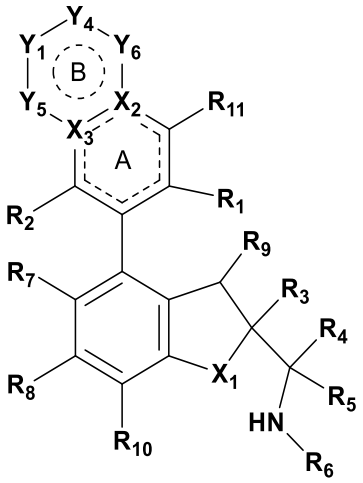
What is claimed is:

1. A compound of the following formula I or a pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof:



I

in the formula:

X_1 is selected from: O and NR_a;

X_2 is selected from: C and N; X_3 is selected from: C and N; preferably, ring A is a benzene ring or a 6-membered heteroaryl ring; more preferably, ring A is a benzene ring or a pyridine ring;

Y_5 and Y_6 are independently selected from: a bond, O, S, N, -S(O)-, $-S(O)_2-$, C, $CH(R_{13})$, $C(R_{13})_2$, $C(R_{13})$, $-OCH_2-$, $-N(R_{12})CH_2-$, $-CH_2CH_2-$ and $N(R_{12})$, and Y_5 and Y_6 are not simultaneously a bond;

Y_1 and Y_4 are independently selected from: a bond, O, N, C, S, -S(O)-, -C(O)-, $-S(O)_2-$, CH, CH_2, NH, $C(R_{13})$, $CH(R_{13})$, $C(R_{13})_2$ and $N(R_{12})$, provided that Y_1 and Y_4, Y_1 and Y_5, Y_4 and Y_6 are not simultaneously a bond, O, S, -S(O)- or $-S(O)_2-$ and satisfy the valence bond theory;

alternatively, when Y_1, Y_4 and Y_6 are arbitrarily selected from $C(R_{13})_2$, two R_{13} on the same carbon atom, together with the C atom to which they are attached, can form a substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl or substituted or unsubstituted 4- to 9-membered heterocyclyl ring, thereby forming a spiro ring structure with ring B;

alternatively, the ring atom in Y_1 or Y_6 and the ring atom in Y_4, together with the substituent attached to the ring atom, form a substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 4- to 9-membered heterocyclyl, substituted or unsubstituted 6- to 10-membered aryl or substituted or unsubstituted 5- to 10-membered heteroaryl ring, thereby forming a fused ring structure with ring B;

alternatively, X_2, together with the ring atom in Y_6 and the ring atom attached to R_{11} and

the substituent attached to the ring atom, forms a substituted or unsubstituted 5- or 6-membered cyclohydrocarbyl, substituted or unsubstituted 5- or 6-membered heterocyclyl, substituted or unsubstituted phenyl or substituted or unsubstituted 5- or 6-membered heteroaryl ring, thereby forming a three-fused ring structure with rings A and B;

ring B is a 5-, 6- or 7-membered heterocyclyl ring, a benzene ring or a 5-, 6- or 7-membered heteroaryl ring; ring B can be optionally substituted by one or more R_{13} and/or R_{12} that do not participate in ring formation, and can be further optionally substituted by 1, 2 or 3 substituents selected from hydroxyl, amino, halogen, substituted or unsubstituted alkyl, -NR'R'' and substituted or unsubstituted alkoxy;

R_1 is selected from: cyano and -C(O)NR'R'';

R_2 is selected from: H, halogen, substituted or unsubstituted alkyl and substituted or unsubstituted alkoxy;

R_3 is selected from: substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted alkyl; alternatively, R_4 and R_5, together with the carbon atom to which they are attached, form a 3- to 6-membered substituted or unsubstituted ring, and the ring optionally contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_6 is selected from: H, substituted or unsubstituted alkyl, substituted or unsubstituted alkoxy, substituted or unsubstituted alkenyl, substituted or unsubstituted alkynyl, substituted or unsubstituted cyclohydrocarbyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a substituted or unsubstituted 4- to 12-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl ring; the 4- to 12-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl each optionally further contain 1 or 2 heteroatoms selected from N and O;

R_7 is selected from: H, halogen, cyano, nitro, substituted or unsubstituted alkyl, substituted or unsubstituted haloalkyl, substituted or unsubstituted alkoxy, substituted or unsubstituted alkenyl and substituted or unsubstituted alkynyl;

R_8 is selected from: H, halogen, cyano, nitro, substituted or unsubstituted alkyl, substituted or unsubstituted haloalkyl, substituted or unsubstituted alkoxy, substituted or unsubstituted alkenyl and substituted or unsubstituted alkynyl;

R_9 is selected from: H, substituted or unsubstituted alkyl, substituted or unsubstituted alkoxy, hydroxyl and halogen;

R_{10} is selected from: H, halogen and substituted or unsubstituted alkyl;

R_{11} is selected from: H, hydroxyl, amino, halogen, substituted or unsubstituted alkyl, -NR'R'' and substituted or unsubstituted alkoxy;

each R_{12} that does not participate in ring formation is independently selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 6- to 14-membered aryl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl-C(O)- and substituted or unsubstituted C1-C4 alkyl;

each R_{13} that does not participate in ring formation is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-6 alkyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted C6-14 aryl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, or two R_{13} on the same carbon atom form an oxo (=O) or thio (=S) group;

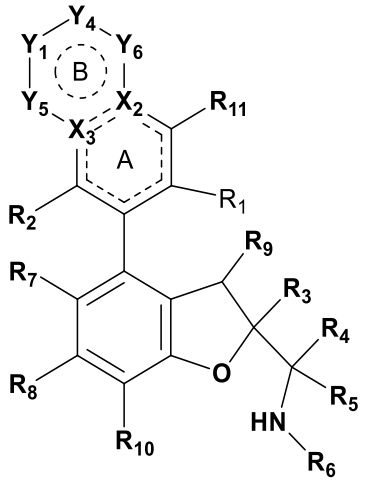
after R_{13} or R_{12} participates in ring formation, its ring atom can be optionally substituted by 1 to 3 heteroatoms selected from O, N and S;

R' and R'' are each independently selected from H, C1-C4 alkyl, C3-C6 cycloalkyl, C1-C4 alkyl-$S(O)_2$- and C1-C4 haloalkyl;

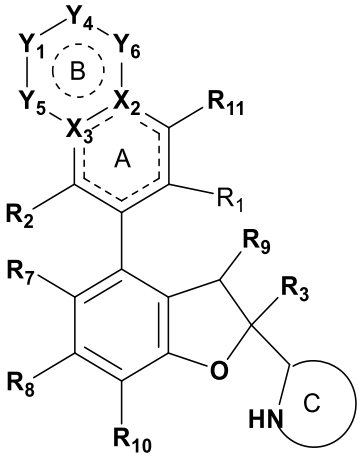
R_a is selected from H and C1-C4 alkyl;

wherein the dashed line indicates the presence or absence of a double bond.

2. The compound or the pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof according to claim 1, wherein the compound of formula I has a structure shown in the following formula Ia or Ib:



Ia



Ib

in formula Ib:

ring C is a substituted or unsubstituted 4- to 12-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl ring, and the 4- to 12-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl each optionally further contain 1 or 2 heteroatoms selected from N and O; ring C is preferably a substituted or unsubstituted 4- to 8-membered nitrogen-containing monocyclic heterocyclyl, substituted or unsubstituted 6- to 12-membered nitrogen-containing spiro heterocyclyl or substituted or unsubstituted 6- to 12-membered nitrogen-containing fused heterocyclyl ring.

3. The compound or the pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof according to any one of claims 1 to 2, wherein:

when R_{12}, which does not participate in ring formation, is present, each R_{12} is independently selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl-C(O)- and substituted or unsubstituted C1-C4 alkyl, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 8-membered cyclohydrocarbyl-C(O)- and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; or

when R_{12}, which does not participate in ring formation, is present, each R_{12} is independently selected from: H, acetyl, propionyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 4- to 6-membered heterocyclyl, 3- to 5-membered cyclohydrocarbyl-C(O)- and substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 alkyl is optionally substituted by 1, 2 or 3

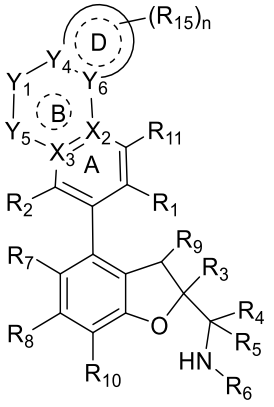
substituents selected from F, hydroxyl and cyano; and/or

when R_{13}, which does not participate in ring formation, is present, each R_{13} is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, or two R_{13} on the same carbon atom form an oxo (=O) or thio (=S) group; wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C6 alkyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; or

when R_{13}, which does not participate in ring formation, is present, each R_{13} is independently selected from: H, fluorine, chlorine, C1-C4 acyl, hydroxyl, cyano, C1-C4 alkoxy, C1-C6 alkyl, C1-C4 alkyl-$S(O)_2$- and 3- to 4-membered cyclohydrocarbyl-C(O)-.

4. The compound or the pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof according to any one of claims 1 to 3, wherein:

(1) the compound of formula I has a structure shown in the following formula IIa:



IIa

in the formula,

Y_4 is selected from: C, CH and N;

Y_6 is selected from: C, CH and N;

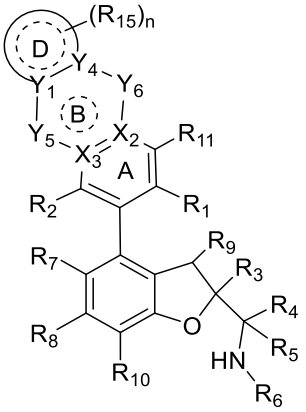
ring D is a 3- to 8-membered cyclohydrocarbyl, 4- to 9-membered heterocyclyl, 6- to 10-membered aryl or 5- to 10-membered heteroaryl ring, wherein the 4- to 9-membered heterocyclyl and 5- to 10-membered heteroaryl contain 1, 2 or 3 heteroatoms selected from O, N and S;

R_{15} is selected from: H, halogen, oxo (=O), thio (=S), substituted or unsubstituted C1-C4 acyl, hydroxyl, substituted or unsubstituted C1-C4 alkoxy, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 6- to 10-membered aryl-$S(O)_2$-,

substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-S(O)$_2$-, 6- to 10-membered aryl-S(O)$_2$-, 4- to 9-membered heterocyclyl, 3- to 8-membered cyclohydrocarbyl, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; and

n is 0, 1, 2, 3 or 4;

(2) the compound of formula I has a structure shown in the following formula IIb:



IIb

in the formula,

Y_1 is selected from: C, CH and N;

Y_4 is selected from: C, CH and N;

ring D is a 3- to 8-membered cyclohydrocarbyl, 4- to 9-membered heterocyclyl, 6- to 10-membered aryl or 5- to 10-membered heteroaryl ring, wherein the 4- to 9-membered heterocyclyl and 5- to 10-membered heteroaryl contain 1, 2 or 3 heteroatoms selected from O, N and S;

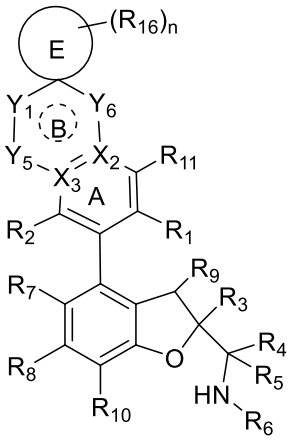
R_{15} is selected from: H, halogen, oxo (=O), thio (=S), substituted or unsubstituted C1-C4 acyl, hydroxyl, substituted or unsubstituted C1-C4 alkoxy, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkyl-S(O)$_2$-, substituted or unsubstituted 6- to 10-membered aryl-S(O)$_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-S(O)$_2$-, 6- to 10-membered aryl-S(O)$_2$-, 4- to 9-membered heterocyclyl, 3- to 8-membered cyclohydrocarbyl, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; and

n is 0, 1, 2, 3 or 4.

preferably, in formulae IIa and IIb, ring D is a 3- to 6-membered cyclohydrocarbyl, 4- to 6-membered heterocyclyl, 6- to 10-membered aryl or 5- to 8-membered heteroaryl ring, wherein the 4- to 6-membered heterocyclyl and 5- to 8-membered heteroaryl contain 1, 2 or 3 heteroatoms selected from O, N and S; R_{15} is selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, substituted or unsubstituted C1-C4 alkoxy, cyano, -NR'R'', substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, 4- to 9-membered heterocyclyl, 3- to 8-membered cyclohydrocarbyl, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; R' and R'' are each independently selected from H and C1-C4 alkyl; n is 0, 1 or 2;

preferably, in formulae IIa and IIb, R_{15} is selected from: H, fluorine, chlorine, acetyl, hydroxyl, C1-C4 alkoxy, cyano, -NR'R'', NR'R''-C(O)-, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl; R' and R'' are each independently selected from H and C1-C4 alkyl; n is 0 or 1;

(3) the compound of formula I has a structure shown in the following formula IIc:



IIc

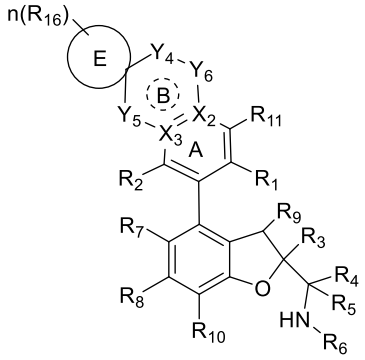
in the formula,

ring E is a 3- to 8-membered cyclohydrocarbyl or 4- to 9-membered heterocyclyl ring, wherein the 4- to 9-membered heterocyclyl contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_{16} is selected from H, halogen, substituted or unsubstituted C1-C4 alkyl, hydroxyl, substituted or unsubstituted C1-C4 acyl and substituted or unsubstituted C1-C4 alkoxy; preferably, the C1-C4 alkyl, C1-C4 acyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; and

n is 0, 1, 2, 3 or 4;

(4) the compound of formula I has a structure shown in the following formula IId:



IId

in the formula,

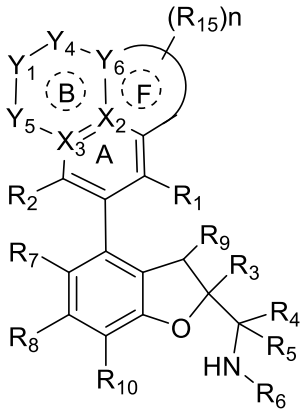
ring E is a 3- to 8-membered cyclohydrocarbyl or 4- to 9-membered heterocyclyl ring, wherein the 4- to 9-membered heterocyclyl contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_{16} is selected from H, halogen, substituted or unsubstituted C1-C4 alkyl, hydroxyl, substituted or unsubstituted C1-C4 acyl and substituted or unsubstituted C1-C4 alkoxy; preferably, the C1-C4 alkyl, C1-C4 acyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; and

n is 0, 1, 2, 3 or 4;

preferably, in formulae IIc and IId, ring E is a 3- to 6-membered cyclohydrocarbyl or 4- to 6-membered heterocyclyl ring, wherein the 4- to 6-membered heterocyclyl contains 1, 2 or 3 heteroatoms selected from O, N and S; R_{16} is selected from H, halogen, C1-C4 alkyl, hydroxyl and acetyl; n is 0 or 1; more preferably, ring E is a cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, oxetanyl, oxolanyl, tetrahydropyranyl, azetidinyl, azacyclopentyl or piperidinyl ring; R_{16} is selected from H, fluorine, methyl, ethyl, hydroxyl and acetyl; n is 0 or 1;

(5) the compound of formula I has a structure shown in the following formula IIe:



IIe

in the formula,

X_2 is C;

Y_6 is selected from: C, CH and N;

ring F is a 5- or 6-membered cyclohydrocarbyl, 5- or 6-membered heterocyclyl, phenyl or 5- or 6-membered heteroaryl ring, wherein the 5- or 6-membered heterocyclyl or 5- or 6-membered heteroaryl contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_{15} is selected from: H, halogen, oxo (=O), thio (=S), substituted or unsubstituted C1-C4 acyl, hydroxyl, substituted or unsubstituted C1-C4 alkoxy, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 6- to 10-membered aryl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 6- to 10-membered aryl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 8-membered cyclohydrocarbyl, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; and

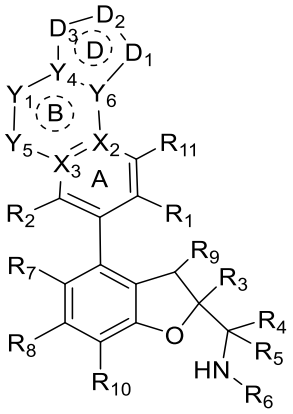
n is 0, 1, 2 or 3;

preferably, ring F is a phenyl or 5- or 6-membered heteroaryl ring, wherein the 5- or 6-membered heteroaryl contains 1, 2 or 3 heteroatoms selected from O, N and S; and/or R_{15} is selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, substituted or unsubstituted C1-C4 alkoxy, cyano, -NR'R'', substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, 4- to 9-membered heterocyclyl, 3- to 8-membered cyclohydrocarbyl, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; wherein R' and R'' are each independently selected from H and C1-C4 alkyl, and n is 0, 1 or 2;

more preferably, ring F is a 5-membered heteroaryl ring, wherein the 5-membered heteroaryl contains 1 or 2 heteroatoms selected from O and N; and/or R_{15} is selected from: H, fluorine, chlorine, acetyl, hydroxyl, C1-C4 alkoxy, cyano, -NR'R'', NR'R''-C(O)-, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl; R' and R'' are each independently selected from H and C1-C4 alkyl; n is 0 or 1;

more preferably, ring F is a pyrrolyl, furyl, pyrazolyl, imidazolyl, oxazolyl or isoxazolyl ring;

(6) the compound of formula I has a structure shown in the following formula IIIa:



IIIa

in the formula,

D_1 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, CR_f and CR_fR_g;

D_2 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, $(CR_f)_p$, $(CR_fR_g)_p$, C(O)-NR_e, N-NR_e, CR_f-NR_e, $N{=}N$ and $N{=}C(R_f)$;

D_3 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, $(CR_f)_p$ and $(CR_fR_g)_p$;

provided that D_1 and D_2, D_1 and D_3 are not simultaneously O, S, -S(O)- or -$S(O)_2$- and satisfy the valence bond theory;

each R_e at each occurrence is independently selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 6-membered cyclohydrocarbyl, 3- to 6-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

each R_f at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

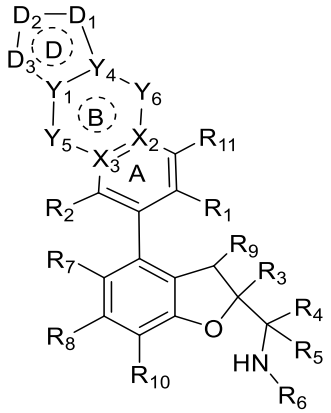
each R_g at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4

alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

alternatively, R_f and R_g on the same carbon atom form an oxo (=O) or thio (=S) group; and

each p is independently 1, 2, 3 or 4, preferably 1 or 2;

(7) the compound of formula I has a structure shown in the following formula IIIb:



IIIb

in the formula,

D_1 is selected from: O, S, S(O), $S(O)_2$, N, NR_c, CR_f and CR_fR_g;

D_2 is selected from: O, S, S(O), $S(O)_2$, N, NR_c, $(CR_f)_p$, $(CR_fR_g)_p$, C(O)-NR_c, N-NR_e, CR_f-NR_e, N=N and $N{=}C(R_f)$;

D_3 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, $(CR_f)_p$ and $(CR_fR_g)_p$;

provided that D_1 and D_2, D_1 and D_3 are not simultaneously O, S, -S(O)- or -$S(O)_2$- and satisfy the valence bond theory;

each R_e at each occurrence is independently selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 6-membered cyclohydrocarbyl, 3- to 6-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2

or 3 substituents selected from F, hydroxyl and cyano;

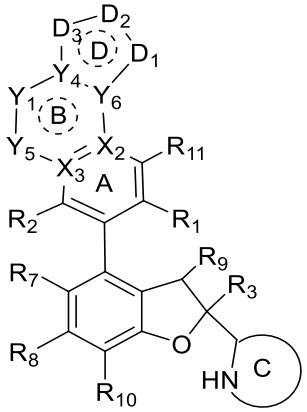
each R_f at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

each R_g at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

alternatively, R_f and R_g on the same carbon atom form an oxo (=O) or thio (=S) group; and

each p is independently 1, 2, 3 or 4, preferably 1 or 2;

(8) the compound of formula I has a structure shown in the following formula IVa:



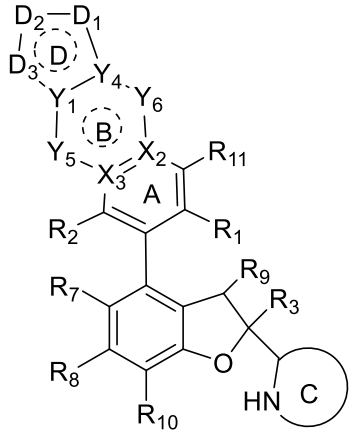
IVa

in the formula,

ring C is a substituted or unsubstituted 4- to 12-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl ring, and the 4- to 12-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6-

to 12-membered spiro heterocyclyl each optionally further contain 1 or 2 heteroatoms selected from N and O; ring C is preferably a substituted or unsubstituted 4- to 8-membered nitrogen-containing monocyclic heterocyclyl, substituted or unsubstituted 6- to 12-membered nitrogen-containing spiro heterocyclyl or substituted or unsubstituted 6- to 12-membered nitrogen-containing fused heterocyclyl ring;

(9) the compound of formula I has a structure shown in the following formula IVb:

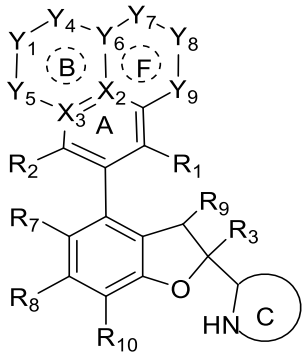


IVb

in the formula,

ring C is a substituted or unsubstituted 4- to 12-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl ring, and the 4- to 12-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl each optionally further contain 1 or 2 heteroatoms selected from N and O; ring C is preferably a substituted or unsubstituted 4- to 8-membered nitrogen-containing monocyclic heterocyclyl, substituted or unsubstituted 6- to 12-membered nitrogen-containing spiro heterocyclyl or substituted or unsubstituted 6- to 12-membered nitrogen-containing fused heterocyclyl ring;

(10) the compound of formula I has a structure shown in the following formula IVc:



IVc

in the formula,

Y_7, Y_8 and Y_9 are independently selected from: a bond, O, S, S(O), $S(O)_2$, N, NR_e, CR_f

and CR_fR_g, provided that at most one of Y_7, Y_8 and Y_9 is a bond, Y_7 and Y_8, Y_8 and Y_9 are not simultaneously O, S, -S(O)- or -$S(O)_2$- and satisfy the valence bond theory,

each R_e at each occurrence is independently selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 6-membered cyclohydrocarbyl, 3- to 6-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

each R_f at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

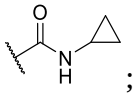
each R_g at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

alternatively, R_f and R_g on the same carbon atom form an oxo (=O) or thio (=S) group; and

ring C is a substituted or unsubstituted 4- to 12-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl ring, and the 4- to 12-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl each optionally further contain 1 or 2 heteroatoms selected

from N and O; ring C is preferably a substituted or unsubstituted 4- to 8-membered nitrogen-containing monocyclic heterocyclyl, substituted or unsubstituted 6- to 12-membered nitrogen-containing spiro heterocyclyl or substituted or unsubstituted 6- to 12-membered nitrogen-containing fused heterocyclyl ring.

5. The compound or the pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof according to any one of claims 1 to 4, wherein:

R_1 is -C(O)NR'R''; preferably, R_1 is -C(O)NHR'; preferably, R' is selected from H, C1-C4 alkyl and C3-C6 cycloalkyl; more preferably R_1 is -C(O)NH_2, -C(O)$NHCH_3$ and ; and/or

R_2 is selected from H, halogen, C1-C4 alkyl and C1-C4 alkoxy; preferably, R_2 is selected from H, halogen and methoxy; more preferably, R_2 is halogen, fluorine or chlorine; most preferably, R_2 is fluorine; and/or

R_3 is selected from substituted or unsubstituted aryl and substituted or unsubstituted heteroaryl; preferably, R_3 is selected from substituted or unsubstituted phenyl and substituted or unsubstituted pyridyl; more preferably, R_3 is phenyl, fluorophenyl or pyridyl; and/or

R_4 and R_5 are each independently selected from: H and substituted or unsubstituted alkyl; alternatively, R_4 and R_5, together with the carbon atom to which they are attached, form a 3- to 6-membered substituted or unsubstituted ring, and the ring optionally contains 1, 2 or 3 heteroatoms selected from O, N and S; preferably, R_4 and R_5 are each independently selected from: H and substituted or unsubstituted C1-C4 alkyl; more preferably, R_4 and R_5 are each independently selected from: H and C1-C3 alkyl; more preferably, R_4 and R_5 are each independently selected from: H and methyl; more preferably, R_4 and R_5 are both H; and/or

R_7 and R_8 are each independently selected from: H, halogen, cyano, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 haloalkyl, substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C2-C4 alkenyl and substituted or unsubstituted C2-C4 alkynyl; preferably, R_7 and R_8 are each independently selected from: H, halogen, cyano, methyl and methoxy; more preferably, R_7 and R_8 are each independently selected from: fluorine and chlorine; more preferably, R_7 is chlorine, R_8 is fluorine; and/or

R_9 is selected from H, C1-C4 alkyl, C1-C4 alkoxy, hydroxyl and halogen; preferably, R_9 is selected from H, methyl, methoxy, hydroxyl and F; more preferably, R_9 is H; and/or

R_{10} is selected from: H, halogen and C1-C4 alkyl; preferably, R_{10} is selected from: H, F and methyl; more preferably, R_{10} is H; and/or

R_{11} is selected from: H, hydroxyl, amino, halogen, C1-C4 alkyl, -NR'R'' and C1-C4 alkoxy, wherein R' and R'' are independently selected from C1-C4 alkyl; preferably, R_{11} is

selected from: H, hydroxyl, amino, fluorine, chlorine, methyl, methoxy and -NH(CH_3); more preferably, R_{11} is H; and/or

X_2 is C or X_2 is N; and/or

X_3 is C or X_3 is N; and/or

Y_5 is selected from: a bond, O, S, -S(O)-, N, CH_2, CH, -C(O)-, -CH(OH)-, NH, -N(CH_3)-, -OCH_2-, -NHCH_2-, -N(CH_3)CH_2- and -CH_2CH_2-; preferably, Y_5 is O, or Y_5 is CH or CH_2, or Y_5 is NH or N; and/or

Y_6 is selected from: a bond, O, S, -S(O)-, -$S(O)_2$-, N, CH, -C(O)-, CH_2, NH, -N(CH_3)-, -N(C_2H_4OH)-, -N(C(O)CH_3)-, -N(C(O)C_2H_5)-, -OCH_2-, -NHCH_2-, -N(CH_3)CH_2- and -CH_2CH_2-; and/or

Y_1 and Y_4 are independently selected from: a bond, O, N, NH, -N(CH_3)-, CH, CH_2 and -CH(CH_3)-, and Y_1 and Y_4 are not simultaneously a bond or O.

6. The compound or the pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof according to any one of claims 1 to 5, wherein:

(1) R_6 is selected from: H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl, substituted or unsubstituted C2-C6 alkynyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 6- to 14-membered aryl, substituted or unsubstituted 5- to 10-membered heteroaryl, substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl and substituted or unsubstituted 6- to 12-membered spiro heterocyclyl;

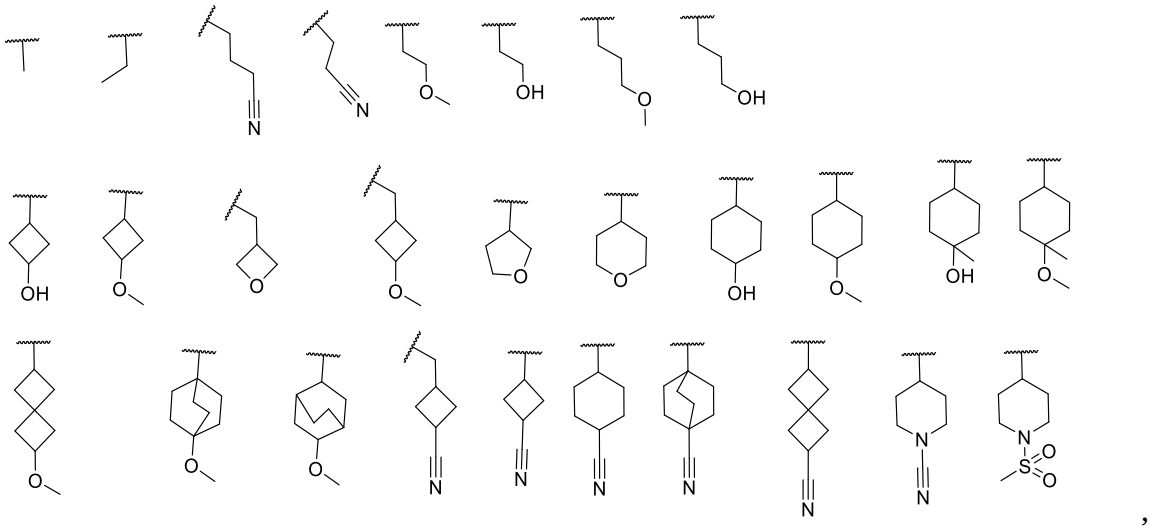
preferably, R_6 is H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl or substituted or unsubstituted C2-C6 alkynyl, and their substituents are 1, 2 or 3 substituents selected from: hydroxyl, halogen, C1-C4 alkoxy optionally substituted by halogen, cyano, -$S(O)_2$-C1-C4 alkyl optionally substituted by halogen, C1-C4 alkyl optionally substituted by halogen, -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2, -C(O)-C1-C4 alkyl, -NR'-C(O)-C1-C4 alkyl and 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl, wherein the 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, halogen, cyano, C1-C4 alkyl-$S(O)_2$-, hydroxyl, carboxyl, -NR'R'', 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl; wherein R' and R'' are each independently selected from H and C1-C4 alkyl; or

R_6 is substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl or substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: halogen, hydroxyl, cyano, -NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2, -NR'-C(O)-C1-C4 alkyl, -$S(O)_2$-C1-C4 alkyl, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, -C(O)-C1-C4 alkyl and C1-C4 alkoxycarbonyl, and the C1-C4 alkyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 groups selected from halogen, hydroxyl and -NR'R'', wherein the R' and R'' are each independently selected from H and C1-C4 alkyl; or

R_6 is substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, cyano, -$S(O)_2$-C1-C4 alkyl, hydroxyl, halogen, NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2 and -NR'-C(O)-C1-C4 alkyl, wherein the R' and R'' are each independently selected from H and C1-C4 alkyl; or

R_6 is -L-W-Z, wherein L is a bond or substituted or unsubstituted C1-C4 alkyl; W is a bond, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 6- to 14-membered aryl, substituted or unsubstituted 5- to 10-membered heteroaryl, substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl; Z is hydrogen, halogen, C1-C4 alkyl, C1-C4 alkoxy, hydroxyl, -$S(O)_2$-C1-C4 alkyl, -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2, cyano, -C(O)-C1-C4 alkyl, -O-3- to 8-membered cyclohydrocarbyl or -NR'-C(O)-C1-C4 alkyl, wherein R' and R'' are each independently H or C1-C4 alkyl;

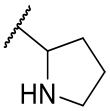
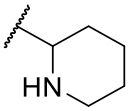
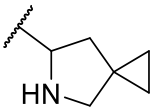
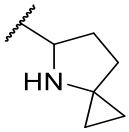
preferably, the -L-W-Z is selected from:

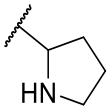


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wherein the wavy line indicates the bond connection position; and/or

(2) R_4 or R_5 and R_6, together with the atom to which they are attached, form a 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl or 6- to 12-membered spiro heterocyclyl ring, and the 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl or 6- to 12-membered spiro heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, cyano, C1-C4 alkyl, halogen and C1-C4 alkoxy;

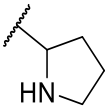
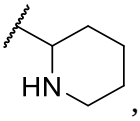
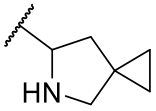
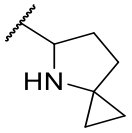
preferably, R_4 or R_5 and R_6, together with the atom to which they are attached, form the following group optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy: , ,  or , wherein the wavy line indicates the bond connection position; or

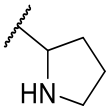
R_4 or R_5 and R_6, together with the atom to which they are attached, form , which is optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy.

7. The compound or the pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof according to any one of claims 1-6, wherein:

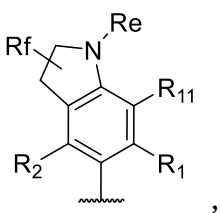
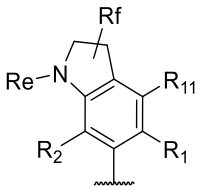
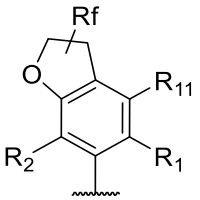
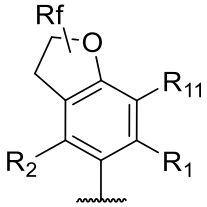
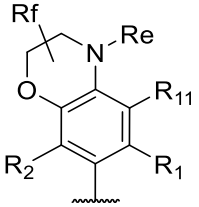
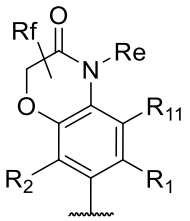
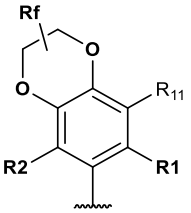
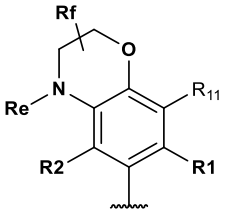
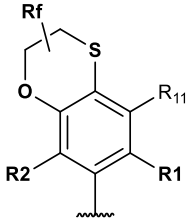
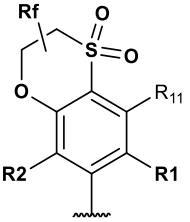
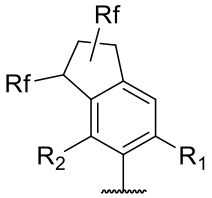
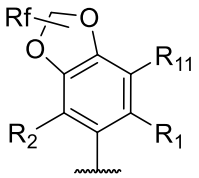
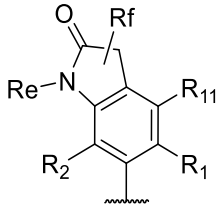
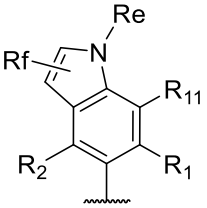
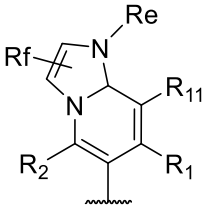
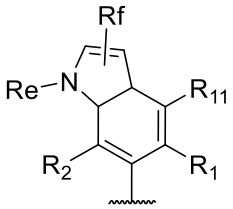
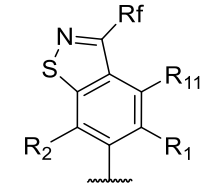
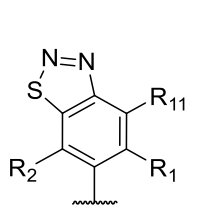
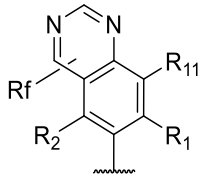
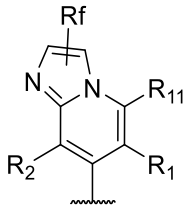
(1) ring C is a 4- to 9-membered monocyclic or fused heterocyclyl ring, which is optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, cyano, C1-C4 alkyl, halogen and C1-C4 alkoxy;

preferably, ring C is the following group optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy:

, ,  or , wherein the wavy line indicates the bond connection position; or

ring C is , which is optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy; and/or

(2) the ring A and ring B, together with their substituents, form any one of the following groups:

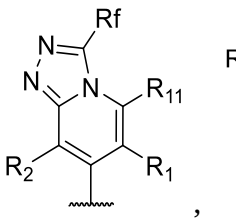
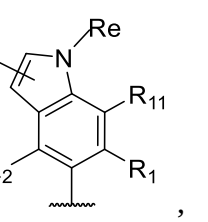
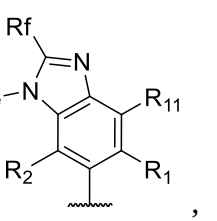
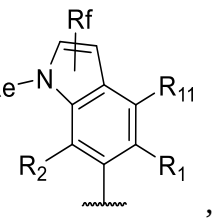
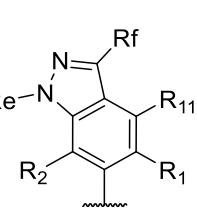
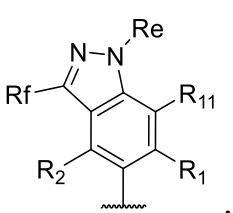
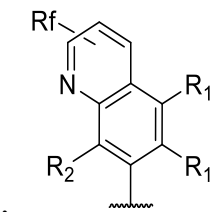
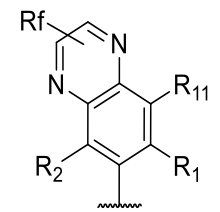
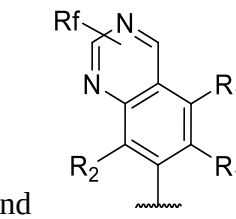

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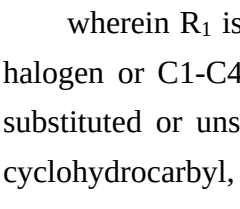
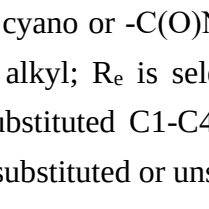
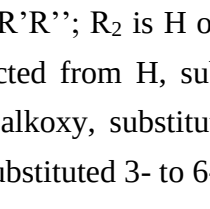
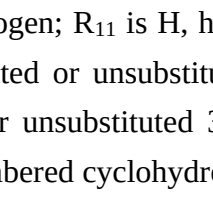
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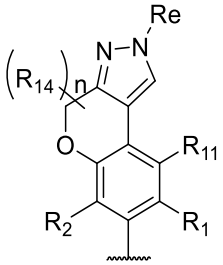
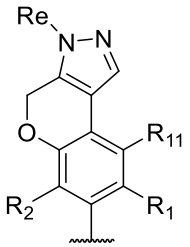
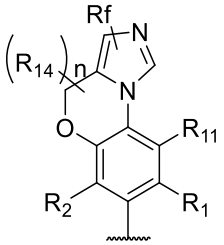
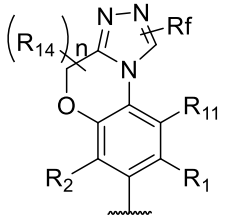
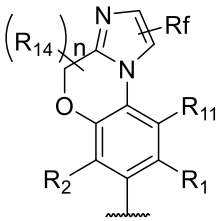
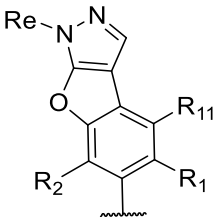
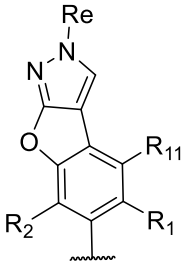
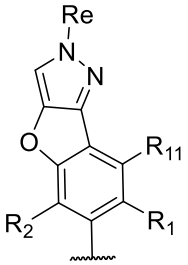
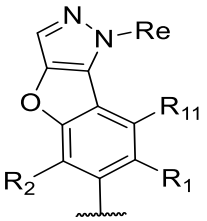
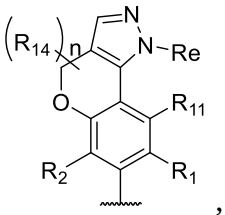
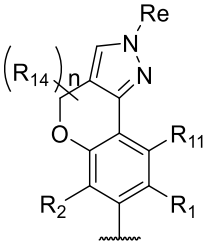
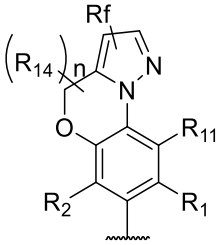
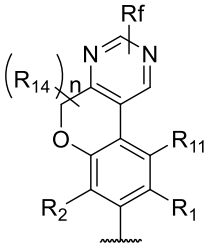
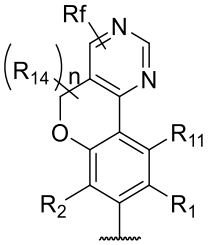
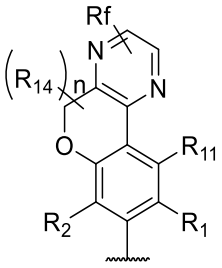
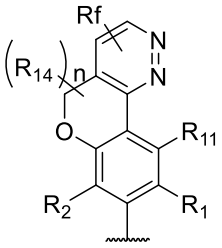
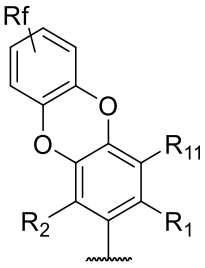
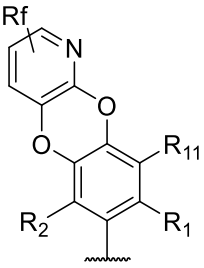
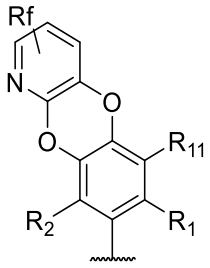
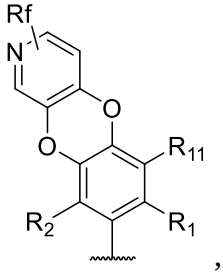
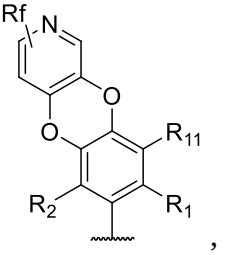
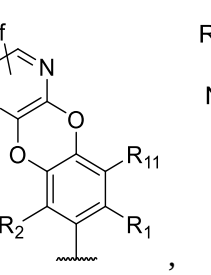
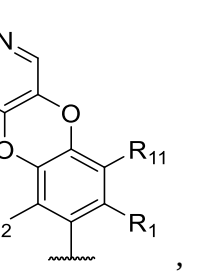
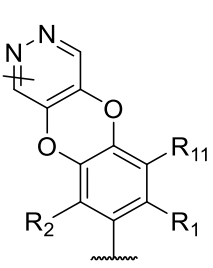
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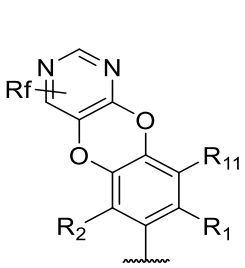
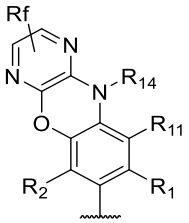
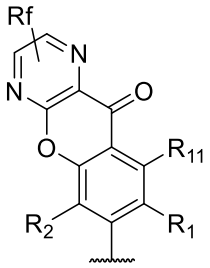
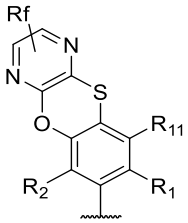
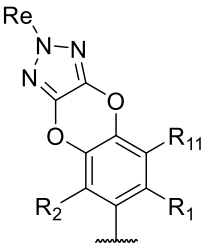
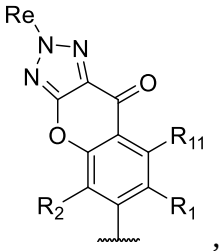
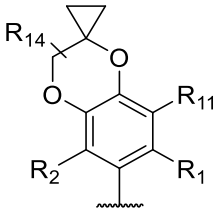
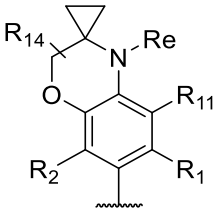
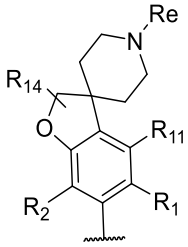
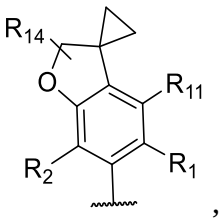
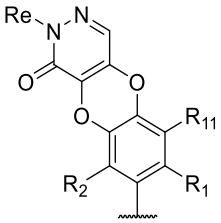
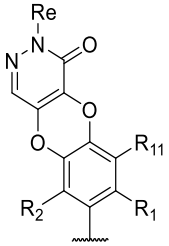
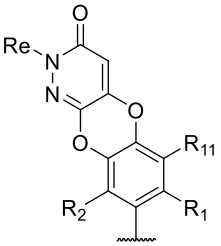
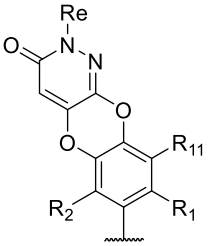
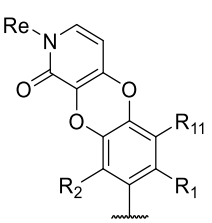
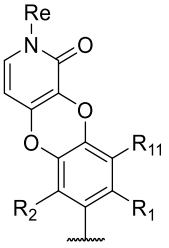
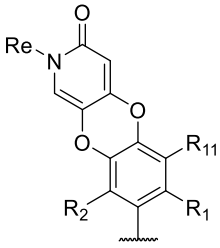
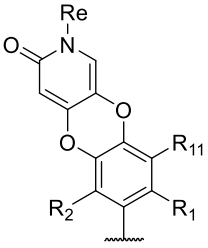
wherein R_1 is cyano or -C(O)NR'R''; R_2 is H or halogen; R_{11} is H, hydroxyl, -NR'R'', halogen or C1-C4 alkyl; R_e is selected from H, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and substituted or unsubstituted C1-C4 acyl; R_f is selected from H, halogen, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl; preferably, the C1-C4 alkyl, C1-C4 alkoxy, 3- to 6-membered cyclohydrocarbyl, 3- to 6-membered cyclohydrocarbyl-C(O)- and C1-C4 acyl are optionally substituted by 1, 2 or 3 substituents

selected from F, hydroxyl and cyano; wherein R' and R'' are each independently selected from H and C1-C4 alkyl; the wavy line indicates the bond connection position; or

(3) the ring A and ring B, together with their substituents, form any one of the following groups:

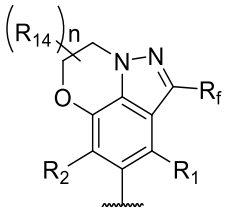
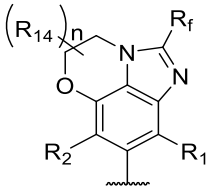
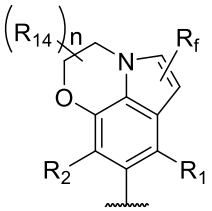
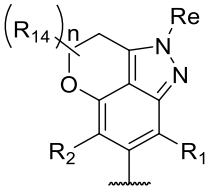
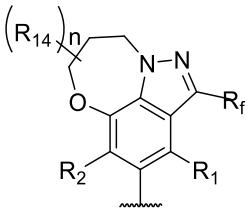




























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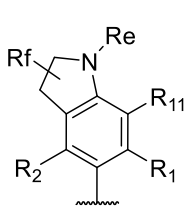
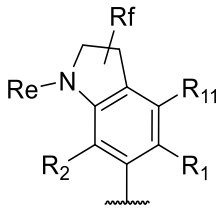
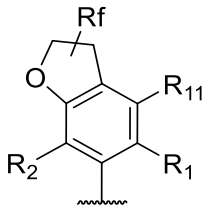
wherein R_1 is cyano or -C(O)NR'R''; R_2 is H or halogen; R_{11} is H, hydroxyl, -NR'R'', halogen or C1-C4 alkyl; R_{14} is H, halogen or C1-C4 alkyl; n is 0, 1 or 2; R_{16} is selected from H, hydroxyl, halogen and C1-C4 alkyl; R_e is selected from H, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and substituted or unsubstituted C1-C4 acyl; R_f is selected from H, halogen, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl; preferably, the C1-C4 alkyl, C1-C4 alkoxy, 3- to 6-membered cyclohydrocarbyl, 3- to 6-membered cyclohydrocarbyl-C(O)- and C1-C4 acyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; wherein R' and R'' are each independently selected from H, C1-C4 alkyl and C3-C6 cycloalkyl; the wavy line indicates the bond connection position; or

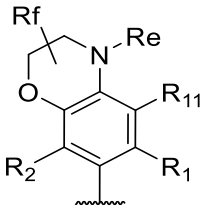
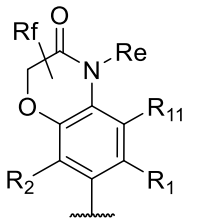
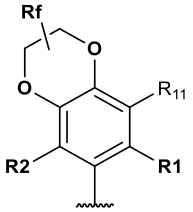
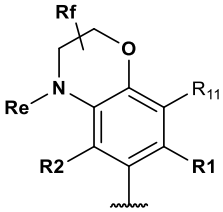
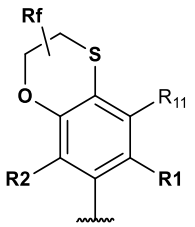
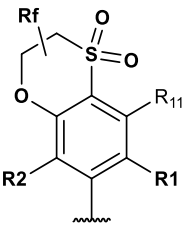
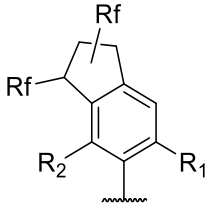
(4) the ring A and ring B, together with their substituents, form any one of the following groups:

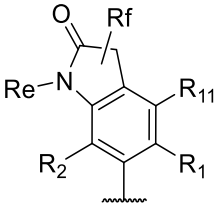
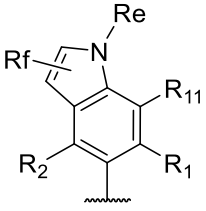
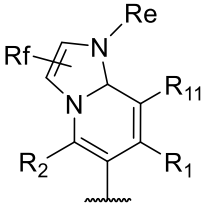

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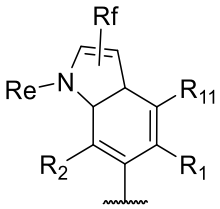
wherein R_1 is cyano or -C(O)NR'R''; R_2 is H or halogen; R_{14} is H, halogen or C1-C4 alkyl; n is 0, 1 or 2; R_e is selected from H, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and substituted or unsubstituted C1-C4 acyl; R_f is selected from H, halogen, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl; preferably, the C1-C4 alkyl, C1-C4 alkoxy, 3- to 6-membered cyclohydrocarbyl, 3- to 6-membered cyclohydrocarbyl-C(O)- and C1-C4 acyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; wherein R' and R'' are each independently selected from H and C1-C4 alkyl; the wavy line indicates the bond connection position; or

(5) ring A and ring B, together with their ring substituents, form any one of the following groups:

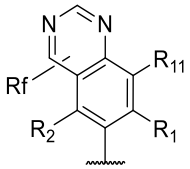
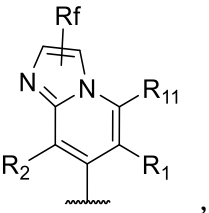
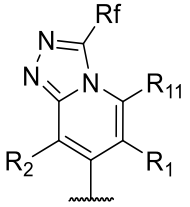
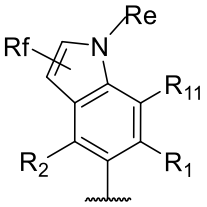
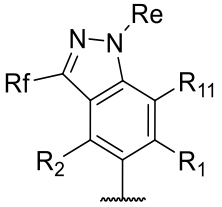
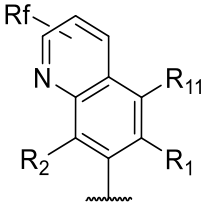
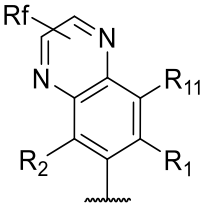
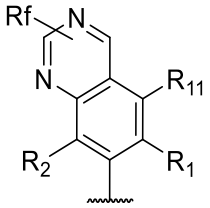
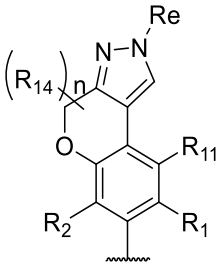
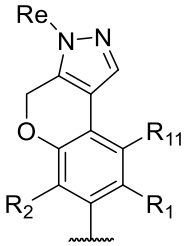
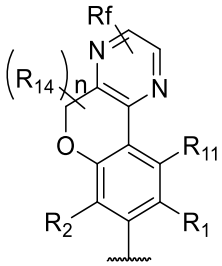
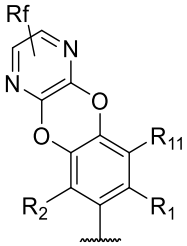
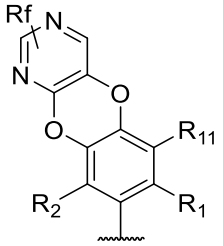
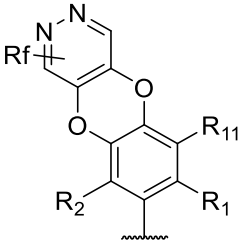
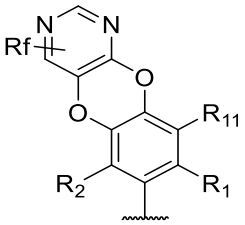
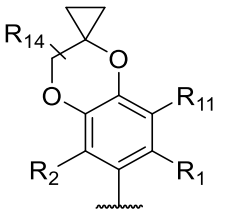
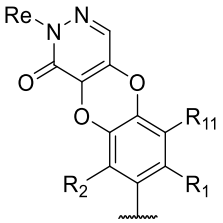
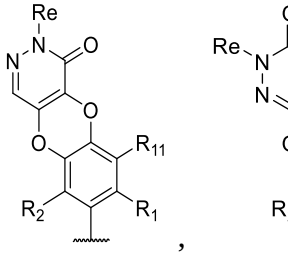
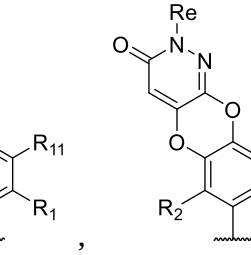
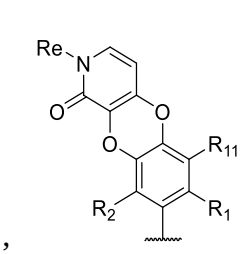
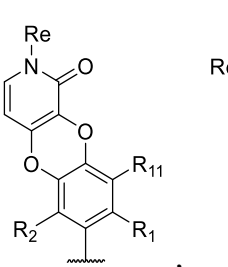
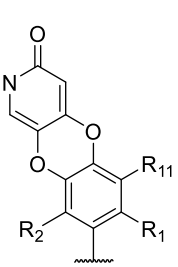
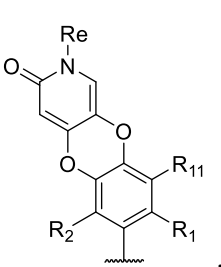
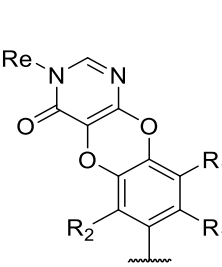
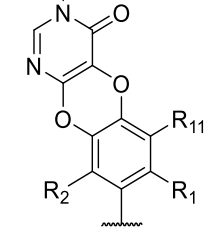
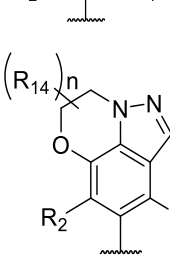
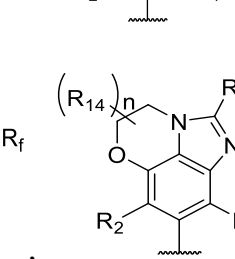
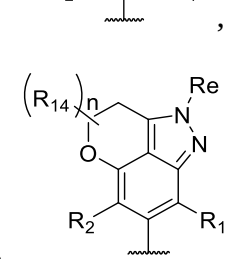
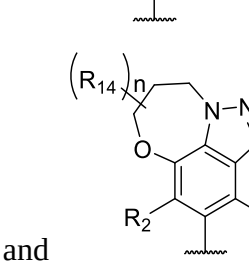
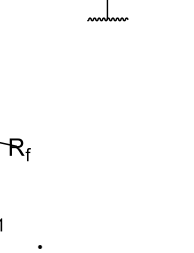
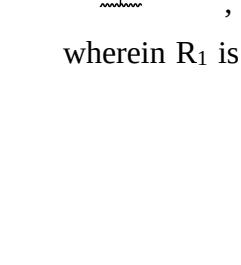
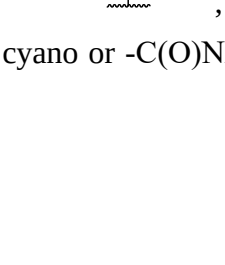
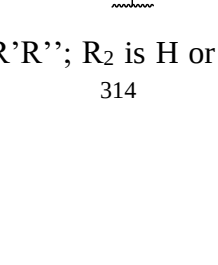
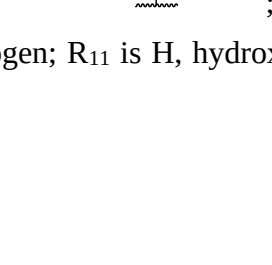

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and

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wherein R_1 is cyano or -C(O)NR'R''; R_2 is H or halogen; R_{11} is H, hydroxyl, -NR'R'',

halogen or C1-C4 alkyl; R_{14} is H, halogen or C1-C4 alkyl; n is 0, 1 or 2; R_{16} is selected from H, hydroxyl, halogen and C1-C4 alkyl; R_e is selected from H, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and substituted or unsubstituted C1-C4 acyl; R_f is selected from H, halogen, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl; preferably, the C1-C4 alkyl, C1-C4 alkoxy, 3- to 6-membered cyclohydrocarbyl, 3- to 6-membered cyclohydrocarbyl-C(O)- and C1-C4 acyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; wherein R' and R'' are each independently selected from H, C1-C4 alkyl and C3-C6 cycloalkyl; the wavy line indicates the bond connection position;

X_1 is O;

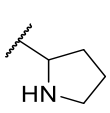
R_3 is selected from unsubstituted phenyl or phenyl substituted by 1, 2 or 3 substituents selected from hydroxyl, halogen, C1-C4 alkyl, C1-C4 haloalkyl and C1-C4 alkoxy;

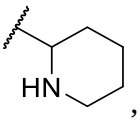
R_4 is selected from H and C1-C4 alkyl;

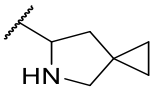
R_5 is selected from H and C1-C4 alkyl;

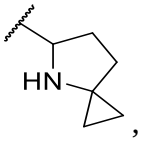
R_6 is selected from: H; C1-C4 alkyl, which is optionally substituted by 1, 2 or 3 substituents selected from hydroxyl, halogen, C1-C4 alkoxy, cyano and -$S(O)_2$-C1-C4 alkyl; 3- to 8-membered cyclohydrocarbyl, which is optionally substituted by 1, 2 or 3 substituents selected from halogen, hydroxyl, cyano, -$S(O)_2$-C1-C4 alkyl, C1-C4 alkyl and C1-C4 alkoxy; 4- to 9-membered monocyclic or fused heterocyclyl, which is optionally substituted by 1, 2 or 3 substituents selected from halogen, hydroxyl, cyano, -$S(O)_2$-C1-C4 alkyl, C1-C4 alkyl and C1-C4 alkoxy; and 6- to 12-membered bridged cyclyl, 6- to 12-membered spiro cyclyl, 6- to 12-membered bridged heterocyclyl or 6- to 12-membered spiro heterocyclyl, each of which is optionally substituted by 1, 2 or 3 substituents selected from C1-C4 alkyl, C1-C4 alkoxy and cyano;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form the following group optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy:



, 

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or 

, wherein the wavy line indicates the bond connection position;

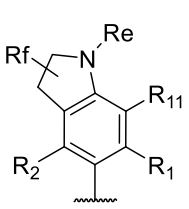
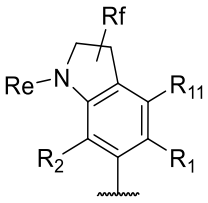
R_7 and R_8 are each independently selected from: H, halogen, cyano, methyl and methoxy;

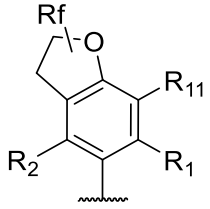
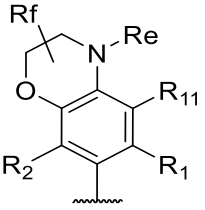
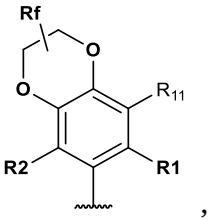
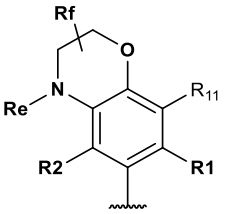
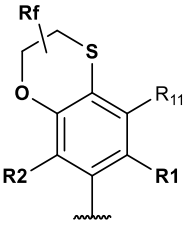
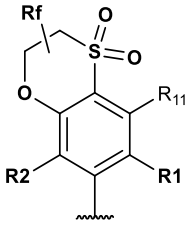
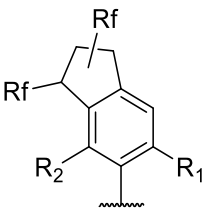
R_9 is selected from: H, methyl, methoxy, hydroxyl and F;

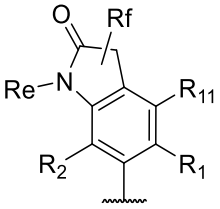
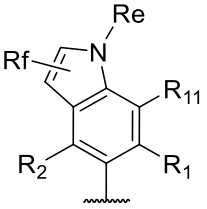
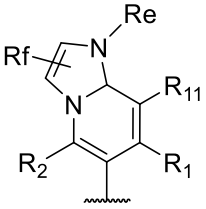
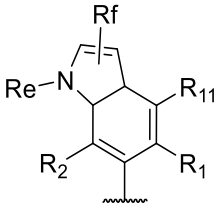
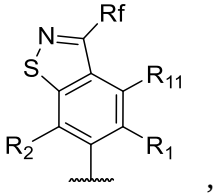
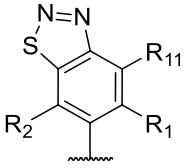
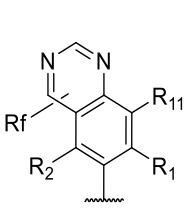
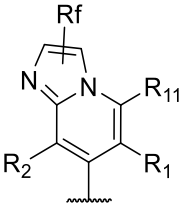
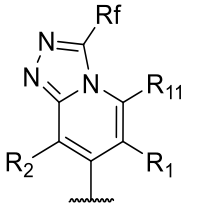
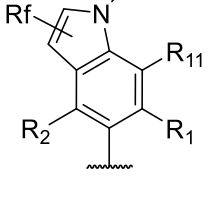
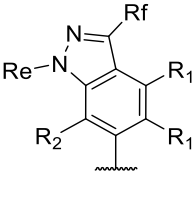
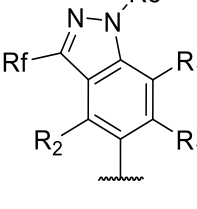
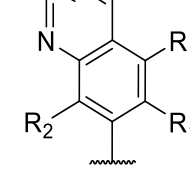
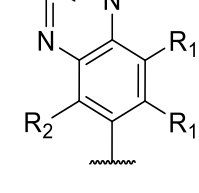
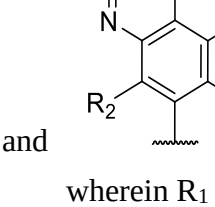
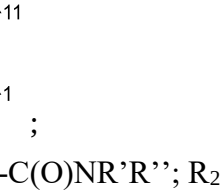
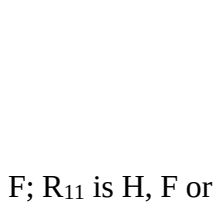
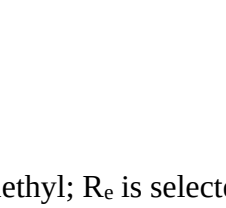
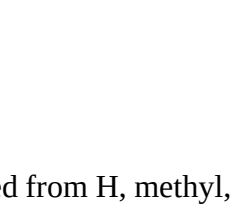
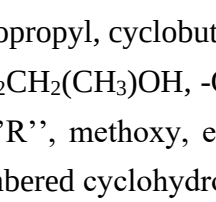
R_{10} is selected from: H, F and methyl; or

(6) ring A and ring B, together with their ring substituents, form any one of the following

groups:


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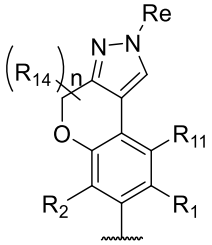
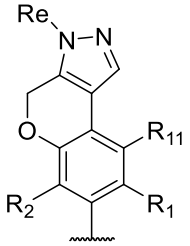
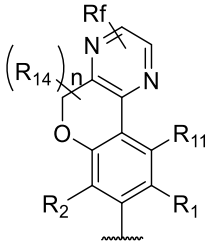
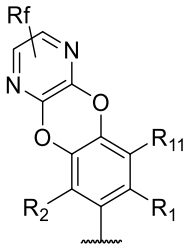
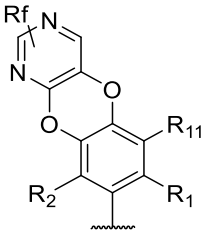
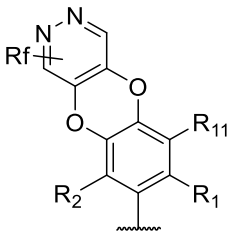
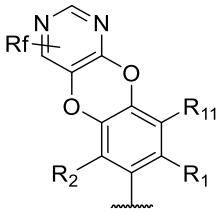
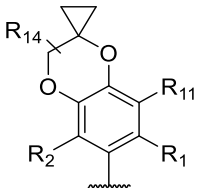
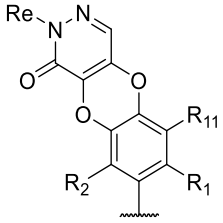
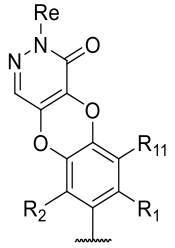
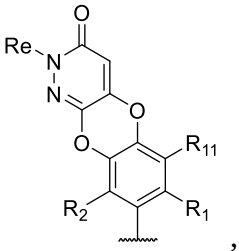
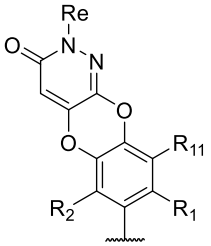
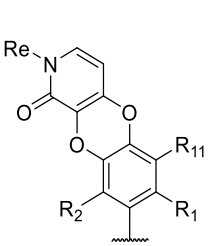
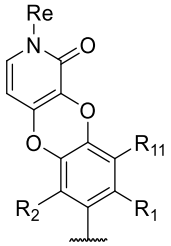
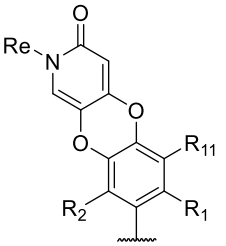
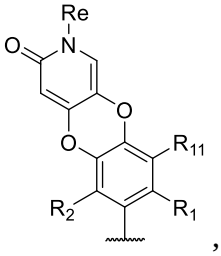
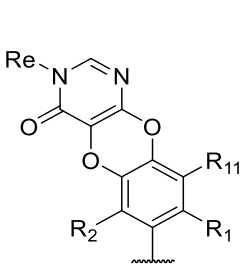
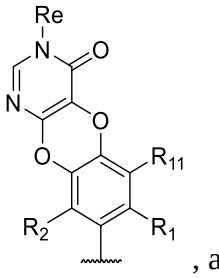
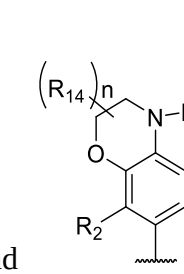
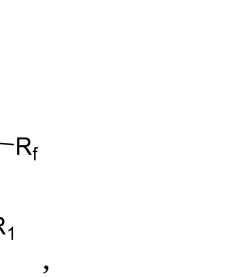
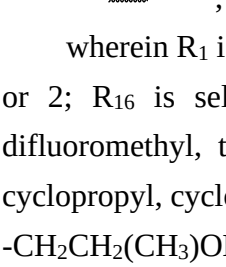
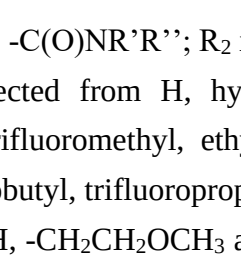
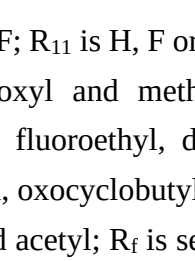
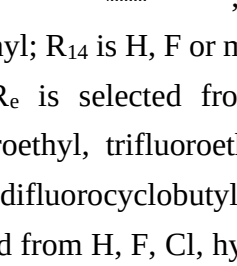
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wherein R_1 is -C(O)NR'R''; R_2 is F; R_{11} is H, F or methyl; R_e is selected from H, methyl, difluoromethyl, trifluoromethyl, ethyl, fluoroethyl, difluoroethyl, trifluoroethyl, isopropyl, cyclopropyl, cyclobutyl, trifluoropropyl, oxocyclobutyl, 1,1-difluorocyclobutyl, $-CH_2CH_2OH$, $-CH_2CH_2(CH_3)OH$, $-CH_2CH_2OCH_3$ and acetyl; R_f is selected from H, F, Cl, hydroxyl, cyano, -NR'R'', methoxy, ethoxy, $-CH_2OH$, $-(CH_2)_2OH$, $-(CH_2)_2OCH_3$, C1-C6 alkyl and 3- to 6-membered cyclohydrocarbyl, wherein R' and R'' are each independently selected from H and methyl; the wavy line indicates the bond connection position; or

(7) ring A and ring B, together with their ring substituents, form any one of the following

groups:


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wherein R_1 is -C(O)NR'R''; R_2 is F; R_{11} is H, F or methyl; R_{14} is H, F or methyl; n is 0, 1 or 2; R_{16} is selected from H, hydroxyl and methyl; R_e is selected from H, methyl, difluoromethyl, trifluoromethyl, ethyl, fluoroethyl, difluoroethyl, trifluoroethyl, isopropyl, cyclopropyl, cyclobutyl, trifluoropropyl, oxocyclobutyl, 1,1-difluorocyclobutyl, $-CH_2CH_2OH$, $-CH_2CH_2(CH_3)OH$, $-CH_2CH_2OCH_3$ and acetyl; R_f is selected from H, F, Cl, hydroxyl, cyano, -NR'R'', methoxy, ethoxy, $-CH_2OH$, $-(CH_2)_2OH$, $-(CH_2)_2OCH_3$, C1-C6 alkyl and 3- to 6-membered cyclohydrocarbyl, wherein R' and R'' are each independently selected from H, methyl and cyclopropyl; the wavy line indicates the bond connection position;

preferably, in (2), R_1 is cyano, $-C(O)NH_2$ or $-C(O)NHCH_3$; R_2 is H or F; R_{11} is H; R_e is selected from H, methyl, difluoromethyl, trifluoromethyl, ethyl, fluoroethyl, difluoroethyl, trifluoroethyl, isopropyl, cyclopropyl, cyclobutyl, trifluoropropyl, oxocyclobutyl, 1,1-difluorocyclobutyl, $-CH_2CH_2OH$, $-CH_2CH_2(CH_3)OH$, acetyl, propionyl and cyclopropionyl; R_f is selected from H, F, Cl, hydroxyl, cyano, $-NH_2$, $-CH_2OH$, $-(CH_2)_2OH$, $-(CH_2)_2OCH_3$, methoxy, methyl, ethyl, cyclopropyl and cyclobutyl;

preferably, R_1 is -C(O)NH_2 or -C(O)$NHCH_3$; R_2 is F; R_{11} is H; R_e is selected from H, methyl, difluoromethyl, trifluoromethyl, ethyl, fluoroethyl, difluoroethyl, trifluoroethyl, isopropyl, -CH_2CH_2OH, -$CH_2CH_2(CH_3)OH$, trifluoropropyl, oxocyclobutyl, 1,1-difluorocyclobutyl, cyclopropyl and acetyl; R_f is selected from H, F, Cl, hydroxyl, cyano, -NH_2, -CH_2OH, -$(CH_2)_2OH$, -$(CH_2)_2OCH_3$, methoxy and methyl;

in (3), R_1 is cyano, -C(O)NH_2 or -C(O)$NHCH_3$; R_2 is H or F; R_{11} is H; R_{14} is H or methyl; n is 0, 1 or 2; R_{16} is H, hydroxyl or methyl; R_e is selected from H, methyl, difluoromethyl, trifluoromethyl, ethyl, fluoroethyl, difluoroethyl, trifluoroethyl, isopropyl, cyclopropyl, cyclobutyl, trifluoropropyl, oxocyclobutyl, 1,1-difluorocyclobutyl, -CH_2CH_2OH, -$CH_2CH_2(CH_3)OH$, acetyl, propionyl and cyclopropionyl; R_f is selected from H, F, Cl, hydroxyl, cyano, -NH_2, -CH_2OH, -$(CH_2)_2OH$, -$(CH_2)_2OCH_3$, methoxy, methyl, ethyl, cyclopropyl and cyclobutyl; or

preferably, R_1 is -C(O)NH_2 or -C(O)$NHCH_3$; R_2 is F; R_{11} is H; R_{14} is H; R_{16} is H; R_c is selected from H, methyl, difluoromethyl, trifluoromethyl, ethyl, fluoroethyl, difluoroethyl, trifluoroethyl, isopropyl, trifluoropropyl, oxocyclobutyl, 1,1-difluorocyclobutyl, cyclopropyl, -CH_2CH_2OH, -$CH_2CH_2(CH_3)OH$ and acetyl; R_f is selected from H, F, Cl, hydroxyl, cyano, -NH_2, methoxy, -CH_2OH, -$(CH_2)_2OH$, -$(CH_2)_2OCH_3$ and methyl;

in (4), R_1 is cyano, -C(O)NH_2 or -C(O)$NHCH_3$; R_2 is H or F; R_{14} is H or methyl; n is 0, 1 or 2; R_c is selected from H, methyl, difluoromethyl, trifluoromethyl, ethyl, fluoroethyl, difluoroethyl, trifluoroethyl, isopropyl, ethyl, cyclopropyl, cyclobutyl, -CH_2CH_2OH, -$CH_2CH_2(CH_3)OH$, acetyl, propionyl and cyclopropionyl; R_f is selected from H, F, Cl, hydroxyl, cyano, -NH_2, methoxy, -CH_2OH, -$(CH_2)_2OH$, -$(CH_2)_2OCH_3$, methyl, ethyl, cyclopropyl and cyclobutyl.

8. The compound or the pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof according to any one of claims 1 to 7, wherein:

(1) X_2 is selected from: C and N;

X_3 is selected from: C and N;

Y_5 and Y_6 are independently selected from: O, S, N, -S(O)-, -$S(O)_2$-, $CH(R_{13})$, $C(R_{13})_2$, $C(R_{13})$, -OCH_2-, -$N(R_{12})CH_2$-, -CH_2CH_2- and $N(R_{12})$; and Y_5 and Y_6 are not simultaneously a bond;

Y_1 is selected from: a bond, O, N, CH, CH_2, NH, $CH(R_{13})$, $C(R_{13})_2$ and $N(R_{12})$;

Y_4 is selected from: a bond, O, N, CH, CH_2, NH, $CH(R_{13})$, $C(R_{13})_2$ and $N(R_{12})$;

ring B can be optionally substituted by one or more R_{13} and/or R_{12} that do not participate in ring formation, and can be further optionally substituted by 1, 2 or 3 substituents selected from hydroxyl, amino, halogen, substituted or unsubstituted C1-C4 alkyl, -NR'R'' and

substituted or unsubstituted C1-C4 alkoxy;

R_1 is selected from: cyano and -C(O)NR'R'';

R_2 is selected from: H, halogen, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_3 is selected from: substituted or unsubstituted aryl;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl; alternatively, R_4 and R_5, together with the carbon atom to which they are attached, form a 3- to 6-membered substituted or unsubstituted ring, and the ring optionally contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_6 is selected from: H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl, substituted or unsubstituted C2-C6 alkynyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 6- to 14-membered aryl, substituted or unsubstituted 5- to 10-membered heteroaryl, substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl and substituted or unsubstituted 6- to 12-membered spiro heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl or 6- to 12-membered spiro heterocyclyl ring, and the 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, cyano, C1-C4 alkyl, halogen and C1-C4 alkoxy;

R_7 and R_8 are each independently selected from: H, halogen, cyano, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkoxy;

R_9 is selected from: H, C1-C4 alkyl, C1-C4 alkoxy, hydroxyl and halogen;

R_{10} is selected from: H, halogen and C1-C4 alkyl;

R_{11} is selected from: H, hydroxyl, amino, halogen, C1-C4 alkyl, -NR'R'' and C1-C4 alkoxy;

each R_{12} that does not participate in ring formation is independently selected from H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, 3- to 8-membered cyclohydrocarbyl-C(O)- and substituted or unsubstituted C1-C4 alkyl; the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 4- to 9-membered heterocyclyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

each R_{13} that does not participate in ring formation is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-; the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano, or two R_{13} on the same carbon atom form an oxo (=O) or thio (=S) group;

R' and R'' are each independently selected from H, C1-C4 alkyl and C3-C6 cycloalkyl;

wherein the dashed line indicates the presence or absence of a double bond;

(2) X_2 is selected from: C and N;

X_3 is selected from: C and N;

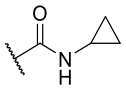
Y_5 is selected from: O, S, -S(O)-, -$S(O)_2$-, N, CH_2, CH, -C(O)-, NH and -$N(CH_3)$-;

Y_6 is selected from: O, S, -S(O)-, -$S(O)_2$-, N, CH_2, CH, -C(O)-, NH and -$N(CH_3)$-;

Y_1 is selected from: a bond, O, NH, -$N(CH_3)$-, CH_2 and -$CH(CH_3)$-;

Y_4 is selected from: a bond, O, NH, -$N(CH_3)$-, CH_2 and -$CH(CH_3)$-;

H on ring B can be further optionally substituted by 1, 2 or 3 substituents selected from hydroxyl, amino, halogen, substituted or unsubstituted C1-C4 alkyl, -NR'R'' and substituted or unsubstituted C1-C4 alkoxy;

R_1 is selected from: cyano, -$C(O)NH_2$, -$C(O)NHCH_3$ and ;

R_2 is selected from: H, fluorine and methoxy;

R_3 is phenyl;

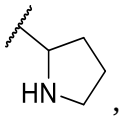
R_4 and R_5 are each independently selected from: H and C1-C4 alkyl;

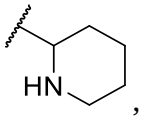
R_6 is H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl or substituted or unsubstituted C2-C6 alkynyl, and their substituents are 1, 2 or 3 substituents selected from: hydroxyl, halogen, C1-C4 alkoxy optionally substituted by halogen, cyano, -$S(O)_2$-C1-C4 alkyl optionally substituted by halogen, C1-C4 alkyl optionally substituted by halogen, -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2, -C(O)-C1-C4 alkyl, -NR'-C(O)-C1-C4 alkyl and 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl, wherein the 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, halogen, cyano, C1-C4 alkyl-$S(O)_2$-, hydroxyl, carboxyl, -NR'R'', 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl; wherein R' and R'' are each independently selected from H and C1-C4 alkyl; or

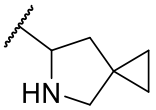
R_6 is substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl or substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: halogen, hydroxyl, cyano, -NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2, -NR'-C(O)-C1-C4 alkyl, -$S(O)_2$-C1-C4 alkyl, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, -C(O)-C1-C4 alkyl and C1-C4 alkoxycarbonyl, and the C1-C4 alkyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 groups selected from halogen, hydroxyl and -NR'R'', wherein the R' and R'' are each independently selected from H and C1-C4 alkyl; or

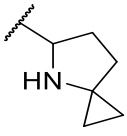
R_6 is substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, cyano, -$S(O)_2$-C1-C4 alkyl, hydroxyl, halogen, NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2 and -NR'-C(O)-C1-C4 alkyl, wherein the R' and R'' are each independently selected from H and C1-C4 alkyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form the following group optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy:



,


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or


, wherein the wavy line indicates the bond connection position;

R_7 and R_8 are each independently selected from: H, halogen, cyano, methyl and methoxy;

R_9 is selected from: H, methyl, methoxy, hydroxyl and F;

R_{10} is selected from: H, F and methyl; R_{11} is selected from: H, hydroxyl, amino, fluorine, chlorine, methyl, methoxy and -NH(CH_3).

9. The compound or the pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof according to claim 4, wherein:

(1) in formula IIa

X_2 is selected from: C and N;

X_3 is selected from: C and N;

Y_1 is selected from: a bond, O, NH, -N(CH_3)-, CH_2 and -CH(CH_3)-;

Y_5 is selected from: O, S, N, CH_2, CH, NH, -N(CH_3)-, -OCH_2-, -NHCH_2-, -N(CH_3)CH_2- and -CH_2CH_2-;

Y_4 is selected from: C, CH or N;

Y_6 is selected from: C, CH or N;

R_{15} is selected from: H, fluorine, chlorine, acetyl, hydroxyl, C1-C4 alkoxy, cyano, -NR'R'', NR'R''-C(O)-, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl; R' and R'' are each independently selected from H and C1-C4 alkyl;

n is 0 or 1;

R_1 is selected from: cyano and -C(O)NR'R'';

R_2 is selected from: H, halogen, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_3 is selected from: substituted or unsubstituted aryl;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl; alternatively, R_4 and R_5, together with the carbon atom to which they are attached, form a 3- to 6-membered substituted or unsubstituted ring, and the ring optionally contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_6 is selected from: H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl, substituted or unsubstituted C2-C6 alkynyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 6- to 14-membered aryl, substituted or unsubstituted 5- to 10-membered heteroaryl, substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl and substituted or unsubstituted 6- to 12-membered spiro heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl or 6- to 12-membered spiro heterocyclyl ring, and the 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, cyano, C1-C4 alkyl, halogen and C1-C4 alkoxy;

R_7 and R_8 are each independently selected from: H, halogen, cyano, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkoxy;

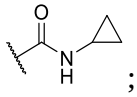
R_9 is selected from: H, C1-C4 alkyl, C1-C4 alkoxy, hydroxyl and halogen;

R_{10} is selected from: H, halogen and C1-C4 alkyl;

R_{11} is selected from: H, hydroxyl, amino, halogen, C1-C4 alkyl, -NR'R'' and C1-C4 alkoxy;

R' and R'' are each independently selected from H, C1-C4 alkyl and C3-C6 cycloalkyl; and

wherein the dashed line indicates the presence or absence of a double bond;

preferably, R_1 is selected from: cyano, -C(O)NH_2, -C(O)$NHCH_3$ and  ;

R_2 is selected from: H, fluorine and methoxy;

R_3 is phenyl;

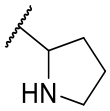
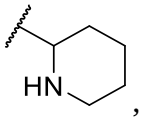
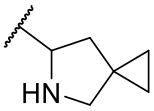
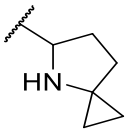
R_4 and R_5 are each independently selected from: H and C1-C4 alkyl;

R_6 is H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl or substituted or unsubstituted C2-C6 alkynyl, and their substituents are 1, 2 or 3 substituents selected from: hydroxyl, halogen, C1-C4 alkoxy optionally substituted by halogen, cyano, -$S(O)_2$-C1-C4 alkyl optionally substituted by halogen, C1-C4 alkyl optionally substituted by halogen, -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2, -C(O)-C1-C4 alkyl, -NR'-C(O)-C1-C4 alkyl and 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl, wherein the 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, halogen, cyano, C1-C4 alkyl-$S(O)_2$-, hydroxyl, carboxyl, -NR'R'', 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl; wherein R' and R'' are each independently selected from H and C1-C4 alkyl; or

R_6 is substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl or substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: halogen, hydroxyl, cyano, -NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2, -NR'-C(O)-C1-C4 alkyl, -$S(O)_2$-C1-C4 alkyl, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, -C(O)-C1-C4 alkyl and C1-C4 alkoxycarbonyl, and the C1-C4 alkyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 groups selected from halogen, hydroxyl and -NR'R'', wherein the R' and R'' are each independently selected from H and C1-C4 alkyl; or

R_6 is substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, cyano, -$S(O)_2$-C1-C4 alkyl, hydroxyl, halogen, NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2 and -NR'-C(O)-C1-C4 alkyl, wherein the R' and R'' are each independently selected from H and C1-C4 alkyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form the following group optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy:

, ,  or , wherein the wavy line indicates the bond connection position;

R_7 and R_8 are each independently selected from: H, halogen, cyano, methyl and methoxy;

R_9 is selected from: H, methyl, methoxy, hydroxyl and F;

R_{10} is selected from: H, F and methyl; and

R_{11} is selected from: H, hydroxyl, amino, fluorine, chlorine, methyl, methoxy and -NH(CH_3);

(2) in formula IIb

X_2 and X_3 are C;

Y_1 is selected from: C, CH and N;

Y_4 is selected from: C, CH and N;

Y_5 is selected from: a bond, O, S, -S(O)-, -S(O)$_2$-, -C(O)-, N, NH, -N(CH_3)-, CH_2, -CH(CH_3)-, -OCH_2-, -NHCH_2-, -N(CH_3)CH_2- and -CH_2CH_2-;

Y_6 is selected from: a bond, O, S, -S(O)-, -S(O)$_2$-, -C(O)-, N, CH_2, CH, NH, -N(CH_3)-, -OCH_2-, -NHCH_2-, -N(CH_3)CH_2- and -CH_2CH_2-; and Y_5 and Y_6 are not simultaneously a bond;

R_{15} is selected from: H, fluorine, chlorine, acetyl, hydroxyl, C1-C4 alkoxy, cyano, -NR'R'', NR'R''-C(O)-, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl; R' and R'' are each independently selected from H and C1-C4 alkyl;

n is 0 or 1;

R_1 is selected from: cyano and -C(O)NR'R'';

R_2 is selected from: H, halogen, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_3 is selected from: substituted or unsubstituted aryl;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl; alternatively, R_4 and R_5, together with the carbon atom to which they are attached, form a 3- to 6-membered substituted or unsubstituted ring, and the ring optionally contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_6 is selected from: H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl, substituted or unsubstituted C2-C6 alkynyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 6- to 14-membered aryl, substituted or unsubstituted 5- to 10-membered heteroaryl, substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl and substituted or unsubstituted 6- to 12-membered spiro heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl or 6- to 12-membered spiro heterocyclyl ring, and the 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, cyano, C1-C4 alkyl, halogen and C1-C4 alkoxy;

R_7 and R_8 are each independently selected from: H, halogen, cyano, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkoxy;

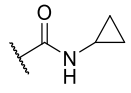
R_9 is selected from: H, C1-C4 alkyl, C1-C4 alkoxy, hydroxyl and halogen;

R_{10} is selected from: H, halogen and C1-C4 alkyl;

R_{11} is selected from: H, hydroxyl, amino, halogen, C1-C4 alkyl, -NR'R'' and C1-C4 alkoxy;

R' and R'' are each independently selected from H, C1-C4 alkyl and C3-C6 cycloalkyl; and

wherein the dashed line indicates the presence or absence of a double bond;

preferably, R_1 is selected from: cyano, $-C(O)NH_2$, $-C(O)NHCH_3$ and ;

R_2 is selected from: H, fluorine and methoxy;

R_3 is phenyl;

R_4 and R_5 are each independently selected from: H and C1-C4 alkyl;

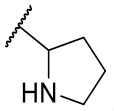
R_6 is H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl or substituted or unsubstituted C2-C6 alkynyl, and their substituents are 1, 2 or 3 substituents selected from: hydroxyl, halogen, C1-C4 alkoxy optionally substituted by halogen, cyano, $-S(O)_2$-C1-C4 alkyl optionally substituted by halogen, C1-C4 alkyl optionally substituted by halogen, $-S(O)_2$-NR'R'', $-S(O)_2-NH_2$, -C(O)-C1-C4 alkyl, -NR'-C(O)-C1-C4 alkyl and 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl, wherein the 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, halogen, cyano, C1-C4 alkyl-$S(O)_2$-, hydroxyl, carboxyl, -NR'R'', 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl; wherein R' and R'' are each independently selected from H and C1-C4 alkyl; or

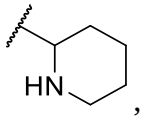
R_6 is substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl or substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: halogen, hydroxyl, cyano, -NR'R'', $-S(O)_2$-NR'R'', $-S(O)_2$-

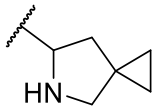
NH_2, -NR'-C(O)-C1-C4 alkyl, -$S(O)_2$-C1-C4 alkyl, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, -C(O)-C1-C4 alkyl and C1-C4 alkoxycarbonyl, and the C1-C4 alkyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 groups selected from halogen, hydroxyl and -NR'R'', wherein the R' and R'' are each independently selected from H and C1-C4 alkyl; or

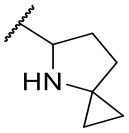
R_6 is substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, cyano, -$S(O)_2$-C1-C4 alkyl, hydroxyl, halogen, NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2 and -NR'-C(O)-C1-C4 alkyl, wherein the R' and R'' are each independently selected from H and C1-C4 alkyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form the following group optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy:



,


,


or


, wherein the wavy line indicates the bond connection position;

R_7 and R_8 are each independently selected from: H, halogen, cyano, methyl and methoxy;

R_9 is selected from: H, methyl, methoxy, hydroxyl and F;

R_{10} is selected from: H, F and methyl; and

R_{11} is selected from: H, hydroxyl, amino, fluorine, chlorine, methyl, methoxy and -$NH(CH_3)$;

(3) in formula IIc

X_2 and X_3 are C;

Y_1 is selected from: O or CH_2;

Y_5 is selected from: a bond, O, NH, -$N(CH_3)$-, CH_2 and -$CH(CH_3)$-;

Y_6 is selected from: a bond, O, S, N, CH_2, CH, NH and -$N(CH_3)$-;

R_{16} is selected from halogen, C1-C4 alkyl, hydroxyl, C1-C4 acyl and C1-C4 alkoxy;

R_1 is selected from: cyano and -C(O)NR'R'';

R_2 is selected from: H, halogen, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_3 is selected from: substituted or unsubstituted aryl;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl; alternatively, R_4 and R_5, together with the carbon atom to which they are attached, form a 3- to 6-membered substituted or unsubstituted ring, and the ring optionally contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_6 is selected from: H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl, substituted or unsubstituted C2-C6 alkynyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 6- to 14-membered aryl, substituted or unsubstituted 5- to 10-membered heteroaryl, substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl and substituted or unsubstituted 6- to 12-membered spiro heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl or 6- to 12-membered spiro heterocyclyl ring, and the 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, cyano, C1-C4 alkyl, halogen and C1-C4 alkoxy;

R_7 and R_8 are each independently selected from: H, halogen, cyano, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkoxy;

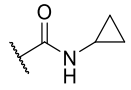
R_9 is selected from: H, C1-C4 alkyl, C1-C4 alkoxy, hydroxyl and halogen;

R_{10} is selected from: H, halogen and C1-C4 alkyl;

R_{11} is selected from: H, hydroxyl, amino, halogen, C1-C4 alkyl, -NR'R'' and C1-C4 alkoxy;

R' and R'' are each independently selected from H, C1-C4 alkyl and C3-C6 cycloalkyl; and

wherein the dashed line indicates the presence or absence of a double bond;

preferably, R_1 is selected from: cyano, $-C(O)NH_2$, $-C(O)NHCH_3$ and ;

R_2 is selected from: H, fluorine and methoxy;

R_3 is phenyl;

R_4 and R_5 are each independently selected from: H and C1-C4 alkyl;

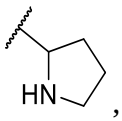
R_6 is H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl or substituted or unsubstituted C2-C6 alkynyl, and their substituents are 1, 2 or 3 substituents selected from: hydroxyl, halogen, C1-C4 alkoxy optionally substituted by halogen, cyano, $-S(O)_2$-C1-C4 alkyl optionally substituted by halogen, C1-C4 alkyl optionally substituted by halogen, $-S(O)_2$-NR'R'', $-S(O)_2-NH_2$, -C(O)-C1-C4 alkyl, -NR'-C(O)-C1-C4 alkyl and 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl, wherein the 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl

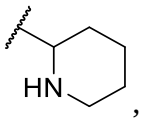
and 4- to 9-membered heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, halogen, cyano, C1-C4 alkyl-$S(O)_2$-, hydroxyl, carboxyl, -NR'R'', 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl; wherein R' and R'' are each independently selected from H and C1-C4 alkyl; or

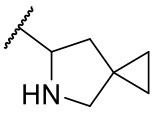
R_6 is substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl or substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: halogen, hydroxyl, cyano, -NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2, -NR'-C(O)-C1-C4 alkyl, -$S(O)_2$-C1-C4 alkyl, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, -C(O)-C1-C4 alkyl and C1-C4 alkoxycarbonyl, and the C1-C4 alkyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 groups selected from halogen, hydroxyl and -NR'R'', wherein the R' and R'' are each independently selected from H and C1-C4 alkyl; or

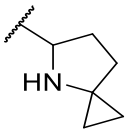
R_6 is substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, cyano, -$S(O)_2$-C1-C4 alkyl, hydroxyl, halogen, NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2 and -NR'-C(O)-C1-C4 alkyl, wherein the R' and R'' are each independently selected from H and C1-C4 alkyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form the following group optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy:



,


,


or


, wherein the wavy line indicates the bond connection position;

R_7 and R_8 are each independently selected from: H, halogen, cyano, methyl and methoxy;

R_9 is selected from: H, methyl, methoxy, hydroxyl and F;

R_{10} is selected from: H, F and methyl; and

R_{11} is selected from: H, hydroxyl, amino, fluorine, chlorine, methyl, methoxy and -$NH(CH_3)$;

(4) in formula IId

X_2 and X_3 are C;

Y_4 is selected from: O or CH_2;

Y_5 is selected from: a bond, O, NH, -$N(CH_3)$-, CH_2 and -$CH(CH_3)$-;

Y_6 is selected from: a bond, O, S, N, CH_2, CH, NH and -$N(CH_3)$-;

R_{16} is selected from halogen, C1-C4 alkyl, hydroxyl, C1-C4 acyl and C1-C4 alkoxy;

R_1 is selected from: cyano and -C(O)NR'R'';

R_2 is selected from: H, halogen, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_3 is selected from: substituted or unsubstituted aryl;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl; alternatively, R_4 and R_5, together with the carbon atom to which they are attached, form a 3- to 6-membered substituted or unsubstituted ring, and the ring optionally contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_6 is selected from: H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl, substituted or unsubstituted C2-C6 alkynyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 6- to 14-membered aryl, substituted or unsubstituted 5- to 10-membered heteroaryl, substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl and substituted or unsubstituted 6- to 12-membered spiro heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl or 6- to 12-membered spiro heterocyclyl ring, and the 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, cyano, C1-C4 alkyl, halogen and C1-C4 alkoxy;

R_7 and R_8 are each independently selected from: H, halogen, cyano, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkoxy;

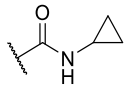
R_9 is selected from: H, C1-C4 alkyl, C1-C4 alkoxy, hydroxyl and halogen;

R_{10} is selected from: H, halogen and C1-C4 alkyl;

R_{11} is selected from: H, hydroxyl, amino, halogen, C1-C4 alkyl, -NR'R'' and C1-C4 alkoxy;

R' and R'' are each independently selected from H, C1-C4 alkyl and C3-C6 cycloalkyl; and

wherein the dashed line indicates the presence or absence of a double bond;

preferably, R_1 is selected from: cyano, $-C(O)NH_2$, $-C(O)NHCH_3$ and ;

R_2 is selected from: H, fluorine and methoxy;

R_3 is phenyl;

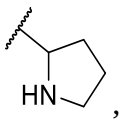
R_4 and R_5 are each independently selected from: H and C1-C4 alkyl;

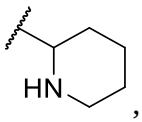
R_6 is H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl or substituted or unsubstituted C2-C6 alkynyl, and their substituents are 1, 2 or 3 substituents selected from: hydroxyl, halogen, C1-C4 alkoxy optionally substituted by halogen, cyano, -$S(O)_2$-C1-C4 alkyl optionally substituted by halogen, C1-C4 alkyl optionally substituted by halogen, -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2, -C(O)-C1-C4 alkyl, -NR'-C(O)-C1-C4 alkyl and 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl, wherein the 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, halogen, cyano, C1-C4 alkyl-$S(O)_2$-, hydroxyl, carboxyl, -NR'R'', 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl; wherein R' and R'' are each independently selected from H and C1-C4 alkyl; or

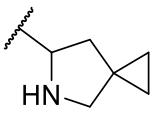
R_6 is substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl or substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: halogen, hydroxyl, cyano, -NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2, -NR'-C(O)-C1-C4 alkyl, -$S(O)_2$-C1-C4 alkyl, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, -C(O)-C1-C4 alkyl and C1-C4 alkoxycarbonyl, and the C1-C4 alkyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 groups selected from halogen, hydroxyl and -NR'R'', wherein the R' and R'' are each independently selected from H and C1-C4 alkyl; or

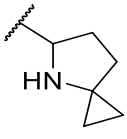
R_6 is substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, cyano, -$S(O)_2$-C1-C4 alkyl, hydroxyl, halogen, NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2 and -NR'-C(O)-C1-C4 alkyl, wherein the R' and R'' are each independently selected from H and C1-C4 alkyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form the following group optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy:



,


,


or


, wherein the wavy line indicates the bond connection position;

R_7 and R_8 are each independently selected from: H, halogen, cyano, methyl and methoxy;

R_9 is selected from: H, methyl, methoxy, hydroxyl and F;

R_{10} is selected from: H, F and methyl; and

R_{11} is selected from: H, hydroxyl, amino, fluorine, chlorine, methyl, methoxy and -$NH(CH_3)$;

(5) in formula IIe

Y_1, Y_4 and Y_5 are independently selected from: O, CH, CH_2, -$CH(CH_3)$-, N, NH and -$N(CH_3)$-;

ring F is a phenyl or 5- or 6-membered heteroaryl ring, wherein the 5- or 6-membered heteroaryl contains 1, 2 or 3 heteroatoms selected from O, N and S; R_{15} is selected from: H, fluorine, chlorine, acetyl, hydroxyl, C1-C4 alkoxy, cyano, -NR'R'', NR'R''-C(O)-, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl; R' and R'' are each independently selected from H and C1-C4 alkyl; n is 0 or 1;

R_1 is selected from: cyano and -C(O)NR'R'';

R_2 is selected from: H, halogen, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_3 is selected from: substituted or unsubstituted aryl;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl; alternatively, R_4 and R_5, together with the carbon atom to which they are attached, form a 3- to 6-membered substituted or unsubstituted ring, and the ring optionally contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_6 is selected from: H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl, substituted or unsubstituted C2-C6 alkynyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 6- to 14-membered aryl, substituted or unsubstituted 5- to 10-membered heteroaryl, substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl and substituted or unsubstituted 6- to 12-membered spiro heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl or 6- to 12-membered spiro heterocyclyl ring, and the 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, cyano, C1-C4 alkyl, halogen and C1-C4 alkoxy;

R_7 and R_8 are each independently selected from: H, halogen, cyano, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkoxy;

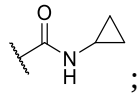
R_9 is selected from: H, C1-C4 alkyl, C1-C4 alkoxy, hydroxyl and halogen;

R_{10} is selected from: H, halogen and C1-C4 alkyl;

R_{11} is selected from: H, hydroxyl, amino, halogen, C1-C4 alkyl, -NR'R'' and C1-C4 alkoxy;

R' and R'' are each independently selected from H, C1-C4 alkyl and C3-C6 cycloalkyl; and

wherein the dashed line indicates the presence or absence of a double bond;

preferably, R_1 is selected from: cyano, $-C(O)NH_2$, $-C(O)NHCH_3$ and ;

R_2 is selected from: H, fluorine and methoxy;

R_3 is phenyl;

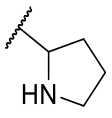
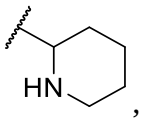
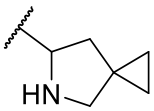
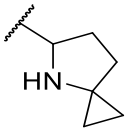
R_4 and R_5 are each independently selected from: H and C1-C4 alkyl;

R_6 is H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl or substituted or unsubstituted C2-C6 alkynyl, and their substituents are 1, 2 or 3 substituents selected from: hydroxyl, halogen, C1-C4 alkoxy optionally substituted by halogen, cyano, $-S(O)_2$-C1-C4 alkyl optionally substituted by halogen, C1-C4 alkyl optionally substituted by halogen, $-S(O)_2$-NR'R'', $-S(O)_2-NH_2$, -C(O)-C1-C4 alkyl, -NR'-C(O)-C1-C4 alkyl and 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl, wherein the 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, halogen, cyano, C1-C4 alkyl-$S(O)_2$-, hydroxyl, carboxyl, -NR'R'', 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl; wherein R' and R'' are each independently selected from H and C1-C4 alkyl; or

R_6 is substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl or substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: halogen, hydroxyl, cyano, -NR'R'', $-S(O)_2$-NR'R'', $-S(O)_2-NH_2$, -NR'-C(O)-C1-C4 alkyl, $-S(O)_2$-C1-C4 alkyl, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, -C(O)-C1-C4 alkyl and C1-C4 alkoxycarbonyl, and the C1-C4 alkyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 groups selected from halogen, hydroxyl and -NR'R'', wherein the R' and R'' are each independently selected from H and C1-C4 alkyl; or

R_6 is substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, cyano, $-S(O)_2$-C1-C4 alkyl, hydroxyl, halogen, NR'R'', $-S(O)_2$-NR'R'', $-S(O)_2-NH_2$ and -NR'-C(O)-C1-C4 alkyl, wherein the R' and R'' are each independently selected from H and C1-C4 alkyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form the following group optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy:

, ,  or , wherein the wavy line indicates the bond connection position;

R_7 and R_8 are each independently selected from: H, halogen, cyano, methyl and methoxy;

R_9 is selected from: H, methyl, methoxy, hydroxyl and F;

R_{10} is selected from: H, F and methyl;

R_{11} is selected from: H, hydroxyl, amino, fluorine, chlorine, methyl, methoxy and -NH(CH_3).

(6) in formula IIIa

X_2 is selected from: C and N;

X_3 is selected from: C and N;

Y_1 is selected from: a bond, O, NH, -N(CH_3)-, CH_2 and -CH(CH_3)-;

Y_5 is selected from: O, S, N, CH_2, CH, NH, -N(CH_3)-, -OCH_2-, -NHCH_2-, -N(CH_3)CH_2- and -CH_2CH_2-;

Y_4 is selected from: C, CH or N;

Y_6 is selected from: C, CH or N;

D_1 is selected from: O, S, N, NR_c, CR_f and CR_fR_g;

D_2 is selected from: O, S, N, NR_c, N-NR_c, C(O)-NR_e, CR_f-NR_c, $(CR_f)_p$ and $(CR_fR_g)_p$;

D_3 is selected from: O, S, N, NR_c, $(CR_f)_p$ and $(CR_fR_g)_p$;

R_1 is selected from: cyano and -C(O)NR'R'';

R_2 is selected from: H, halogen, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_3 is selected from: substituted or unsubstituted aryl;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl; alternatively, R_4 and R_5, together with the carbon atom to which they are attached, form a 3- to 6-membered substituted or unsubstituted ring, and the ring optionally contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_6 is selected from: H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl, substituted or unsubstituted C2-C6 alkynyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 6- to 14-membered aryl, substituted or unsubstituted 5- to 10-membered heteroaryl, substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or

unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl and substituted or unsubstituted 6- to 12-membered spiro heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl or 6- to 12-membered spiro heterocyclyl ring, and the 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, cyano, C1-C4 alkyl, halogen and C1-C4 alkoxy;

R_7 and R_8 are each independently selected from: H, halogen, cyano, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkoxy;

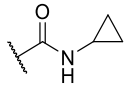
R_9 is selected from: H, C1-C4 alkyl, C1-C4 alkoxy, hydroxyl and halogen;

R_{10} is selected from: H, halogen and C1-C4 alkyl;

R_{11} is selected from: H, hydroxyl, amino, halogen, C1-C4 alkyl, -NR'R'' and C1-C4 alkoxy;

R' and R'' are each independently selected from H, C1-C4 alkyl and C3-C6 cycloalkyl; and

wherein the dashed line indicates the presence or absence of a double bond;

preferably, R_1 is selected from: cyano, $-C(O)NH_2$, $-C(O)NHCH_3$ and ;

R_2 is selected from: H, fluorine and methoxy;

R_3 is phenyl;

R_4 and R_5 are each independently selected from: H and C1-C4 alkyl;

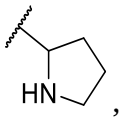
R_6 is H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl or substituted or unsubstituted C2-C6 alkynyl, and their substituents are 1, 2 or 3 substituents selected from: hydroxyl, halogen, C1-C4 alkoxy optionally substituted by halogen, cyano, $-S(O)_2$-C1-C4 alkyl optionally substituted by halogen, C1-C4 alkyl optionally substituted by halogen, $-S(O)_2$-NR'R'', $-S(O)_2-NH_2$, -C(O)-C1-C4 alkyl, -NR'-C(O)-C1-C4 alkyl and 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl, wherein the 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, halogen, cyano, C1-C4 alkyl-$S(O)_2$-, hydroxyl, carboxyl, -NR'R'', 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl; wherein R' and R'' are each independently selected from H and C1-C4 alkyl; or

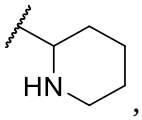
R_6 is substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl or substituted or

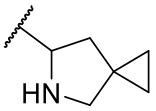
unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: halogen, hydroxyl, cyano, -NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2, -NR'-C(O)-C1-C4 alkyl, -$S(O)_2$-C1-C4 alkyl, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, -C(O)-C1-C4 alkyl and C1-C4 alkoxycarbonyl, and the C1-C4 alkyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 groups selected from halogen, hydroxyl and -NR'R'', wherein the R' and R'' are each independently selected from H and C1-C4 alkyl; or

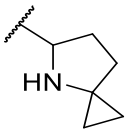
R_6 is substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, cyano, -$S(O)_2$-C1-C4 alkyl, hydroxyl, halogen, NR'R'', -$S(O)_2$-NR'R'', -$S(O)_2$-NH_2 and -NR'-C(O)-C1-C4 alkyl, wherein the R' and R'' are each independently selected from H and C1-C4 alkyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form the following group optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy:



,


,


or


, wherein the wavy line indicates the bond connection position;

R_7 and R_8 are each independently selected from: H, halogen, cyano, methyl and methoxy;

R_9 is selected from: H, methyl, methoxy, hydroxyl and F;

R_{10} is selected from: H, F and methyl; and

R_{11} is selected from: H, hydroxyl, amino, fluorine, chlorine, methyl, methoxy and -$NH(CH_3)$;

(7) in formula IIIb

X_2 and X_3 are C;

Y_1 is selected from: C, CH and N;

Y_4 is selected from: C, CH and N;

Y_5 is selected from: a bond, O, S, -S(O)-, -$S(O)_2$-, -C(O)-, N, NH, -$N(CH_3)$-, CH, CH_2, -$CH(CH_3)$-, -OCH_2-, -$NHCH_2$-, -$N(CH_3)CH_2$- and -CH_2CH_2-;

Y_6 is selected from: a bond, O, S, -S(O)-, -$S(O)_2$-, -C(O)-, N, CH_2, CH, -$CH(CH_3)$-, NH, -$N(CH_3)$-, -OCH_2-, -$NHCH_2$-, -$N(CH_3)CH_2$- and -CH_2CH_2-; and Y_5 and Y_6 are not simultaneously a bond;

D_1 is selected from: O, S, N, NR_e, CR_f and CR_fR_g;

D_2 is selected from: O, S, N, NR_e, C(O)-NR_e, N-NR_e, CR_f-NR_e, $(CR_f)_p$ and $(CR_fR_g)_p$;

D_3 is selected from: O, S, N, NR_e, $(CR_f)_p$ and $(CR_fR_g)_p$; R_1 is selected from: cyano and -

C(O)NR’R’’;

R_2 is selected from: H, halogen, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_3 is selected from: substituted or unsubstituted aryl;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl; alternatively, R_4 and R_5, together with the carbon atom to which they are attached, form a 3- to 6-membered substituted or unsubstituted ring, and the ring optionally contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_6 is selected from: H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6 alkoxy, substituted or unsubstituted C2-C6 alkenyl, substituted or unsubstituted C2-C6 alkynyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 6- to 14-membered aryl, substituted or unsubstituted 5- to 10-membered heteroaryl, substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl and substituted or unsubstituted 6- to 12-membered spiro heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl or 6- to 12-membered spiro heterocyclyl ring, and the 4- to 9-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, cyano, C1-C4 alkyl, halogen and C1-C4 alkoxy;

R_7 and R_8 are each independently selected from: H, halogen, cyano, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkoxy;

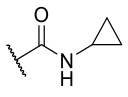
R_9 is selected from: H, C1-C4 alkyl, C1-C4 alkoxy, hydroxyl and halogen;

R_{10} is selected from: H, halogen and C1-C4 alkyl;

R_{11} is selected from: H, hydroxyl, amino, halogen, C1-C4 alkyl, -NR’R’’ and C1-C4 alkoxy;

R’ and R’’ are each independently selected from H and C1-C4 alkyl; and

wherein the dashed line indicates the presence or absence of a double bond;

preferably, R_1 is selected from: cyano, -C(O)NH_2, -C(O)$NHCH_3$ and 

;

R_2 is selected from: H, fluorine and methoxy;

R_3 is phenyl;

R_4 and R_5 are each independently selected from: H and C1-C4 alkyl;

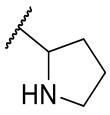
R_6 is H, substituted or unsubstituted C1-C6 alkyl, substituted or unsubstituted C1-C6

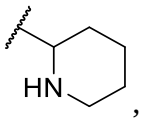
alkoxy, substituted or unsubstituted C2-C6 alkenyl or substituted or unsubstituted C2-C6 alkynyl, and their substituents are 1, 2 or 3 substituents selected from: hydroxyl, halogen, C1-C4 alkoxy optionally substituted by halogen, cyano, -S(O)$_2$-C1-C4 alkyl optionally substituted by halogen, C1-C4 alkyl optionally substituted by halogen, -S(O)$_2$-NR'R'', -S(O)$_2$-NH$_2$, -C(O)-C1-C4 alkyl, -NR'-C(O)-C1-C4 alkyl and 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl, wherein the 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl are optionally substituted by 1, 2 or 3 substituents selected from C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, halogen, cyano, C1-C4 alkyl-S(O)$_2$-, hydroxyl, carboxyl, -NR'R'', 6- to 14-membered aryl, 5- to 10-membered heteroaryl, 3- to 8-membered cyclohydrocarbyl and 4- to 9-membered heterocyclyl; wherein R' and R'' are each independently selected from H and C1-C4 alkyl; or

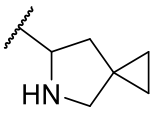
R_6 is substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl or substituted or unsubstituted 4- to 9-membered monocyclic or fused heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: halogen, hydroxyl, cyano, -NR'R'', -S(O)$_2$-NR'R'', -S(O)$_2$-NH$_2$, -NR'-C(O)-C1-C4 alkyl, -S(O)$_2$-C1-C4 alkyl, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, -C(O)-C1-C4 alkyl and C1-C4 alkoxycarbonyl, and the C1-C4 alkyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 groups selected from halogen, hydroxyl and -NR'R'', wherein the R' and R'' are each independently selected from H and C1-C4 alkyl; or

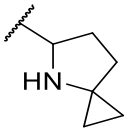
R_6 is substituted or unsubstituted 6- to 12-membered bridged cyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl, substituted or unsubstituted 6- to 12-membered spiro cyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl, and their substituents are 1, 2 or 3 substituents selected from: C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy, C1-C4 haloalkoxy, cyano, -S(O)$_2$-C1-C4 alkyl, hydroxyl, halogen, NR'R'', -S(O)$_2$-NR'R'', -S(O)$_2$-NH$_2$ and -NR'-C(O)-C1-C4 alkyl, wherein the R' and R'' are each independently selected from H and C1-C4 alkyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form the following group optionally substituted by 1, 2 or 3 substituents selected from H, deuterium, hydroxyl, methyl, F and methoxy:



,


,


or


, wherein the wavy line indicates the bond connection position;

R_7 and R_8 are each independently selected from: H, halogen, cyano, methyl and methoxy;

R_9 is selected from: H, methyl, methoxy, hydroxyl and F;

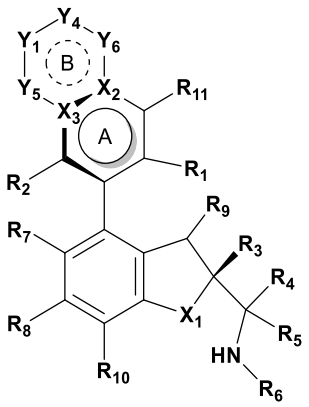
R_{10} is selected from: H, F and methyl; and

R_{11} is selected from: H, hydroxyl, amino, fluorine, chlorine, methyl, methoxy and -

$NH(CH_3)$.

10. The compound or the pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof according to any one of claims 1 to 9, wherein:

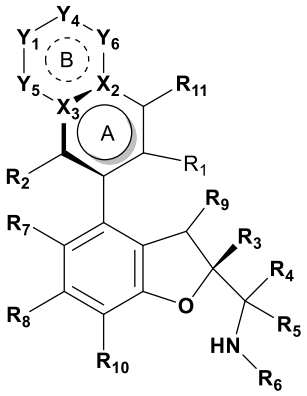
(1) the compound is selected from the following compounds:



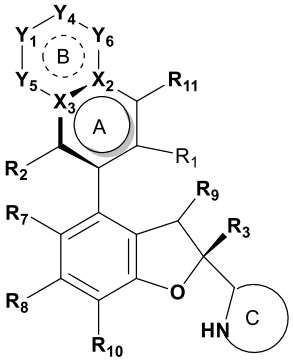
XI

wherein R_1~R_{11}, X_1~X_3 and Y_1~Y_6 are as defined in any one of claims 1 to 9;

(2) the compound is selected from the following compounds:



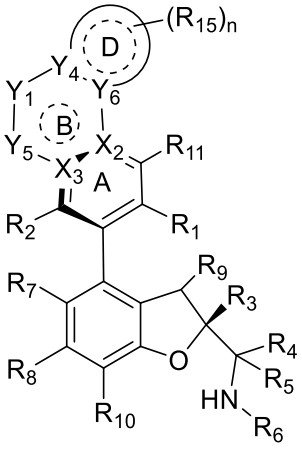
XIa



XIb

wherein ring C is a substituted or unsubstituted 4- to 12-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl ring, and the 4- to 12-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl each optionally further contain 1 or 2 heteroatoms selected from N and O; ring C is preferably a substituted or unsubstituted 4- to 8-membered nitrogen-containing monocyclic heterocyclyl, substituted or unsubstituted 6- to 12-membered nitrogen-containing spiro heterocyclyl or substituted or unsubstituted 6- to 12-membered nitrogen-containing fused heterocyclyl ring;

(3) the compound is selected from the following compounds:



XIIa

in the formula,

Y_4 is selected from: C, CH and N;

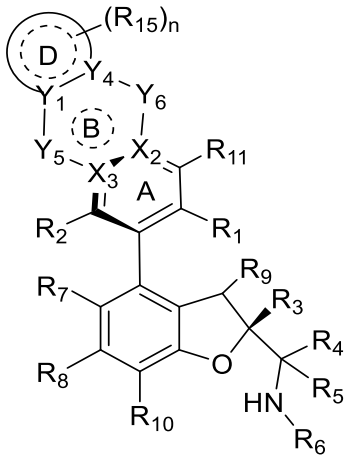
Y_6 is selected from: C, CH and N;

ring D is a 3- to 8-membered cyclohydrocarbyl, 4- to 9-membered heterocyclyl, 6- to 10-membered aryl or 5- to 10-membered heteroaryl ring, wherein the 4- to 9-membered heterocyclyl and 5- to 10-membered heteroaryl contain 1, 2 or 3 heteroatoms selected from O, N and S;

R_{15} is selected from: H, halogen, oxo (=O), thio (=S), substituted or unsubstituted C1-C4 acyl, hydroxyl, substituted or unsubstituted C1-C4 alkoxy, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 6- to 10-membered aryl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 6- to 10-membered aryl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 8-membered cyclohydrocarbyl, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; and

n is 0, 1, 2, 3 or 4;

(4) the compound is selected from the following compounds:



XIIb

in the formula,

Y_1 is selected from: C, CH and N;

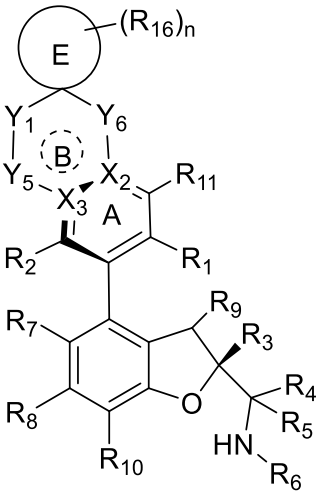
Y_4 is selected from: C, CH and N;

ring D is a 3- to 8-membered cyclohydrocarbyl, 4- to 9-membered heterocyclyl, 6- to 10-membered aryl or 5- to 10-membered heteroaryl ring, wherein the 4- to 9-membered heterocyclyl and 5- to 10-membered heteroaryl contain 1, 2 or 3 heteroatoms selected from O, N and S;

R_{15} is selected from: H, halogen, oxo (=O), thio (=S), substituted or unsubstituted C1-C4 acyl, hydroxyl, substituted or unsubstituted C1-C4 alkoxy, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 6- to 10-membered aryl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 6- to 10-membered aryl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 8-membered cyclohydrocarbyl, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; and

n is 0, 1, 2, 3 or 4;

(5) the compound is selected from the following compounds:



XIIc

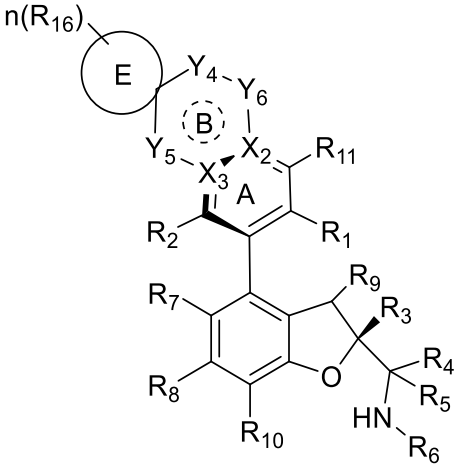
in the formula,

ring E is a 3- to 8-membered cyclohydrocarbyl or 4- to 9-membered heterocyclyl ring, wherein the 4- to 9-membered heterocyclyl contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_{16} is selected from H, halogen, substituted or unsubstituted C1-C4 alkyl, hydroxyl, substituted or unsubstituted C1-C4 acyl and substituted or unsubstituted C1-C4 alkoxy; preferably, the C1-C4 alkyl, C1-C4 acyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; and

n is 0, 1, 2, 3 or 4;

(6) the compound is selected from the following compounds:



XIId

in the formula,

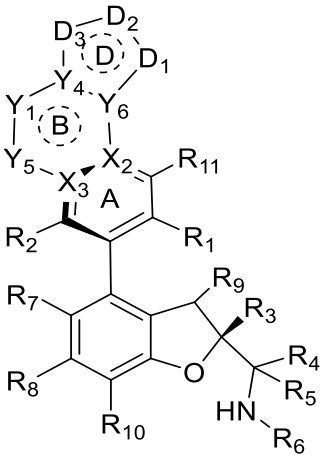
ring E is a 3- to 8-membered cyclohydrocarbyl or 4- to 9-membered heterocyclyl ring, wherein the 4- to 9-membered heterocyclyl contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_{16} is selected from H, halogen, substituted or unsubstituted C1-C4 alkyl, hydroxyl,

substituted or unsubstituted C1-C4 acyl and substituted or unsubstituted C1-C4 alkoxy; preferably, the C1-C4 alkyl, C1-C4 acyl and C1-C4 alkoxy are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; and

n is 0, 1, 2, 3 or 4;

(7) the compound is selected from the following compounds:



XIIIa

in the formula,

Y_4 is selected from: C, CH and N;

Y_6 is selected from: C, CH and N;

ring D is a 3- to 8-membered cyclohydrocarbyl, 4- to 9-membered heterocyclyl, 6- to 10-membered aryl or 5- to 10-membered heteroaryl ring, wherein the 4- to 9-membered heterocyclyl and 5- to 10-membered heteroaryl contain 1, 2 or 3 heteroatoms selected from O, N and S;

D_1 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, CR_f and CR_fR_g;

D_2 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, $(CR_f)_p$, $(CR_fR_g)_p$, C(O)-NR_e, N-NR_e, CR_f-NR_e, $N{=}N$ and $N{=}C(R_f)$;

D_3 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, $(CR_f)_p$ and $(CR_fR_g)_p$;

provided that D_1 and D_2, D_1 and D_3 are not simultaneously O, S, -S(O)- or -$S(O)_2$- and satisfy the valence bond theory;

each R_c at each occurrence is independently selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 6-membered cyclohydrocarbyl, 3- to 6-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2

or 3 substituents selected from F, hydroxyl and cyano;

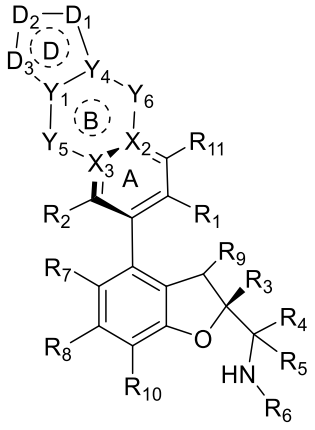
each R_f at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

each R_g at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

alternatively, R_f and R_g on the same carbon atom form an oxo (=O) or thio (=S) group; and

each p is independently 1, 2, 3 or 4, preferably 1 or 2;

(8) the compound is selected from the following compounds:



XIIIb

in the formula,

Y_1 is selected from: C, CH and N;

Y_4 is selected from: C, CH and N;

ring D is a 3- to 8-membered cyclohydrocarbyl, 4- to 9-membered heterocyclyl, 6- to 10-

membered aryl or 5- to 10-membered heteroaryl ring, wherein the 4- to 9-membered heterocyclyl and 5- to 10-membered heteroaryl contain 1, 2 or 3 heteroatoms selected from O, N and S;

D_1 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, CR_f and CR_fR_g;

D_2 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, $(CR_f)_p$, $(CR_fR_g)_p$, C(O)-NR_e, N-NR_e, CR_f-NR_e,  and ;

D_3 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, $(CR_f)_p$ and $(CR_fR_g)_p$;

provided that D_1 and D_2, D_1 and D_3 are not simultaneously O, S, -S(O)- or -$S(O)_2$- and satisfy the valence bond theory;

each R_e at each occurrence is independently selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 6-membered cyclohydrocarbyl, 3- to 6-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

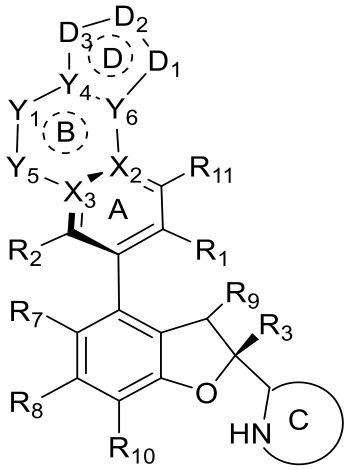
each R_f at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

each R_g at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

alternatively, R_f and R_g on the same carbon atom form an oxo (=O) or thio (=S) group; and

each p is independently 1, 2, 3 or 4, preferably 1 or 2;

(9) the compound is selected from the following compounds:



XIVa

in the formula,

Y_4 is selected from: C, CH and N;

Y_6 is selected from: C, CH and N;

ring D is a 3- to 8-membered cyclohydrocarbyl, 4- to 9-membered heterocyclyl, 6- to 10-membered aryl or 5- to 10-membered heteroaryl ring, wherein the 4- to 9-membered heterocyclyl and 5- to 10-membered heteroaryl contain 1, 2 or 3 heteroatoms selected from O, N and S;

D_1 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, CR_f and CR_fR_g;

D_2 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, $(CR_f)_p$, $(CR_fR_g)_p$, C(O)-NR_e, N-NR_e, CR_f-NR_e, $N{=}{-}N$ and $N{=}{-}C(R_f)$;

D_3 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, $(CR_f)_p$ and $(CR_fR_g)_p$;

provided that D_1 and D_2, D_1 and D_3 are not simultaneously O, S, -S(O)- or -$S(O)_2$- and satisfy the valence bond theory;

each R_e at each occurrence is independently selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 6-membered cyclohydrocarbyl, 3- to 6-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2

or 3 substituents selected from F, hydroxyl and cyano;

each R_f at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

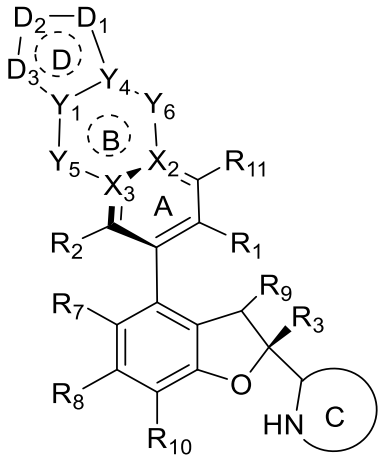
each R_g at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

alternatively, R_f and R_g on the same carbon atom form an oxo (=O) or thio (=S) group;

each p is independently 1, 2, 3 or 4, preferably 1 or 2; and

ring C is a substituted or unsubstituted 4- to 12-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl ring, and the 4- to 12-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl each optionally further contain 1 or 2 heteroatoms selected from N and O; ring C is preferably a substituted or unsubstituted 4- to 8-membered nitrogen-containing monocyclic heterocyclyl, substituted or unsubstituted 6- to 12-membered nitrogen-containing spiro heterocyclyl or substituted or unsubstituted 6- to 12-membered nitrogen-containing fused heterocyclyl ring;

(10) the compound is selected from the following compounds:



XIVb

in the formula,

Y_1 is selected from: C, CH and N;

Y_4 is selected from: C, CH and N;

ring D is a 3- to 8-membered cyclohydrocarbyl, 4- to 9-membered heterocyclyl, 6- to 10-membered aryl or 5- to 10-membered heteroaryl ring, wherein the 4- to 9-membered heterocyclyl and 5- to 10-membered heteroaryl contain 1, 2 or 3 heteroatoms selected from O, N and S;

D_1 is selected from: O, S, S(O), $S(O)_2$, N, NR_c, CR_f and CR_fR_g;

D_2 is selected from: O, S, S(O), $S(O)_2$, N, NR_c, $(CR_f)_p$, $(CR_fR_g)_p$, C(O)-NR_e, N-NR_c, CR_f-NR_c, and ;

D_3 is selected from: O, S, S(O), $S(O)_2$, N, NR_c, $(CR_f)_p$ and $(CR_fR_g)_p$;

provided that D_1 and D_2, D_1 and D_3 are not simultaneously O, S, -S(O)- or -$S(O)_2$- and satisfy the valence bond theory;

each R_c at each occurrence is independently selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 6-membered cyclohydrocarbyl, 3- to 6-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

each R_f at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-

membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

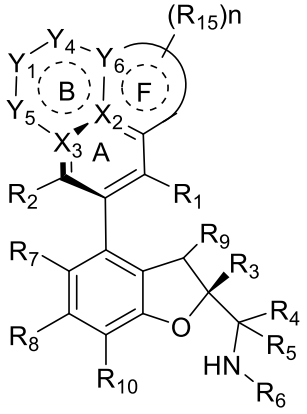
each R_g at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

alternatively, R_f and R_g on the same carbon atom form an oxo (=O) or thio (=S) group;

each p is independently 1, 2, 3 or 4, preferably 1 or 2; and

ring C is a substituted or unsubstituted 4- to 12-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl ring, and the 4- to 12-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl each optionally further contain 1 or 2 heteroatoms selected from N and O; ring C is preferably a substituted or unsubstituted 4- to 8-membered nitrogen-containing monocyclic heterocyclyl, substituted or unsubstituted 6- to 12-membered nitrogen-containing spiro heterocyclyl or substituted or unsubstituted 6- to 12-membered nitrogen-containing fused heterocyclyl ring;

(11) the compound is selected from the following compounds:



XIIe

in the formula,

X_2 is C;

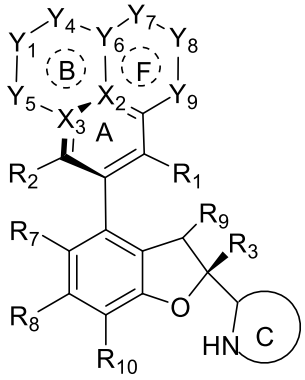
Y_6 is selected from: C, CH and N;

ring F is a 5- or 6-membered cyclohydrocarbyl, 5- or 6-membered heterocyclyl, phenyl or 5- or 6-membered heteroaryl ring, wherein the 5- or 6-membered heterocyclyl or 5- or 6-membered heteroaryl contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_{15} is selected from: H, halogen, oxo (=O), thio (=S), substituted or unsubstituted C1-C4 acyl, hydroxyl, substituted or unsubstituted C1-C4 alkoxy, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 6- to 10-membered aryl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 8-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 6- to 10-membered aryl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 8-membered cyclohydrocarbyl, 3- to 8-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano; and

n is 0, 1, 2 or 3.

(12) the compound is selected from the following compounds:



XIVc

in the formula,

X_2 is C;

Y_6 is selected from: C, CH and N;

ring F is a 5- or 6-membered cyclohydrocarbyl, 5- or 6-membered heterocyclyl, phenyl or 5- or 6-membered heteroaryl ring, wherein the 5- or 6-membered heterocyclyl or 5- or 6-membered heteroaryl contains 1, 2 or 3 heteroatoms selected from O, N and S;

Y_7, Y_8 and Y_9 are independently selected from: a bond, O, S, S(O), $S(O)_2$, N, NR_e, CR_f and CR_fR_g, provided that at most one of Y_7, Y_8 and Y_9 is a bond, Y_7 and Y_8, Y_8 and Y_9 are not simultaneously O, S, -S(O)- or -$S(O)_2$- and satisfy the valence bond theory,

each R_e at each occurrence is independently selected from: H, substituted or unsubstituted

C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl-$S(O)_2$-, 4- to 9-membered heterocyclyl, 3- to 6-membered cyclohydrocarbyl, 3- to 6-membered cyclohydrocarbyl-C(O)-, C1-C4 haloalkyl and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

each R_f at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

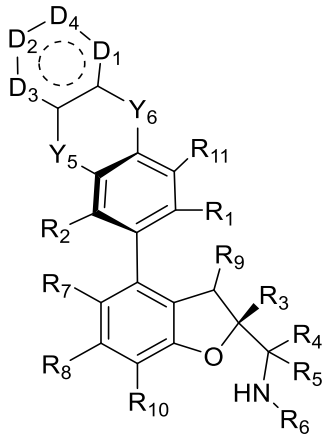
each R_g at each occurrence is independently selected from: H, halogen, substituted or unsubstituted C1-C4 acyl, hydroxyl, cyano, -NR'R'', substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)- and NR'R''-C(O)-, wherein R' and R'' are each independently selected from H and C1-C4 alkyl; preferably, the C1-C4 acyl, C1-C4 alkoxy, C1-C4 alkyl, 3- to 6-membered cyclohydrocarbyl, C1-C4 alkyl-$S(O)_2$- and 3- to 6-membered cyclohydrocarbyl-C(O)- are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

alternatively, R_f and R_g on the same carbon atom form an oxo (=O) or thio (=S) group; and

ring C is a substituted or unsubstituted 4- to 12-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl ring, and the 4- to 12-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl each optionally further contain 1 or 2 heteroatoms selected from N and O; ring C is preferably a substituted or unsubstituted 4- to 8-membered nitrogen-containing monocyclic heterocyclyl, substituted or unsubstituted 6- to 12-membered nitrogen-containing spiro heterocyclyl or substituted or unsubstituted 6- to 12-membered nitrogen-

containing fused heterocyclyl ring.

(13) the compound has a structure shown in the following formula XVa:



XVa

in the formula,

D_1 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, CR_fR_g, CR_f and C(=O);

D_2 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, CR_fR_g, CR_f and C(=O);

D_3 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, CR_fR_g, CR_f and C(=O);

D_4 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, CR_fR_g, CR_f and C(=O); and wherein the ring in which D_1, D_2, D_3 and D_4 are located satisfies valence bond theory and contains at most two C(=O) and three N atoms;

each R_e at each occurrence is independently selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl; each R_f at each occurrence is independently selected from: H, halogen, hydroxyl, cyano, oxo, substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 alkoxy and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

Y_5 and Y_6 are independently selected from: a bond, O, S, N, -S(O)-, -$S(O)_2$-, C, $CH(R_{13})$, $C(R_{13})_2$ and $N(R_{12})$, and Y_5 and Y_6 are not simultaneously a bond;

R_1 is selected from: cyano and -C(O)NR'R'';

R_2 is selected from: H, halogen, substituted or unsubstituted alkyl and substituted or unsubstituted alkoxy;

R_3 is selected from: substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl;

R_6 is selected from: H, substituted or unsubstituted alkyl, substituted or unsubstituted alkoxy, substituted or unsubstituted alkenyl, substituted or unsubstituted alkynyl, substituted or unsubstituted cyclohydrocarbyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a substituted or unsubstituted 4- to 6-membered heterocyclyl ring; the 4- to 6-membered heterocyclyl contains 1 or 2 heteroatoms selected from N and O;

R_7 is selected from: H, halogen, cyano, nitro, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_8 is selected from: H, halogen, cyano, nitro, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_9 is selected from: H, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 alkoxy, hydroxyl and halogen;

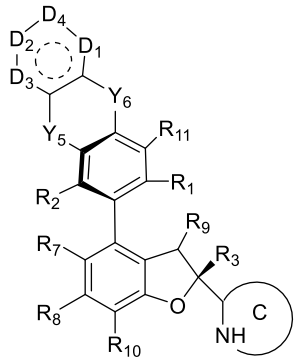
R_{10} is selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl;

R_{11} is selected from: H, hydroxyl, amino, halogen, substituted or unsubstituted C1-C4 alkyl, -NR'R'' and substituted or unsubstituted C1-C4 alkoxy;

R' and R'' are each independently selected from H, C1-C4 alkyl, C3-C6 cycloalkyl, C1-C4 alkyl-$S(O)_2$- and C1-C4 haloalkyl; and

each p is independently 1, 2, 3 or 4;

(14) the compound has a structure shown in the following formula XVb:



XVb

in the formula,

D_1 is selected from: O, S, S(O), $S(O)_2$, N, NR_c, CR_fR_g, CR_f and C(=O);

D_2 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, CR_fR_g, CR_f and C(=O);

D_3 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, CR_fR_g, CR_f and C(=O);

D_4 is selected from: O, S, S(O), $S(O)_2$, N, NR_e, CR_fR_g, CR_f and C(=O); and wherein the ring in which D_1, D_2, D_3 and D_4 are located satisfies valence bond theory and contains at most two C(=O) and three N atoms;

each R_e at each occurrence is independently selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-

C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl; each R_f at each occurrence is independently selected from: H, halogen, hydroxyl, cyano, oxo, substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 alkoxy and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

Y_5 and Y_6 are independently selected from: a bond, O, S, N, -S(O)-, -$S(O)_2$-, C, $CH(R_{13})$, $C(R_{13})_2$ and $N(R_{12})$, and Y_5 and Y_6 are not simultaneously a bond;

R_2 is selected from: H, halogen, substituted or unsubstituted alkyl and substituted or unsubstituted alkoxy;

R_7 is selected from: H, halogen, cyano, nitro, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_8 is selected from: H, halogen, cyano, nitro, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_9 is selected from: H, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 alkoxy, hydroxyl and halogen;

R_{10} is selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl;

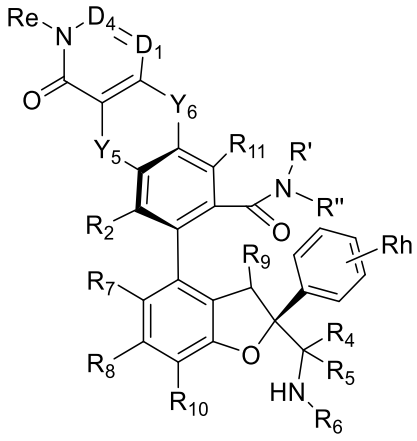
R_{11} is selected from: H, hydroxyl, amino, halogen, substituted or unsubstituted C1-C4 alkyl, -NR'R'' and substituted or unsubstituted C1-C4 alkoxy;

R' and R'' are each independently selected from H, C1-C4 alkyl, C3-C6 cycloalkyl, C1-C4 alkyl-$S(O)_2$- and C1-C4 haloalkyl;

ring C is a substituted or unsubstituted 4- to 12-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl ring, and the 4- to 12-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl each optionally further contain 1 or 2 heteroatoms selected from N and O; ring C is preferably a substituted or unsubstituted 4- to 8-membered nitrogen-containing monocyclic heterocyclyl, substituted or unsubstituted 6- to 12-membered nitrogen-containing spiro heterocyclyl or substituted or unsubstituted 6- to 12-membered nitrogen-containing fused heterocyclyl ring; and

each p is 0, 1, 2, 3 or 4.

(15) the compound is selected from the following compounds:



XVIa

in the formula,

D_1 is selected from: N and CR_f;

D_4 is selected from: N and CR_f, and D_1 and D_4 are not simultaneously N;

R_e is selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl;

each R_f at each occurrence is independently selected from: H, halogen, hydroxyl, cyano, substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 alkoxy and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

Y_5 and Y_6 are independently selected from: a bond, O, S, N, -S(O)-, -$S(O)_2$-, C, $CH(R_{13})$, $C(R_{13})_2$ and $N(R_{12})$, and Y_5 and Y_6 are not simultaneously a bond;

R_2 is selected from: H, halogen, substituted or unsubstituted alkyl and substituted or unsubstituted alkoxy;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl;

R_6 is selected from: H, substituted or unsubstituted alkyl, substituted or unsubstituted alkoxy, substituted or unsubstituted alkenyl, substituted or unsubstituted alkynyl, substituted or unsubstituted cyclohydrocarbyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a substituted or unsubstituted 4- to 6-membered heterocyclyl ring; the 4- to 6-membered heterocyclyl contains 1 or 2 heteroatoms selected from N and O;

R_7 is selected from: H, halogen, cyano, nitro, substituted or unsubstituted C1-C4 alkyl and

substituted or unsubstituted C1-C4 alkoxy;

R_8 is selected from: H, halogen, cyano, nitro, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_9 is selected from: H, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 alkoxy, hydroxyl and halogen;

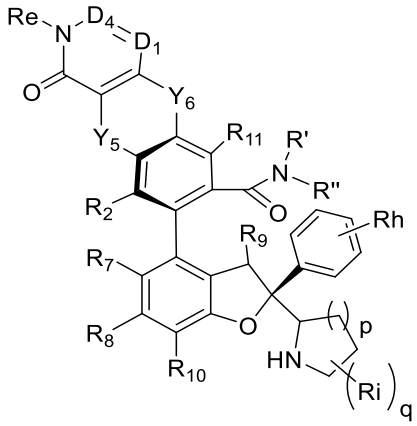
R_{10} is selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl;

R_{11} is selected from: H, hydroxyl, amino, halogen, substituted or unsubstituted C1-C4 alkyl, -NR'R'' and substituted or unsubstituted C1-C4 alkoxy;

R' and R'' are each independently selected from H, C1-C4 alkyl, C3-C6 cycloalkyl, C1-C4 alkyl-$S(O)_2$- and C1-C4 haloalkyl; and

R_h is selected from: H, halogen, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy; or

(16) the compound has a structure shown in the following formula XVIb:



XVIb

in the formula,

D_1 is selected from: N and CR_f;

D_4 is selected from: N and CR_f, and D_1 and D_4 are not simultaneously N;

R_e is selected from: H, substituted or unsubstituted C1-C4 acyl, substituted or unsubstituted C1-C4 alkoxy, cyano, substituted or unsubstituted C1-C4 alkyl-$S(O)_2$-, substituted or unsubstituted 4- to 9-membered heterocyclyl, NR'R''-C(O)-, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl, substituted or unsubstituted 3- to 6-membered cyclohydrocarbyl-C(O)-, substituted or unsubstituted C1-C4 haloalkyl and substituted or unsubstituted C1-C4 alkyl; each R_f at each occurrence is independently selected from: H, halogen, hydroxyl, cyano, substituted or unsubstituted C1-C4 alkoxy, substituted or unsubstituted C1-C4 alkyl; preferably, the C1-C4 alkoxy and C1-C4 alkyl are optionally substituted by 1, 2 or 3 substituents selected from F, hydroxyl and cyano;

Y_5 and Y_6 are independently selected from: a bond, O, S, N, -S(O)-, -$S(O)_2$-, C, $CH(R_{13})$, $C(R_{13})_2$ and $N(R_{12})$, and Y_5 and Y_6 are not simultaneously a bond;

R_2 is selected from: H, halogen, substituted or unsubstituted alkyl and substituted or unsubstituted alkoxy;

R_7 is selected from: H, halogen, cyano, nitro, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_8 is selected from: H, halogen, cyano, nitro, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

R_9 is selected from: H, substituted or unsubstituted C1-C4 alkyl, substituted or unsubstituted C1-C4 alkoxy, hydroxyl and halogen;

R_{10} is selected from: H, halogen and substituted or unsubstituted C1-C4 alkyl;

R_{11} is selected from: H, hydroxyl, amino, halogen, substituted or unsubstituted C1-C4 alkyl, -NR'R'' and substituted or unsubstituted C1-C4 alkoxy;

R' and R'' are each independently selected from H, C1-C4 alkyl, C3-C6 cycloalkyl, C1-C4 alkyl-$S(O)_2$- and C1-C4 haloalkyl;

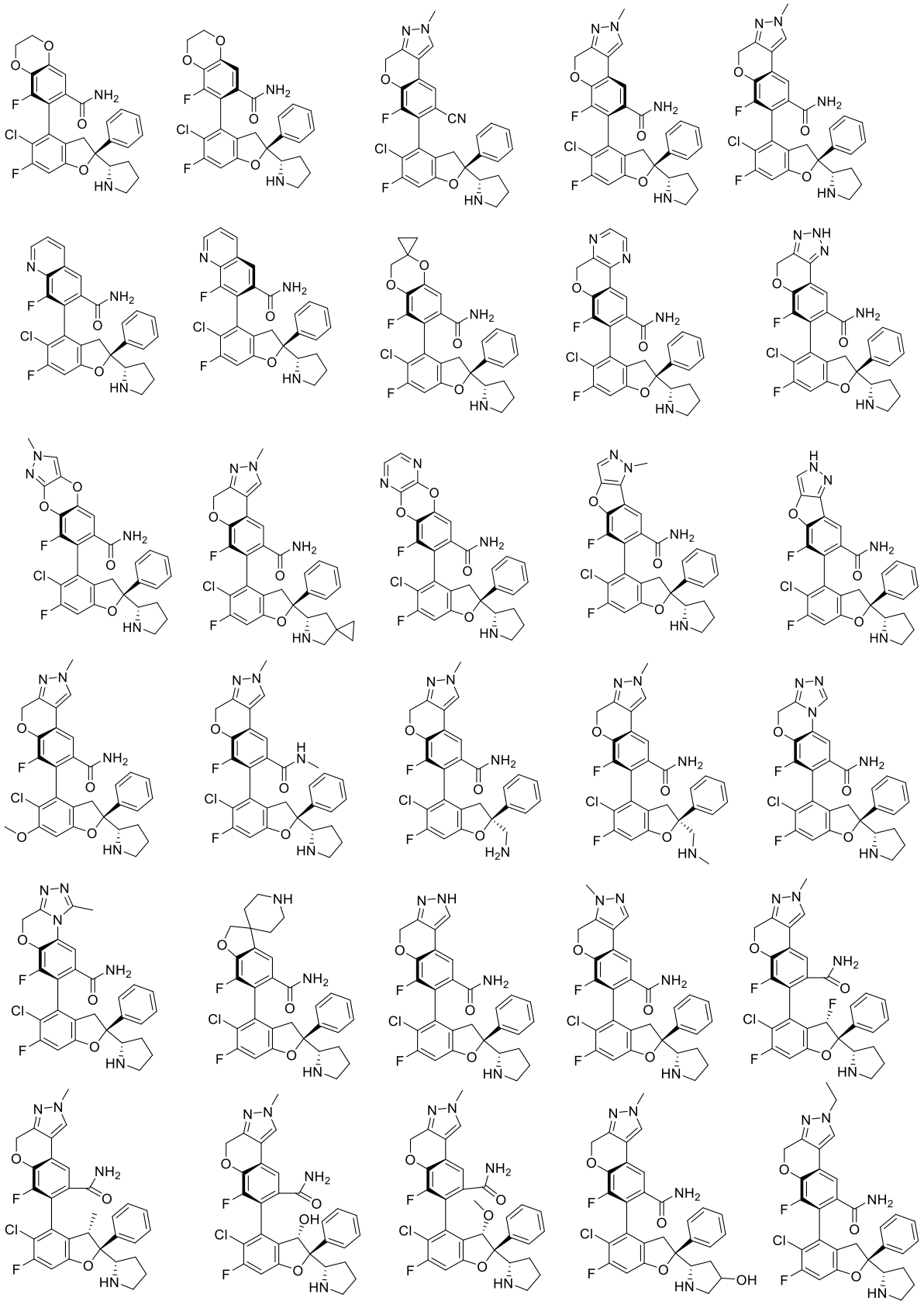
R_h is selected from: H, halogen, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

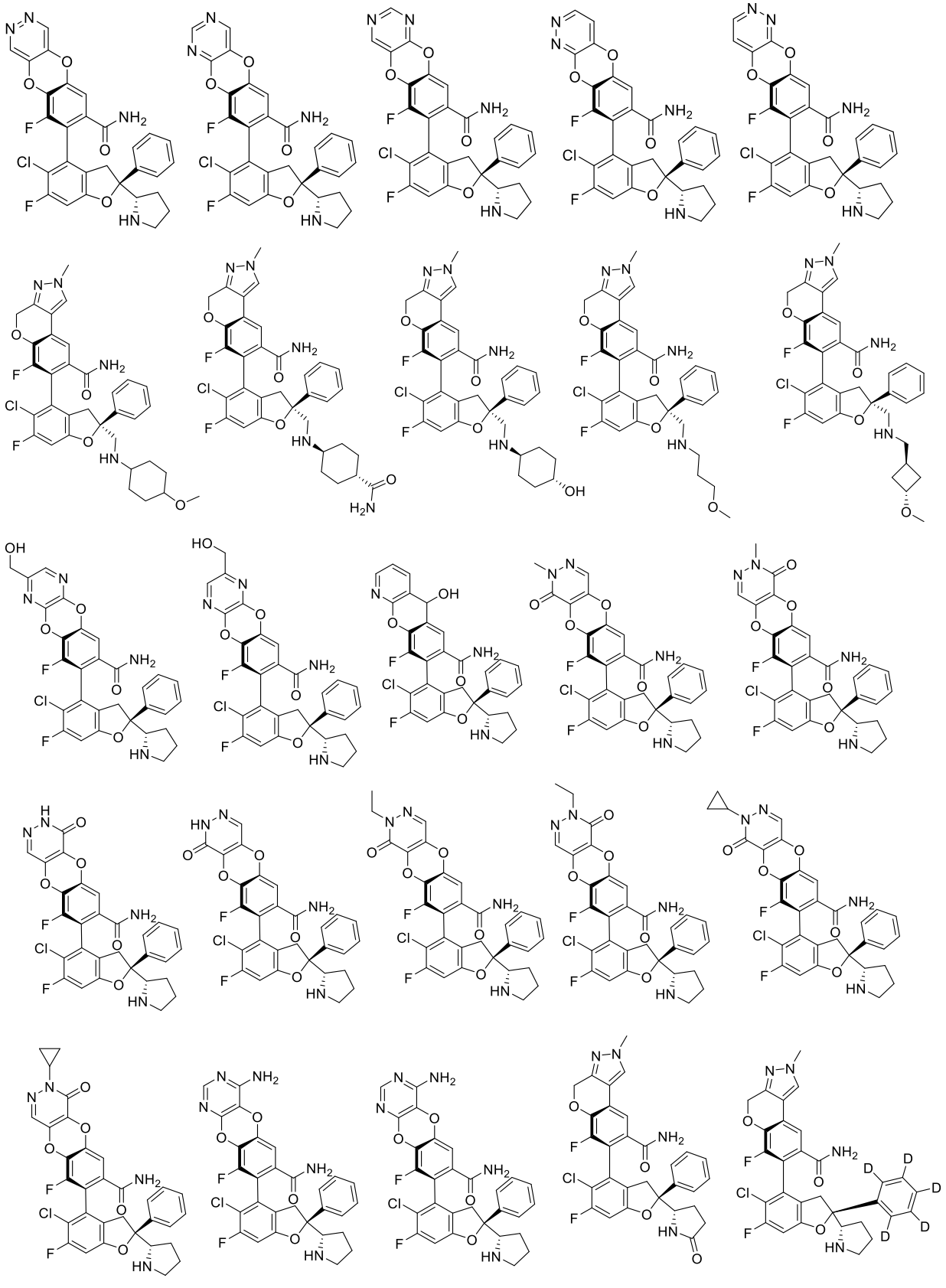
R_i is selected from: H, halogen, substituted or unsubstituted C1-C4 alkyl and substituted or unsubstituted C1-C4 alkoxy;

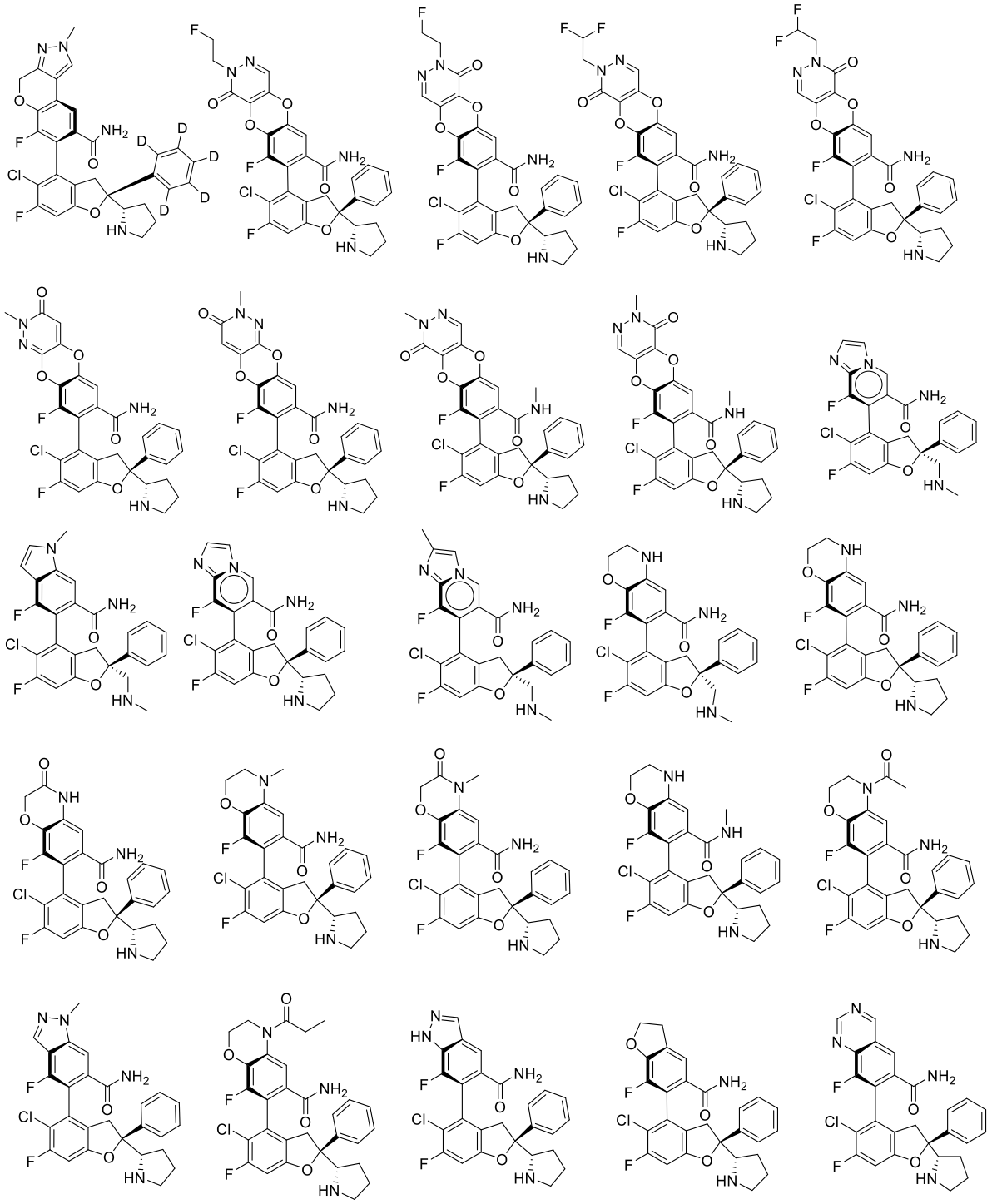
p is 1, 2 or 3; and

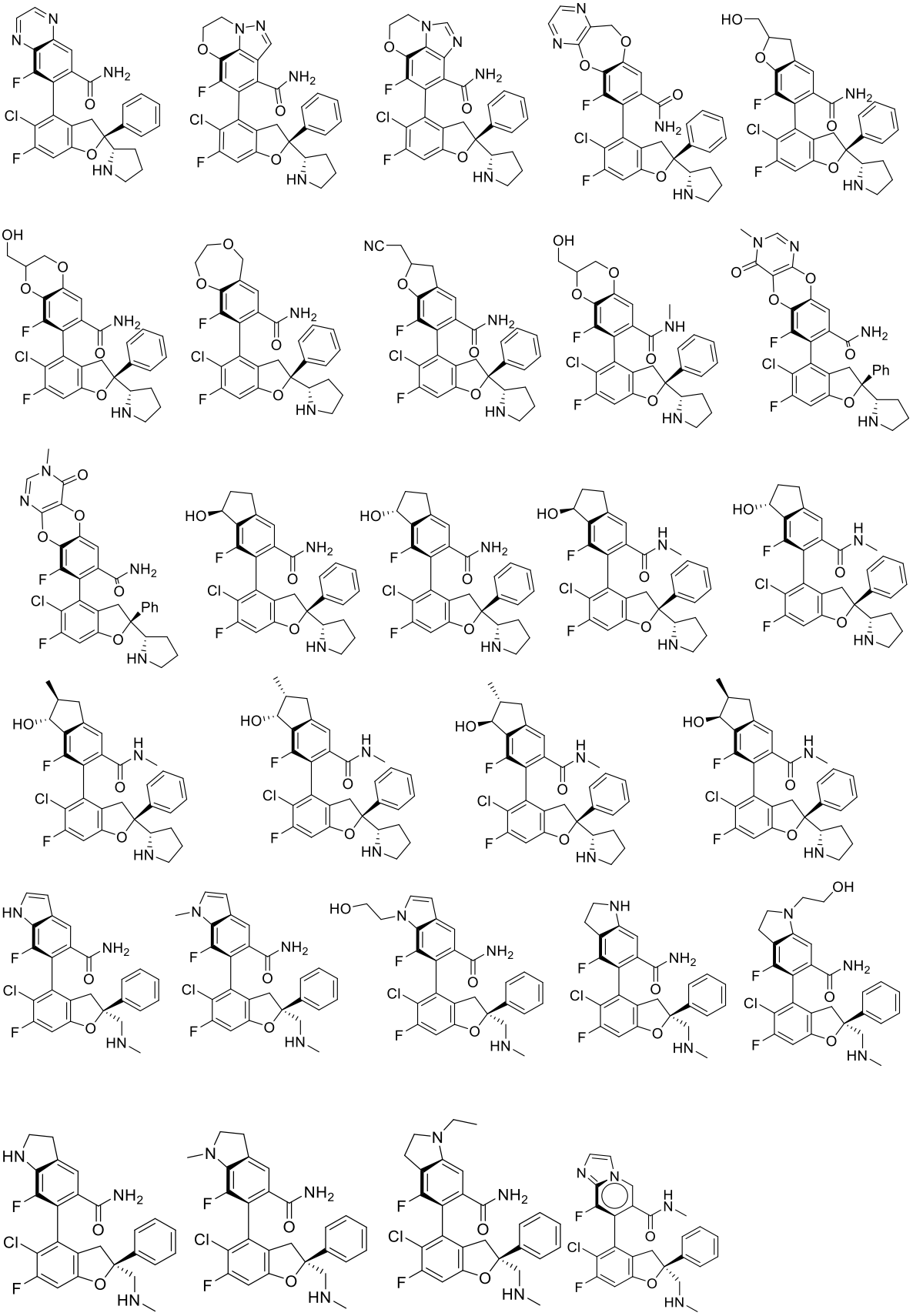
q is 0, 1, 2, 3 or 4.

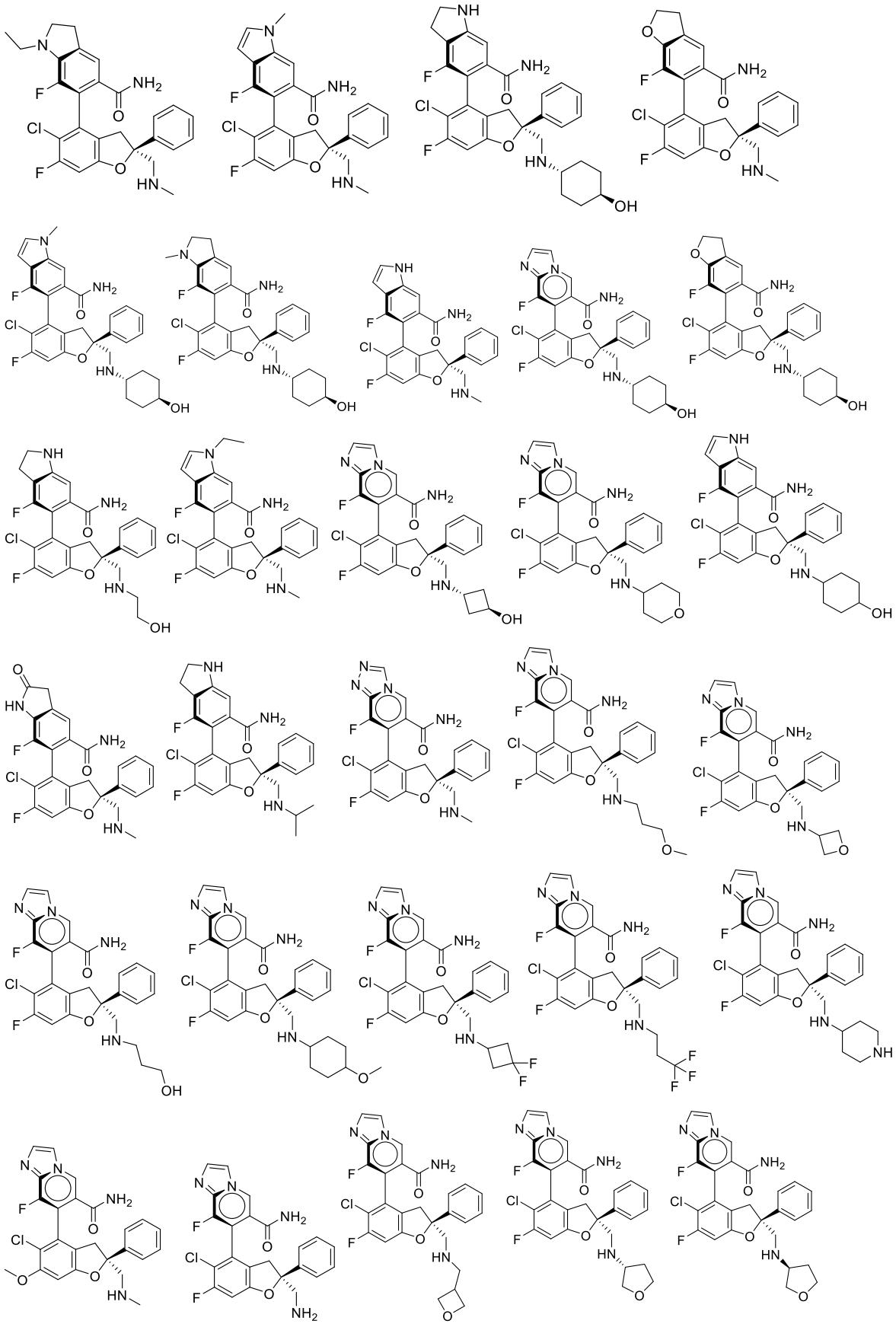
11. The compound or the pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof according to claim 1, wherein the compound is selected from the following compounds:

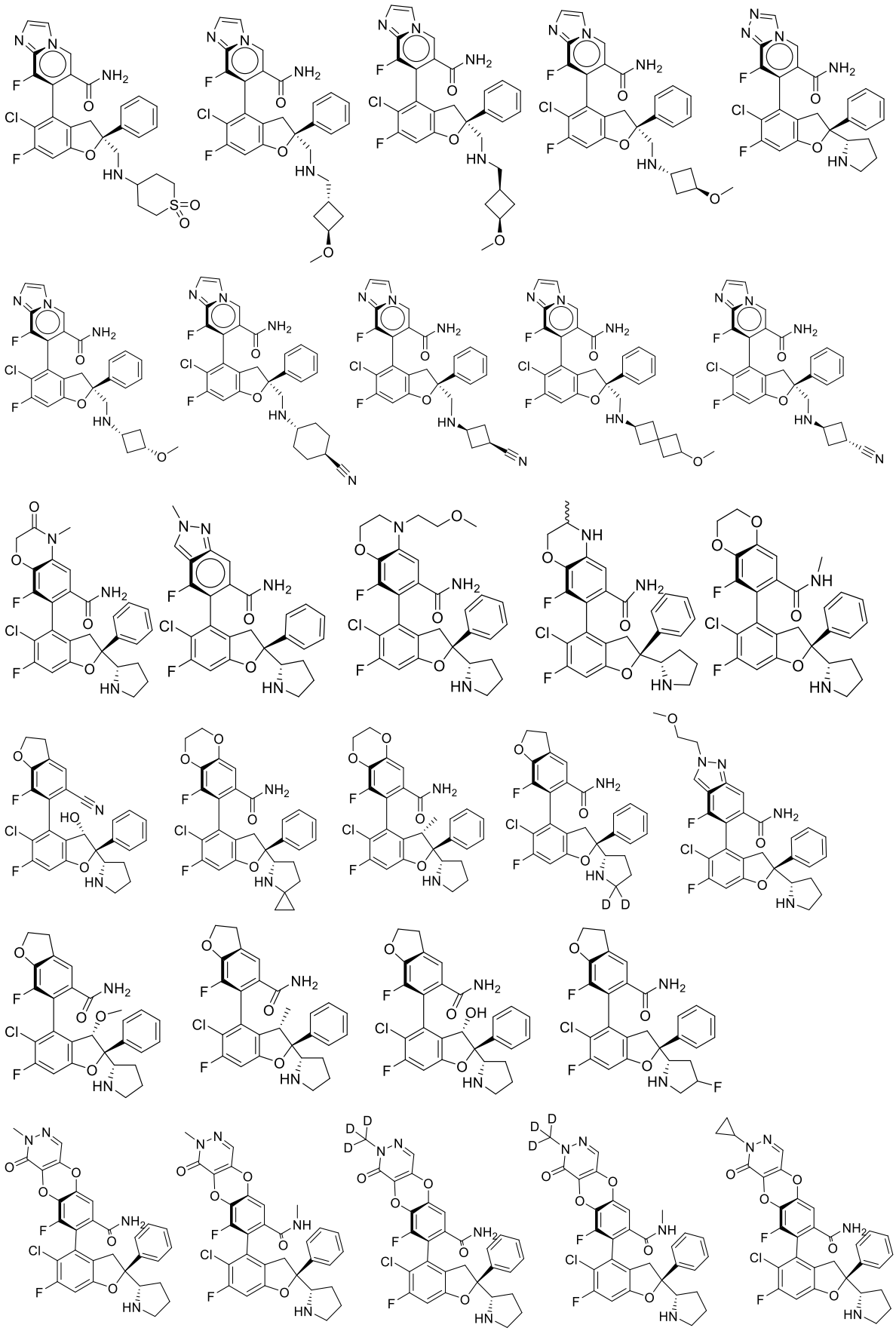


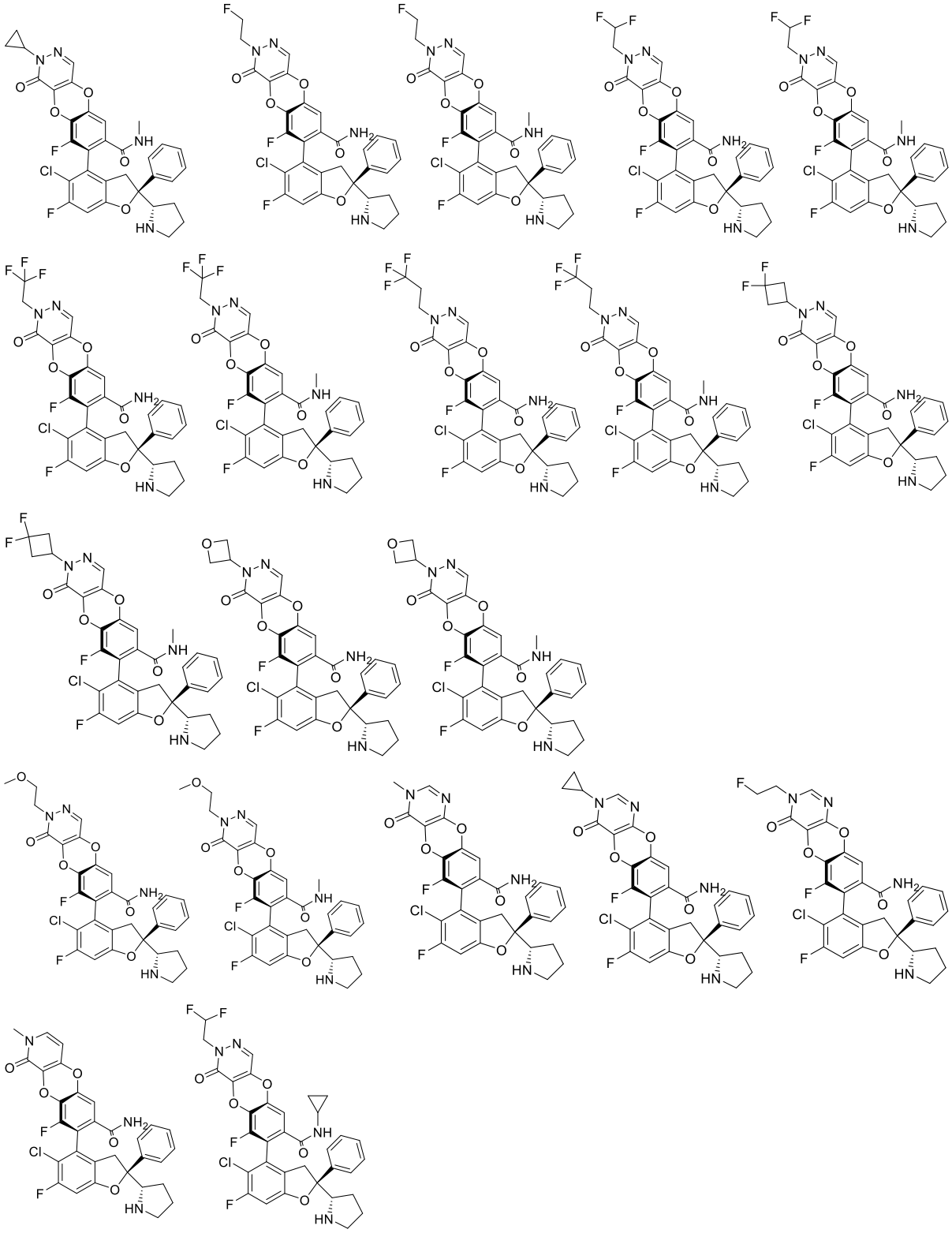


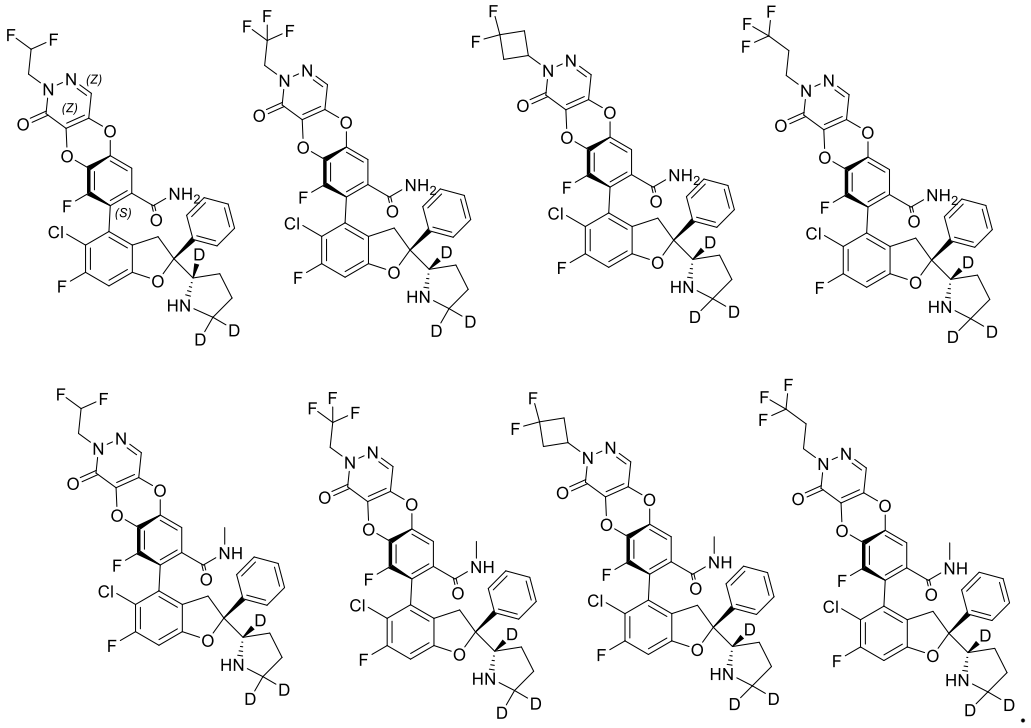












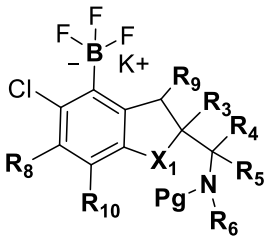
12. A pharmaceutical composition, wherein the pharmaceutical composition comprises the compound or the pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof according to any one of claims 1 to 11 and a pharmaceutically acceptable carrier or excipient;

preferably, the pharmaceutical composition further comprises other known anticancer agents, including but not limited to chemotherapeutic agents, such as mitotic inhibitors, such as taxane compounds (e.g., paclitaxel or docetaxel), vinca alkaloids (e.g., vincristine, vinblastine, vinorelbine or vinflunine), other anticancer agents such as metal platinum complexes (e.g., cisplatin, carboplatin or oxaliplatin), antimetabolites (e.g., pyrimidine antagonists, such as 5-fluorouracil, 5-fluoro-2-4(1*H*,3*H*)-pyrimidinedione (5FU), gemcitabine), hormonal antitumor drugs (e.g., flutamide), and tumor immunotherapy drugs (such as anti-PD1 antibody).

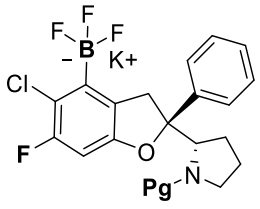
13. The compound or the pharmaceutically acceptable salt, enantiomer, diastereomer, tautomer, solvate, isotopic substitute, polymorph, prodrug or metabolite thereof according to any one of claims 1 to 11, or the pharmaceutical composition according to claim 12 for use in a method for treating or preventing diseases mediated by interaction between YAP/TAZ and TEAD; preferably, the diseases mediated by the interaction between YAP/TAZ and TEAD are tumors, liver fibrosis and renal fibrosis; preferably, the tumors comprise benign tumors and malignant tumors, especially cancers or sarcomas, such as solid tumors or hematological tumors; more preferably, the diseases mediated by the interaction between YAP/TAZ and

TEAD are: mesothelioma (e.g., pleural mesothelioma (such as malignant pleural mesothelioma), peritoneal mesothelioma, pericardial mesothelioma or tunica vaginalis mesothelioma), cervical squamous cell carcinoma, endometrial carcinoma, bladder urothelial carcinoma, skin squamous cell carcinoma, poroma (e.g., benign poroma), porocarcinoma, epithelioid hemangioendothelioma, breast cancer (e.g., triple-negative breast cancer), lung cancer (e.g., non-small cell lung cancer), ovarian cancer, colorectal cancer, melanoma, pancreatic cancer (e.g., pancreatic ductal adenocarcinoma), prostate cancer, gastric cancer, esophageal cancer (e.g., esophageal squamous cell carcinoma or esophageal adenocarcinoma), liver cancer (e.g., hepatocellular carcinoma or hepatoblastoma), cholangiocarcinoma, neurilemmoma, renal cancer, sarcoma (e.g., rhabdomyosarcoma, embryonal rhabdomyosarcoma, osteosarcoma, undifferentiated pleomorphic sarcoma, Kaposi's sarcoma and soft tissue sarcoma (such as rare soft tissue sarcoma)), bone cancer, brain cancer (e.g., ependymoma (e.g., supratentorial ependymoma, such as pediatric supratentorial ependymoma), neuroblastoma, medulloblastoma, glioma or meningioma) or head and neck cancer (e.g., head and neck squamous cell carcinoma).

14. A compound of formula Ya or Za,



Ya



Za

in formula Ya,

X_1 is selected from: O and NR_a;

R_3 is selected from: substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted alkyl; alternatively, R_4 and R_5, together with the carbon atom to which they are attached, form a 3- to 6-membered substituted or unsubstituted ring, and the ring optionally contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_6 is selected from: H, substituted or unsubstituted alkyl, substituted or unsubstituted alkoxy, substituted or unsubstituted alkenyl, substituted or unsubstituted alkynyl, substituted or unsubstituted cyclohydrocarbyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a substituted or unsubstituted 4- to 12-membered monocyclic or fused heterocyclyl, substituted

or unsubstituted 6- to 12-membered bridged heterocyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl ring; the 4- to 12-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl each optionally further contain 1 or 2 heteroatoms selected from N and O;

R_8 is selected from: H, halogen, cyano, nitro, substituted or unsubstituted alkyl, substituted or unsubstituted haloalkyl, substituted or unsubstituted alkoxy, substituted or unsubstituted alkenyl and substituted or unsubstituted alkynyl;

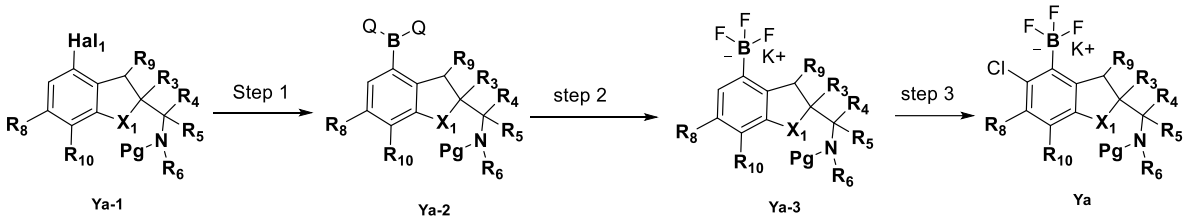
R_9 is selected from: H, substituted or unsubstituted alkyl, substituted or unsubstituted alkoxy, hydroxyl and halogen; and

R_{10} is selected from: H, halogen and substituted or unsubstituted alkyl;

in formula Za, Pg is a nitrogen protecting group, preferably Boc.

15. A preparation method for a compound of formula Ya or Za, wherein:

(1) the method for preparing the compound of formula Ya comprises the following steps:



(i) coupling a borate ester under alkaline conditions with palladium catalysis, converting halogen Hal_1 in formula Ya-1 into Q-B-Q to obtain Ya-2;

(ii) converting Ya-2 into the potassium trifluoroborate salt of Ya-3 in an organic solvent at room temperature;

(iii) using a chlorinating reagent to convert Ya-3 into Ya under acid catalysis in an organic solvent;

in the formula,

X_1 is selected from: O and NR_a; R_a is selected from H and C1-C4 alkyl;

R_3 is selected from: substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl;

R_4 and R_5 are each independently selected from: H, halogen and substituted or unsubstituted alkyl; alternatively, R_4 and R_5, together with the carbon atom to which they are attached, form a 3- to 6-membered substituted or unsubstituted ring, and the ring optionally contains 1, 2 or 3 heteroatoms selected from O, N and S;

R_6 is selected from: H, substituted or unsubstituted alkyl, substituted or unsubstituted alkoxy, substituted or unsubstituted alkenyl, substituted or unsubstituted alkynyl, substituted or unsubstituted cyclohydrocarbyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl;

alternatively, R_4 or R_5 and R_6, together with the atom to which they are attached, form a substituted or unsubstituted 4- to 12-membered monocyclic or fused heterocyclyl, substituted or unsubstituted 6- to 12-membered bridged heterocyclyl or substituted or unsubstituted 6- to 12-membered spiro heterocyclyl ring; the 4- to 12-membered monocyclic or fused heterocyclyl, 6- to 12-membered bridged heterocyclyl and 6- to 12-membered spiro heterocyclyl each optionally further contain 1 or 2 heteroatoms selected from N and O;

R_8 is selected from: H, halogen, cyano, nitro, substituted or unsubstituted alkyl, substituted or unsubstituted haloalkyl, substituted or unsubstituted alkoxy, substituted or unsubstituted alkenyl and substituted or unsubstituted alkynyl;

R_9 is selected from: H, substituted or unsubstituted alkyl, substituted or unsubstituted alkoxy, hydroxyl and halogen;

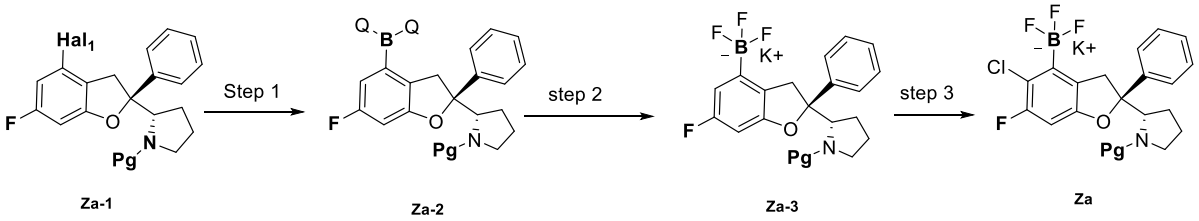
R_{10} is selected from: H, halogen and substituted or unsubstituted alkyl;

Hal_1 is halogen;

Q-B-Q is boric acid or borate ester; and

Pg is a nitrogen protecting group;

(2) the method for preparation of the compound of formula Za comprises the following steps:



Za-1 Za-2 Za-3 Za

(i) coupling a borate ester under alkaline conditions with palladium catalysis, converting halogen Hal_1 in formula Za-1 into Q-B-Q to obtain Za-2;

(ii) adding potassium hydrogen fluoride aqueous solution to convert Q-B-Q into potassium trifluoroborate salt in an organic solvent at room temperature to obtain Za-3;

(iii) using a chlorinating reagent to convert Za-3 into Za under acid catalysis in an organic solvent;

in the formula, Hal_1 is halogen; Q-B-Q is boric acid or borate ester; Pg is a nitrogen protecting group.