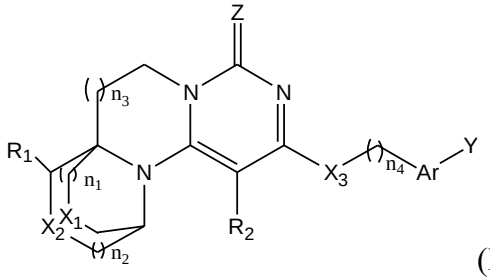
CLAIMS

1. A compound represented by formula (I):



(I)

or a pharmaceutically acceptable salt thereof,

wherein:

n_1, n_2, and n_4 are each independently 0, 1, or 2;

n_3 is 0;

R^1 and R^2 are each independently selected from: -H, hydroxyl, cyano, halogen, alkyl, deuteroalkyl, hydroxyalkyl, haloalkyl, cycloalkyl, and alkoxyl;

X_1 is methylene,

X_2 is selected from: methylene, -O-, -S-, or -NR'-;

and X_3 is selected from: methylene, -O-, -S-, or -NR'-;

R' is selected from: -H, alkyl, deuteroalkyl, or cycloalkyl;

Ar is arylene or heteroarylene; and hydrogen atoms in the arylene or heteroarylene are optionally substituted by one or more substituents that are each independently selected from: halogen, alkyl, haloalkyl, alkoxyl, haloalkoxyl, deuteroalkyl, deuteroalkoxyl, hydroxyl, hydroxyalkyl, cyano, amino, monoalkyl- or dialkyl-substituted amino, nitro, carboxyl, aldehyde, cycloalkyl, heterocyclyl, aryl, or heteroaryl;

Y is -H, halogen, alkyl, haloalkyl, haloalkoxyl, cycloalkyl, alkoxyl, deuteroalkyl, deuteroalkoxyl, -OAr', -SAr', -NH-Ar', -NMe-Ar', -NR'', or -R'''-Ar';

Ar' is selected from aryl or heteroaryl; and hydrogen atoms in the aryl or heteroaryl are optionally substituted by one or more substituents that are each independently selected from: halogen, alkyl, haloalkyl, alkoxyl, hydroxyl, hydroxyalkyl, haloalkoxyl, deuteroalkyl, deuteroalkoxyl, cyano, amino, nitro, carboxyl, aldehyde, cycloalkyl, heterocyclyl, aryl, or heteroaryl;

R" is alkyl;

R"' is alkylene; and

Z is O or S;

optionally, wherein:

n_1, n_2 and n_4 are each independently 0, 1, or 2;

n_3 is 0;

R^1 and R^2 are each independently selected from: -H, hydroxyl, cyano, halogen, alkyl, deuteroalkyl, hydroxyalkyl, haloalkyl, cycloalkyl, and alkoxyl;

X_1 is methylene,

X_2 is selected from: methylene, -O-, -S-, or -NR'-;

and X_3 is selected from: methylene, -O-, -S-, or -NR'-;

R' is selected from: -H, alkyl, deuteroalkyl, or cycloalkyl;

Ar is arylene or heteroarylene; and hydrogen atoms in the arylene or heteroarylene are optionally substituted by one or more substituents that are each independently selected from: halogen, alkyl, haloalkyl, alkoxyl, haloalkoxyl, hydroxyl, hydroxyalkyl, cyano, amino, monoalkyl- or dialkyl-substituted amino, nitro, carboxyl, aldehyde, cycloalkyl, heterocyclyl, aryl, or heteroaryl;

Y is -H, halogen, alkyl, haloalkyl, haloalkoxyl, cycloalkyl, alkoxyl, -OAr', -SAr', -NH-Ar', -NMe-Ar', -NR", or -R"'-Ar';

Ar' is selected from aryl or heteroaryl; and hydrogen atoms in the aryl or heteroaryl are optionally substituted by one or more substituents that are each independently selected from: halogen, alkyl, haloalkyl, alkoxyl, hydroxyl, hydroxyalkyl, haloalkoxyl, cyano, amino, nitro, carboxyl, aldehyde, cycloalkyl, heterocyclyl, aryl, or heteroaryl;

R" is alkyl;

R"' is alkylene; and

Z is O or S.

2. The compound of formula (I), or the pharmaceutically acceptable salt thereof according to claim 1, wherein

halogen atoms in the “halogen”, “haloalkyl”, and “haloalkoxyl” are each independently selected from F, Cl, Br, or I;

optionally, alkyls in the “alkyl”, “deuteroalkyl”, “deuteroalkoxyl”, “hydroxyalkyl”, “haloalkyl”, “haloalkoxyl”, “alkoxyl”, and “monoalkyl- or dialkyl-substituted amino” are each independently C_1-C_{10} linear or branched alkyl; optionally, C_1-C_7 linear or branched alkyl; optionally, C_1-C_4 linear or branched alkyl; optionally, selected from methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, sec-butyl, n-pentyl, 1-methylbutyl, 2-methylbutyl, 3-methylbutyl, isopentyl, 1-ethylpropyl, neopentyl, n-hexyl, 1-methylpentyl, 2-methylpentyl, 3-methylpentyl, isohexyl, 1,1-dimethylbutyl, 2,2-dimethylbutyl, 3,3-dimethylbutyl, 1,2-dimethylbutyl, 1,3-dimethylbutyl, 2,3-dimethylbutyl, 2-ethylbutyl, n-heptyl, 2-methylhexyl, 3-methylhexyl, 2,2-dimethylpentyl, 3,3-dimethylpentyl, 2,3-dimethylpentyl, 2,4-dimethylpentyl, 3-ethylpentyl, or 2,2,3-trimethylbutyl;

optionally, the “alkylenes” are each independently C_1-C_{10} linear or branched alkylene; optionally C_1-C_7 linear or branched alkylene; optionally, C_1-C_5 linear or branched alkylene; and optionally selected from methylene, ethylene, n-propylene, isopropylene, n-butylene, isobutylene, tert-butylene, sec-butylene, n-pentylene, 1-methylbutylene, 2-methylbutylene, 3-methylbutylene, isopentylene, 1-ethylpropylene, neopentylene, n-hexylene, 1-methylpentylene, 2-methylpentylene, 3-methylpentylene, isohexylene, 1,1-dimethylbutylene, 2,2-dimethylbutylene, 3,3-dimethylbutylene, 1,2-dimethylbutylene, 1,3-dimethylbutylene, 2,3-dimethylbutylene, 2-ethylbutylene, n-heptylene, 2-methylhexylene, 3-methylhexylene, 2,2-dimethylpentylene, 3,3-dimethylpentylene, 2,3-dimethylpentylene, 2,4-dimethylpentylene, 3-ethylpentylene, or 2,2,3-trimethylbutylene;

optionally, the “cycloalkyl” is C_3-C_{10} monocyclic or bicyclic cycloalkyl, optionally C_3-C_7 monocyclic cycloalkyl, and optionally cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, or cycloheptyl;

optionally, the “heterocyclyl” is 3- to 10-membered non-aromatic heterocyclic ring containing 1, 2, or 3 heteroatoms selected from N, O, and S on the ring, optionally, the heterocyclic ring is a 3- to 10-membered non-aromatic ring containing 1 or 2 heteroatoms selected from N and O on the ring; optionally, the heterocyclic ring is a 3- to 6-membered non-aromatic ring containing 1 or 2 heteroatoms selected from N and O on the ring; optionally, the heterocyclic

ring is a 3- to 10-membered non-aromatic ring containing 1 or 2 heteroatoms selected from N and S on the ring; and optionally, the heterocyclic ring is a 3- to 6-membered non-aromatic ring containing 1 or 2 heteroatoms selected from N and S on the ring;

optionally, the "aryl" is 6- to 10-membered aryl, optionally phenyl or naphthyl, and optionally phenyl, 1-naphthyl, or 2-naphthyl;

optionally, the "arylene" is 6- to 10-membered arylene, and optionally phenylene or naphthylene;

optionally, the "heteroaryl" is a 5- to 10-membered heteroaromatic ring containing 1 to 3 heteroatoms selected from N, O, and S on the ring, and optionally a 5- to 10-membered heteroaromatic ring containing 1 to 2 heteroatoms selected from N, O, and S on the ring; optionally, the heteroaromatic ring is selected from a pyridine ring, a pyrrole ring, a pyrimidine ring, a pyrazine ring, a pyridazine ring, a thiophene ring, and a furan ring; optionally, the heteroaryl is selected from pyridin-2-yl, pyridin-3-yl, pyridin-4-yl, pyridazin-3-yl, pyridazin-4-yl, pyrimidin-2-yl, pyrimidin-4-yl, pyrimidin-5-yl, pyrazin-2-yl, pyrazin-3-yl, indolyl, isoindolyl, indazolyl, indolizinyl, purinyl, quinolizinyl, quinolinyl, isoquinolinyl, cinnolinyl , phthalazinyl, naphthyridinyl, quinazolinyl, quinoxalinyl, thieno[2,3-b]furyl, furo[3,2-b]-pyranyl, pyrido[2,3-d]oxazinyl, pyrazolo[4,3-d]oxazolyl, imidazo[4,5-d]thiazolyl, pyrazino[2,3-d]pyridazinyl, imidazo[2,1-b]thiazolyl, imidazo[1,2-b][l,2,4]triazinyl, benzothienyl, benzoxazolyl, benzimidazolyl, benzothiazolyl, benzoxepinyl, benzoxazinyl, benzofuranyl, benzotriazolyl, pyrrolo[2,3-b]pyridyl, pyrrolo[3,2-c]pyridyl, pyrrolo[3,2-b]pyridyl, imidazo[4,5-b]pyridyl, imidazo[4,5-c]pyridyl, pyrazolo[4,3-d]pyridyl, pyrazolo[4,3-c]pyridyl, pyrazolo[3,4-c]pyridyl, pyrazolo[3,4-d]pyridyl, pyrazolo[3,4-b]pyridyl, imidazo[1,2-a]pyridyl, pyrazolo[1,5-a]pyridyl, pyrrolo[1,2-b]pyridazinyl, imidazo[1,2-c]pyrimidinyl, pyrido[3,2-d]pyrimidinyl, pyrido[4,3-d]pyrimidinyl, pyrido[3,4-d]pyrimidinyl, pyrido[2,3-d]pyrimidinyl, pyrido[2,3-b]pyrazinyl, pyrido[3,4-b]pyrazinyl, pyrimido[5,4-d]pyrimidinyl, pyrazolo[2,3-b]pyrazinyl, and pyrimido[4,5-d]pyrimidinyl, and optionally pyridin-2-yl, pyridin-3-yl, pyridin-4-yl, pyrimidin-2-yl, pyrimidin-4-yl, or pyrimidin-5-yl; and

optionally, the "heteroarylene" is a 5- to 10-membered heteroarylene ring containing 1 to 3 heteroatoms selected from N, O, and S on the ring, and optionally a 5- to 10-membered heteroarylene ring containing 1 to 2 heteroatoms selected from N, O, and S on the ring; and

optionally, the heteroarylene ring is selected from a pyridylene ring, a pyrrylene ring, a pyrimidylene ring, a pyrazinylene ring, a pyridazinylene ring, a thienylene ring, a furylene ring.

3. The compound of formula (I), or the pharmaceutically acceptable salt thereof according to claim 1 or 2, wherein

n_1 is 0, optionally, n_2 is 0 or 1, optionally, n_4 is 1;

optionally, R_1, R_2 are each independently selected from: -H, F, Cl, Br, hydroxyl, cyano, C_1-C_7 alkyl (methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, sec-butyl, n-pentyl, 1-methylbutyl, 2-methylbutyl, 3-methylbutyl, isopentyl, 1-ethylpropyl, neopentyl, n-hexyl, 1-methylpentyl, 2-methylpentyl, 3-methylpentyl, isohexyl, 1,1-dimethylbutyl, 2,2-dimethylbutyl, 3,3-dimethylbutyl, 1,2-dimethylbutyl, 1,3-dimethylbutyl, 2,3-dimethylbutyl, 2-ethylbutyl, n-heptyl, 2-methylhexyl, 3-methylhexyl, 2,2-dimethylpentyl, 3,3-dimethylpentyl, 2,3-dimethylpentyl, 2,4-dimethylpentyl, 3-ethylpentyl, or 2,2,3-trimethylbutyl), C_1-C_3 deuteroalkyl(-CD_3, -C_2D_5, -C_3D_7), cyclopropanyl, cyclobutanyl, and cyclopentyl; optionally, R_1 is -H, and optionally, R_2 is -H;

optionally, X_2 is selected from -CH_2- or -O-; optionally, X_3 is -O-;

optionally, R' is selected from-H, C_1-C_7 alkyl (methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, sec-butyl, n-pentyl, 1-methylbutyl, 2-methylbutyl, 3-methylbutyl, isopentyl, 1-ethylpropyl, neopentyl, n-hexyl, 1-methylpentyl, 2-methylpentyl, 3-methylpentyl, isohexyl, 1,1-dimethylbutyl, 2,2-dimethylbutyl, 3,3-dimethylbutyl, 1,2-dimethylbutyl, 1,3-dimethylbutyl, 2,3-dimethylbutyl, 2-ethylbutyl, n-heptyl, 2-methylhexyl, 3-methylhexyl, 2,2-dimethylpentyl, 3,3-dimethylpentyl, 2,3-dimethylpentyl, 2,4-dimethylpentyl, 3-ethylpentyl, or 2,2,3-trimethylbutyl), deuteroalkyl (optionally -CD_3, -C_2D_5, -C_3D_7), or C_3-C_6 cycloalkyl (cyclopropanyl, cyclobutanyl, and cyclopentyl, cyclohexyl);

optionally, Ar is phenylene or pyridyl, and a hydrogen atom in the phenylene or pyridyl is optionally substituted by 1, 2, or 3 substituents that are each independently selected from: F, Cl, Br, I, -CN, -Me, -C_2H_5, cyclopropyl, -CD_3, -OMe, or -OCF_3; optionally, Ar is phenylene, and a hydrogen atom in the phenylene is optionally substituted by 2 substituents that are F;

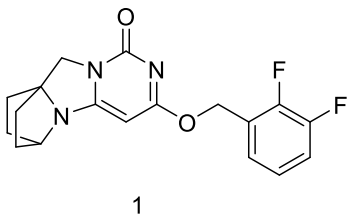
optionally, Y is -H, -F, -Cl, -Br, methyl, ethyl, n-propyl, isoproyl, -CD_3, -CF_3, -CH_2CF_3, -OCF_3, -$OCHF_2$, cyclopropyl, -cyclobutyl, -cyclopentyl, -OCH_3, -OC_2H_5, -OC_3H_7, or -OAr';

optionally, Y is -H or -OAr';

optionally, Ar' is selected from phenyl, pyridyl, pyrimidinyl, or quinolinyl, and hydrogen atoms in the phenyl, pyridyl, pyrimidinyl or quinolinyl ring are each independently optionally substituted with 1, 2 or 3 substituents that are each independently selected from: F, Cl, Br, -CN, C_1-C_7 alkyl (optionally selected from methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, sec-butyl, n-pentyl, 1-methylbutyl, 2-methylbutyl, 3-methylbutyl, isopentyl, 1-ethylpropyl, neopentyl, n-hexyl, 1-methylpentyl, 2-methylpentyl, 3-methylpentyl, isohexyl, 1,1-dimethylbutyl, 2,2-dimethylbutyl, 3,3-dimethylbutyl, 1,2-dimethylbutyl, 1,3-dimethylbutyl, 2,3-dimethylbutyl, 2-ethylbutyl, n-heptyl, 2-methylhexyl, 3-methylhexyl, 2,2-dimethylpentyl, 3,3-dimethylpentyl, 2,3-dimethylpentyl, 2,4-dimethylpentyl, 3-ethylpentyl, or 2,2,3-trimethylbutyl;), -CD_3, C_1-C_6haloalkyl, -OCH_3, -OC_2H_7, -OC_3H_7, C_1-C_6 haloalkoxyl, or C_3-C_6 cycloalkyl (optionally cyclopropanyl, cyclobutanyl, cyclopentyl, or cyclohexyl); optionally, Ar' is selected from phenyl, pyridin-3-yl, or pyridin-4-yl, or pyrimidin-5-yl, optionally, the Ar' is substituted by 1 or 2 substituents that are selected from Cl, -CH_3, -CF_3, or -OCF_3; and

optionally, Z is O.

4. The compound of formula (I), or the pharmaceutically acceptable salt thereof according to any one of claims 1 to 3, wherein the compound of formula (I) is selected from the following compounds:



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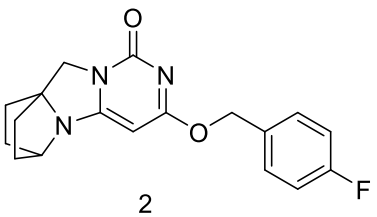

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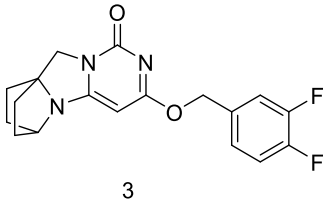

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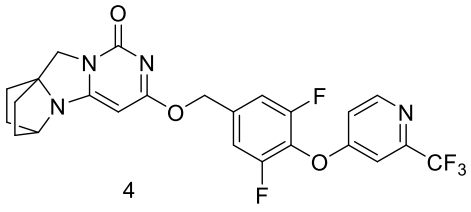

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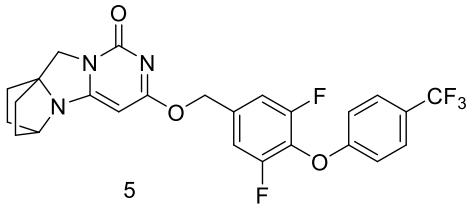

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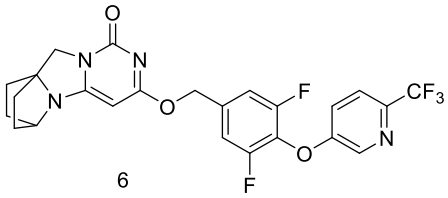

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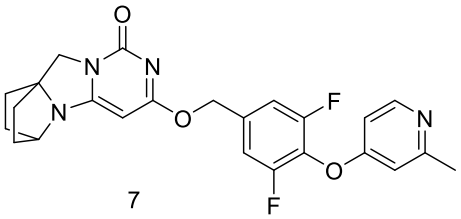

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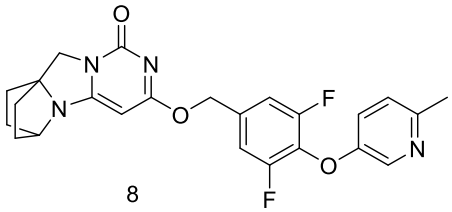

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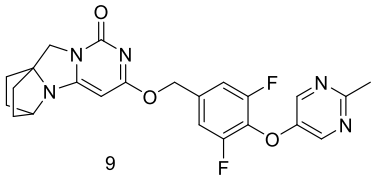

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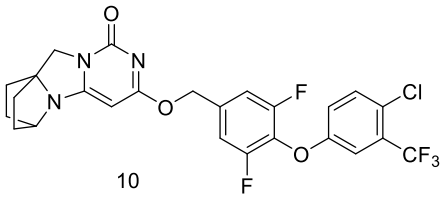

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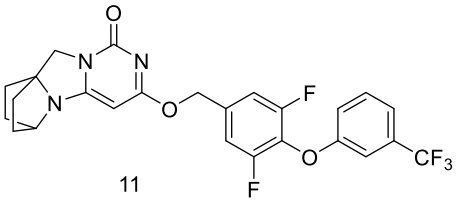

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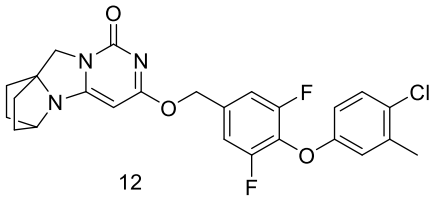

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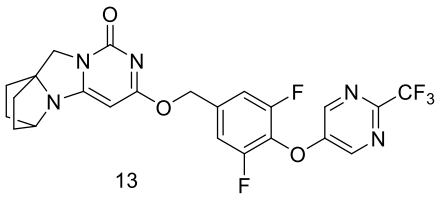

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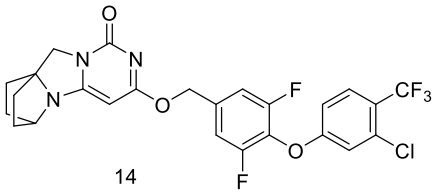

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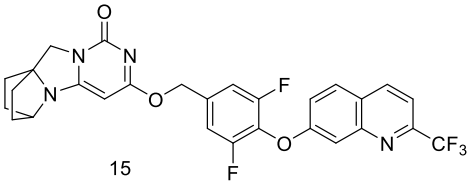

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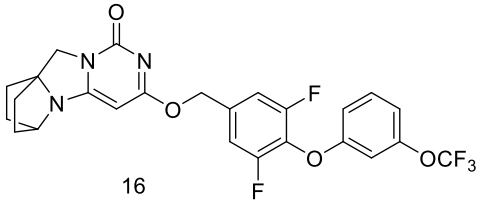

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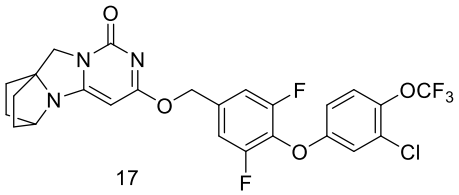

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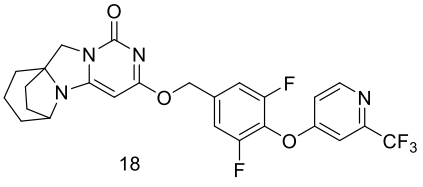

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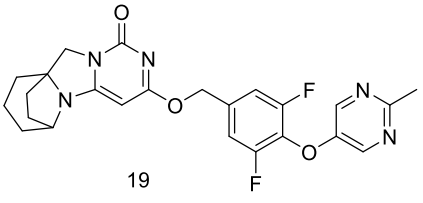

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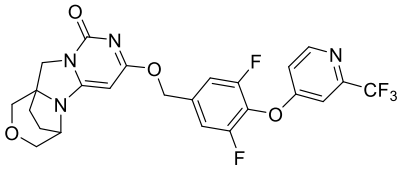

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5. The compound of formula (I), or the pharmaceutically acceptable salt thereof according to any one of claims 1 to 4, wherein the pharmaceutically acceptable salt includes an anionic salt and a cationic salt of the compound of formula (I);

optionally, the pharmaceutically acceptable salt includes an alkali metal salt, an alkaline earth metal salt, and an ammonium salt of the compound of formula (I); optionally, the alkali metal includes sodium, potassium, lithium, and cesium, and the alkaline earth metal includes magnesium, calcium, and strontium;

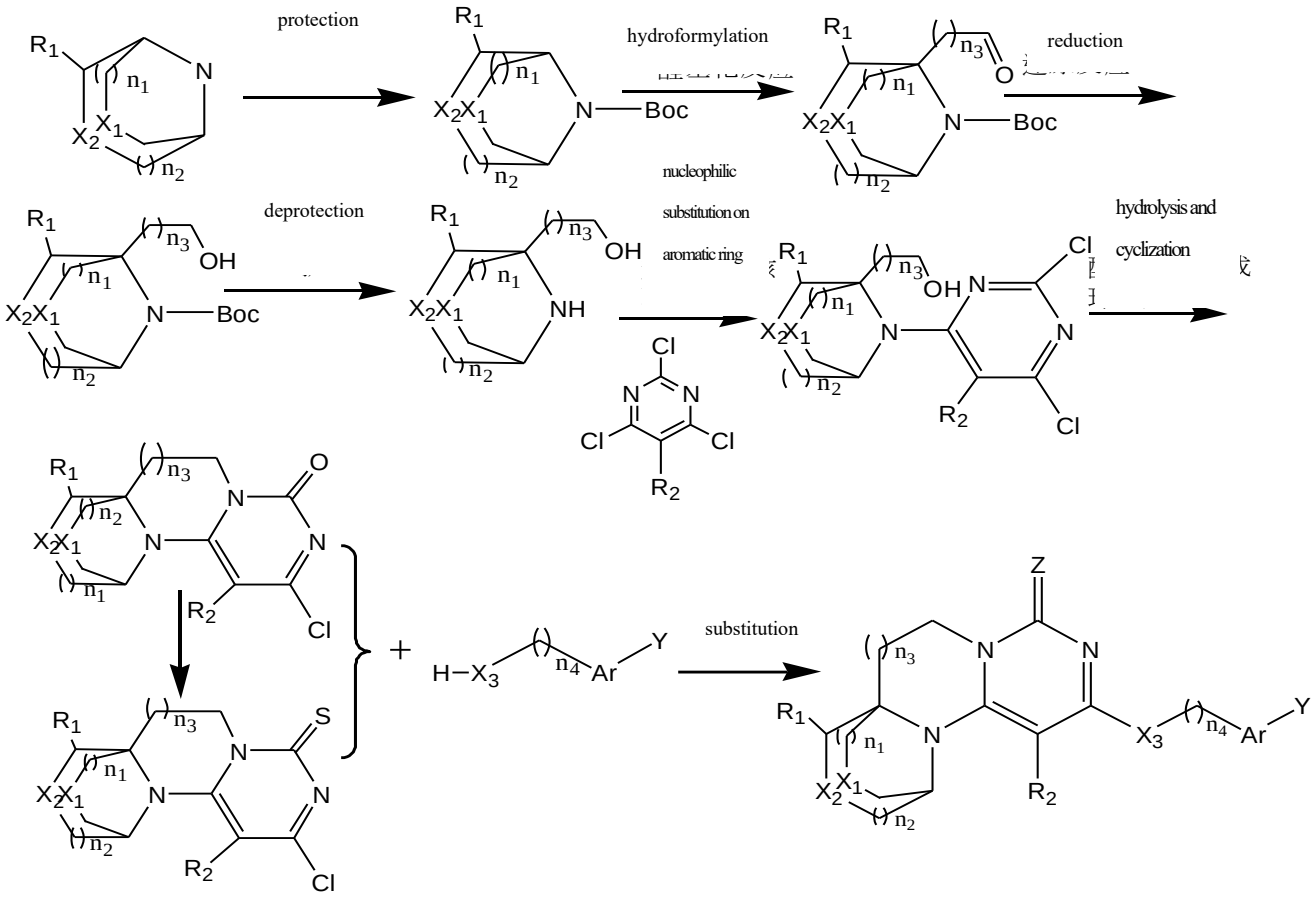
optionally, the pharmaceutically acceptable salt includes a salt formed by the compound of formula (I) and an organic base;

optionally, the organic base includes trialkylamine, pyridine, quinoline, piperidine, imidazole, picoline, dimethylaminopyridine, dimethylaniline, N-alkylmorpholine, 1,5-diazabicyclo[4.3.0]nonene-5, 1,8-diazabicyclo[5.4.0]undecene-7, and 1,4-diazabicyclo[2.2.2]octane; optionally, the trialkylamine includes trimethylamine, triethylamine, and N-ethyldiisopropylamine; and optionally, the N-alkylmorpholine includes N-methylmorpholine;

optionally, the pharmaceutically acceptable salt includes a salt formed by the compound of formula (I) and an acid; and

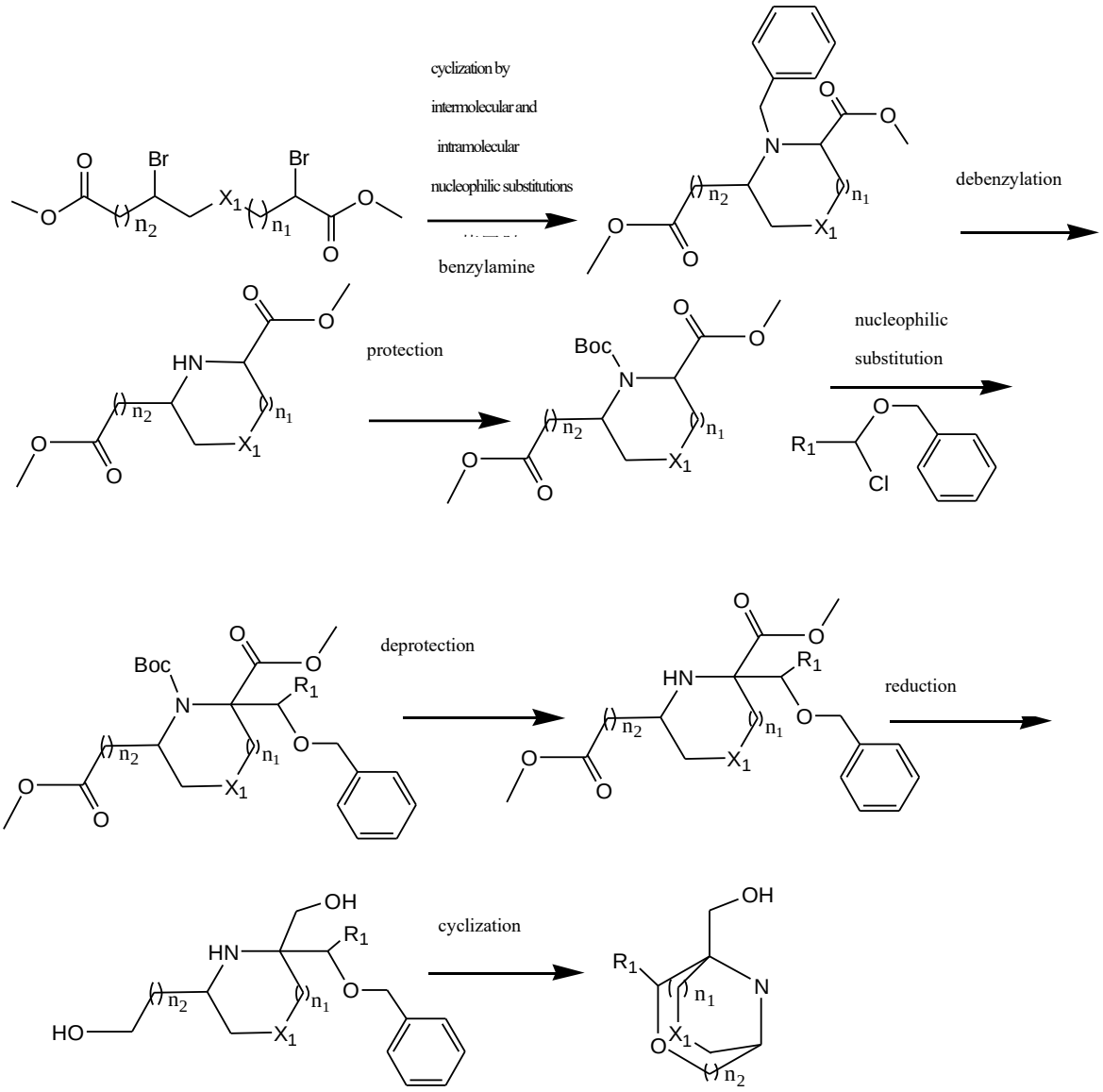
optionally, the acid includes an inorganic acid and an organic acid; optionally, the inorganic acid includes hydrochloric acid, hydrobromic acid, hydroiodic acid, sulfuric acid, nitric acid, phosphoric acid, carbonic acid; optionally, the organic acid includes formic acid, acetic acid, propionic acid, oxalic acid, malonic acid, succinic acid, fumaric acid, maleic acid, lactic acid, malic acid, citric acid, citric acid, tartaric acid, carbonic acid, picric acid, methanesulfonic acid, ethanesulfonic acid, *p*-toluenesulfonic acid, glutamic acid, and pamoic acid.

6. A method for preparing a compound of formula (I), or a pharmaceutically acceptable salt thereof according to any one of claims 1 to 5, comprising the following synthetic route:



in respective formulas, n_1, n_2, n_3, R_1, R_2, X_1, X_2, X_3, Z, Ar, and Y are as defined in any one of claims 1 to 5;

optionally, when X_2 is -O- and n_3 is 0, the following synthetic route is further adopted:



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7. A pharmaceutical composition, comprising one or more of a compound of formula (I), or a pharmaceutically acceptable salt thereof according to any one of claims 1 to 5, and optionally a pharmaceutically acceptable carrier.

8. The pharmaceutical composition according to claim 7, wherein a dosage form of the pharmaceutical composition includes an oral preparation, a rectally administered preparation, and a parenteral administered preparation;

optionally, the oral preparation includes a solid preparation and a liquid preparation,

optionally, the solid preparation includes tablets, powders, granules, and capsules;

optionally, the liquid preparation includes aqueous or oily suspensions, and syrups; and

optionally, the parenteral administered preparation includes solutions for injection, and aqueous or oily suspensions.

9. Use of a compound of formula (I) or a pharmaceutically acceptable salt thereof according to any one of claims 1 to 5, or a pharmaceutical composition according to claim 7 or 8 in the preparation of a Lp-PLA2 inhibitor.

10. Use of a compound of formula (I) or a pharmaceutically acceptable salt thereof according to any one of claims 1 to 5, or a pharmaceutical composition according to claim 7 or 8 in the preparation of a medicament for treating a neurodegenerative-related disease;

optionally, the neurodegenerative-related disease includes Alzheimer's disease (AD), glaucoma, and age-related macular degeneration (AMD).

11. Use of a compound of formula (I) or a pharmaceutically acceptable salt thereof according to any one of claims 1 to 5, or a pharmaceutical composition according to claim 7 or 8 in the preparation of a medicament for treating cardiovascular disease, diabetic macular edema (DME), or prostatic disease; and

optionally, the cardiovascular disease includes atherosclerosis.