-C(=O)N$\mathbf{R^7}$-;

preferably, each $\mathbf{R^2}$ is *-C(=O)NH-;

preferably, each $\mathbf{R^2}$ is independently -C($\mathbf{R^6}$)$_2$-;

preferably, each $\mathbf{R^2}$ is –CH_2-;

preferably, each $\mathbf{R^2}$ is the same;

preferably, each **a** is an independently selected integer from 1 to 4;

preferably, each **a** is independently 2 or 3;

preferably, each **a** is the same;

preferably, each **b** is an independently selected integer from 1 to 4;

preferably, each **b** is independently 2 or 3;

preferably, each **b** is the same.

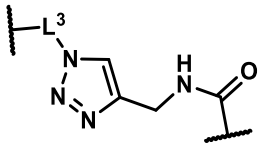
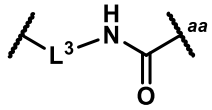
6. The compound of any one of claim 1-5, wherein each **a** is the same; each **b** is the same; and each $\mathbf{R^2}$ is the same;

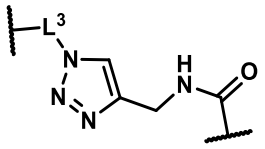
preferably, **a** is an integer from 1 to 4; **b** is an integer from 1 to 4; and $\mathbf{R^2}$ is *-C(=O)N$\mathbf{R^7}$;

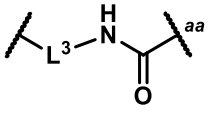
preferably, **a** is 3; **b** is 3; and $\mathbf{R^2}$ is *-C(=O)NH;

preferably, **a** is an integer from 1 to 4; **b** is an integer from 1 to 4; and $\mathbf{R^2}$ is –C($\mathbf{R^6}$)$_2$-;

preferably, $\mathbf{R^2}$ is $-CH_2-$; and $3\leq(\mathbf{a}+\mathbf{b})\leq 5$.

7. The compound of any one of claims 1-6, wherein $\mathbf{R^3}$ is  or ;

preferably, $\mathbf{R^3}$ is ;

preferably, $\mathbf{R^3}$ is ;

preferably, $\mathbf{L^3}$ is $-C(\mathbf{R^6})_2-$;

preferably, $\mathbf{L^3}$ is $-CH_2-$;

preferably, **c** is an integer from 1 to 2;

preferably, **c** is an integer from 2 to 5;

preferably, **c** is an integer from 3 to 7;

preferably, $\mathbf{R^4}$ is *-C(=O)N$\mathbf{R^7}$-;

preferably, $\mathbf{R^4}$ is *-C(=O)NH-;

preferably, $\mathbf{R^4}$ is –C($\mathbf{R^6}$)$_2$-;

preferably, $\mathbf{R^4}$ is –CH_2-;

preferably, **d** is an integer from 1 to 2;

preferably, **d** is an integer from 3 to 7.

8. The compound of any one of claims 1-7, wherein $\mathbf{R^4}$ is –C($\mathbf{R^6}$)$_2$-; and each of **c** and **d** is independently 1 or 2;

preferably, $\mathbf{R^4}$ is –CH_2-; and each of **c** and **d** is 1;

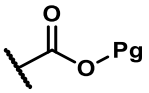
preferably, $\mathbf{R^4}$ is –C($\mathbf{R^6}$)$_2$-; and $4 \leq (\mathbf{c} + \mathbf{d}) \leq 12$;

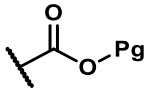
preferably, $\mathbf{R^4}$ is $-CH_2-$; and $7 \leq (\mathbf{c} + \mathbf{d}) \leq 10$;

preferably, $\mathbf{R^4}$ is *–C(=O)N$\mathbf{R^7}$-; and $5 \leq (\mathbf{c} + \mathbf{d}) \leq 10$;

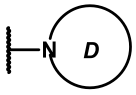
preferably, $\mathbf{R^4}$ is *–C(=O)N$\mathbf{R^7}$-; and $7 \leq (\mathbf{c} + \mathbf{d}) \leq 9$;

preferably, **c** is 3.

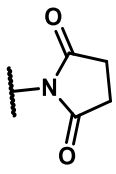
9. The compound of any one of claims 1-8, wherein $\mathbf{R^5}$ is C(O)OH or ;

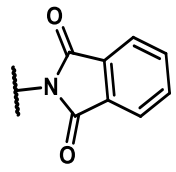
preferably, $\mathbf{R^5}$ is ;

preferably, **Pg** is a carboxyl activating group;

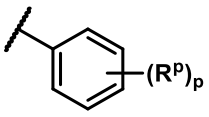
preferably, **Pg** is , wherein **Ring D** is a 5-10 membered heteroaryl or 4-10 membered heterocyclyl, each optionally substituted with 1-6 substituents each independently selected from the group consisting of: halo, oxo, NO_2, $C(O)C_{1-4}$ alkyl, $C(O)OC_{1-4}$ alkyl, $S(O)C_{1-4}$ alkyl, C_{1-6} alkyl, C_{1-6} haloalkyl, and –OH;

preferably, **Pg** is:

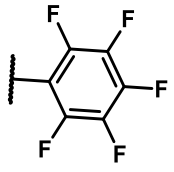
(i) ; or

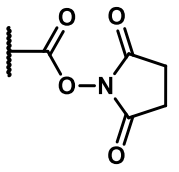
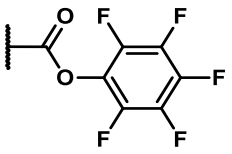
(ii)  which is optionally substituted with 1-6 substituents each independently selected from the group consisting of: halo, NO_2, $C(O)C_{1-4}$ alkyl, $C(O)OC_{1-4}$ alkyl, $S(O)C_{1-4}$ alkyl, C_{1-6} alkyl, C_{1-6} haloalkyl, and –OH;

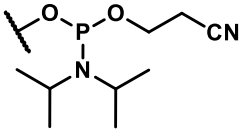
preferably, **Pg** is C_{6-10} aryl or 5-10 membered heteroaryl substituted with 1-6 substituents each independently selected from the group consisting of: -F; -Cl; $-NO_2$; $C(O)C_{1-4}$ alkyl, $C(O)OC_{1-4}$ alkyl, and $S(O)C_{1-4}$ alkyl;

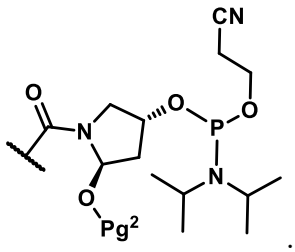
preferably, **Pg** is , wherein **p** is an integer from 1 to 5; and each $\mathbf{R^p}$ is –F, -Cl, or $–NO_2$;

preferably, each $\mathbf{R^p}$ is –F;

preferably, **Pg** is ;

preferably, $\mathbf{R^5}$ is  or ;

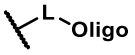
preferably, $\mathbf{R^5}$ is ;

preferably, $\mathbf{R^5}$ is .

10. The compound of any one of claims 1-8, wherein each hydroxyl protecting group is independently selected from the group consisting of: a silyl protecting group; 4-monomethoxytrityl (MMTR); 4,4 -dimethoxytrityl (DMTR); and triphenylmethyl (trityl);

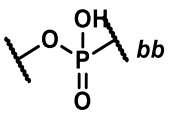
preferably, the silyl protecting group is selected from the group consisting of: *tert*-butyldimethylsilyl (TBMDS); *tert*-butyldiphenylsilyl (TBDPS), and triisopropylsilyl (TIPS).

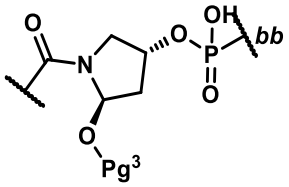
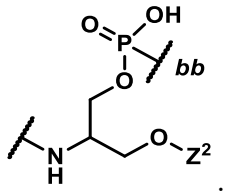
11. The compound of claim 1, wherein the compound is selected from the group consisting of compounds **GalNAc-1** through **GalNAc-12**.

12. The compound of any one of claims 1-8, wherein $\mathbf{R^5}$ is , wherein **Oligo** is an oligonucleotide that is attached to **L** via the 5'-end, 3'-end, or sequence middle of any strand via a phosphate group;

preferably, **L** is a bond;

preferably, **L** is C(=O) or –O-;

preferably, **L** is ;

preferably, **L** is selected from the group consisting of:  and .

13. The compound of any one of claims 1-7 or 12, wherein the oligonucleotide comprises a single-stranded oligonucleotide and/or a double-stranded oligonucleotide;

preferably, the oligonucleotide is selected from the group consisting of: DNA, siRNA, miRNA, pre-miRNA, antagomir, mRNA, antisense oligonucleotide (ASO), aptamer, crRNA, tracRNA, and sgRNA.

14. The compound of any one of claims 1-7 or 12-13, wherein the oligonucleotide comprises unmodified nucleotides and/or modified nucleotides;

preferably, the modified nucleotides are each independently selected from the group consisting of: 2'-O-(2-methoxyethyl)-modified nucleotides; 2'-O-alkyl modified nucleotides; 2'-O-allyl modified nucleotides; 2'-C-allyl modified nucleotides; 2'-fluoro modified nucleotides; 2'-deoxy modified nucleotides; 2'-hydroxy modified nucleotides; locked nucleic acids (LNAs) modified nucleotides, glycol nucleic acids (GNAs) modified nucleotides, and unlocked nucleic acids (UNAs) modified nucleotides;

preferably, the 2'-O-alkyl modified nucleotides are 2'-O-methyl nucleotides.

15. The compound of any one of claims 1-7 or 12-14, wherein the oligonucleotide comprises a modifying group, wherein the modifying group is selected from the group consisting of: cholesterol, polyethylene glycol, fluorescent probes, biotin, polypeptides, vitamins, tissue targeting molecules, and a combination thereof;

preferably, the modifying group is a terminal modifying group;

preferably, the phosphate group is a phosphodiester or a modified phosphate group;

preferably, the modified phosphate group is selected from one or more of: thio modified phosphate, amino modified phosphate,

preferably, the thio modified phosphate is phosphorothioate;

preferably, the oligonucleotide comprises one or more peptide nucleic acids and/or morpholino nucleic acids;

preferably, the oligonucleotide is an oligonucleotide of from 5 to 100 base pairs;

preferably, the oligonucleotide conjugate compound is synthesized via solid-phase synthesis or liquid-phase synthesis.

16. A compound of any one of claims 12-15; or a pharmaceutical composition comprising a compound of any one of claims 12-15, and a pharmaceutically acceptable excipient for use in the treatment or prevention of pathological conditions or diseases in a subject, wherein the conditions or diseases are caused by the expression of one or

more genes in liver cells;

preferably, the one or more genes are selected from: HBV genome, HCV genome, *PCSK9*, a gene expressing xanthine oxidase (e.g., XDH), *URAT1*, *APOB*, liver fibrosis-related genes (e.g., *AP3S2*, *AQP2*, *AZINl*, *DEGSl*, *STXBP5L*, *TLR4*, *TRPM5*), genes related to non-alcoholic fatty liver disease (e.g., *PNPLA3*, *FDFTl*), and genes related to primary biliary cirrhosis (e.g., *HLA-DQB1*, *IL-12*, *IL-12RB2*).

17. A pharmaceutical composition comprising a compound of any one of claims 12-15 and a pharmaceutically acceptable excipient.

18. The pharmaceutical composition of claim 17, wherein the pharmaceutical composition is formulated in a dosage form selected from the group consisting of: powders, tablets, granules, capsules, solutions, emulsions, suspensions, injections, sprays, aerosols, dry powder inhalations, and microneedle patches;
preferably, the pharmaceutical composition is suitable for administration to a subject in need thereof intravenously, intramuscularly, subcutaneously, via microneedle patches, orally, via oral or nasal spray, or topically;

preferably, the subject is a mammal;

preferably, the mammal is selected from the group consisting of: bovine, equine, sheep, swine, canine, feline, rodent, and primate;

preferably, the subject is human.