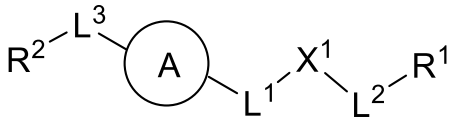
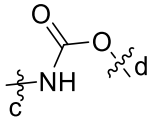
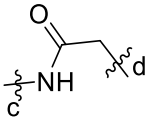
CLAIMS

1. A compound of formula (I):

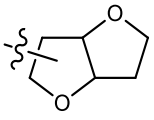
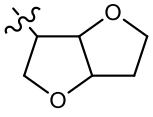


(I)

or a stereoisomer, a tautomer, a diastereomer, a racemate, a cis-trans isomer, an isotopically labelled compound (preferably a deuterated compound), an N-oxide, a metabolite, an ester, a prodrug, a crystal form, a hydrate, a solvate or a pharmaceutically acceptable salt thereof, wherein

moiety -L^1-X^1-L^2-, as a whole, is selected from:  ,  , and -NH-, wherein the bond labelled "c" is attached to ring A and the bond labelled "d" is attached to R^1;

L^3 is selected from a bond and -C_{2-4} alkynylene- (such as ethynylene and propynylene);

R^1 is selected from methyl, ethyl, n-propyl, isopropyl, sec-butyl, isobutyl, tert-butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, oxadiazolyl, thiadiazolyl, pyrimidyl, phenyl and  (preferably ), wherein any of the above groups is optionally substituted with 1, 2 or 3 R^{1a};

each R^{1a} is independently selected from halogen, -OH, -CN, an oxo group, -$COOR^c$, C_{1-4} alkyl, C_{1-4} haloalkyl, C_{1-4} alkoxy, C_{1-4} haloalkoxy, -C_{1-4} alkylene-OH, -OC_{1-4} alkylene-OH, -C_{1-4} alkylene-COOH, -S(=O)$_2$-C_{1-4} alkyl and  ;

R^c, at each occurrence, is independently selected from H, D, C_{1-6} alkyl, C_{1-6} haloalkyl and C_{3-6} cycloalkyl;

ring A (A) is selected from a benzene ring and a 5- to 6-membered aromatic heterocyclic ring, and the benzene ring and 5- to 6-membered aromatic heterocyclic ring are each optionally substituted with 1, 2 or 3 R^A, wherein the R^A is independently selected from H, D, halogen, -OH, -NH_2, -CN, C_{1-6} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{2-6} haloalkenyl, C_{2-6} haloalkynyl, C_{1-6} haloalkoxy, C_{3-6} cycloalkyl, 3- to 6-membered heterocyclyl, phenyl, 5- to 6-membered heteroaryl, -NH(C_{1-6} alkyl) and -N(C_{1-6} alkyl)$_2$; alternatively, where applicable, two adjacent R^A, together with the ring atoms to which they are attached, may form C_{4-6} carbocyclyl, 4- to 6-membered heterocyclyl or 5- to 6-membered heteroaryl;

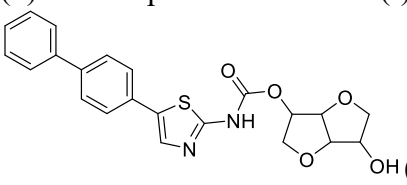
R^2 is selected from C_{6-10} aryl, C_{3-10} saturated or partially unsaturated cyclohydrocarbyl, 4- to 10-membered heterocyclyl and 5- to 10-membered heteroaryl, and the C_{6-10} aryl, C_{3-10} saturated or partially unsaturated cyclohydrocarbyl, 4- to 10-membered heterocyclyl and 5- to 10-membered heteroaryl are optionally substituted with 1, 2, 3, 4 or 5 groups each independently selected from R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e};

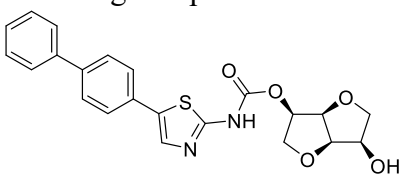
R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e} are each independently selected from H, halogen, -OH, -CN, C_{1-6} alkyl, C_{1-6} haloalkyl, -NH_2, -NHC_{1-6} alkyl, -N(C_{1-6} alkyl)$_2$, C_{1-6} alkoxy,

C_{1-6} haloalkoxy, C_{3-10} saturated or partially unsaturated cyclohydrocarbyl, 4- to 10-membered heterocyclyl, C_{6-10} aryl and 5- to 10-membered heteroaryl, wherein the C_{1-6} alkyl, C_{1-6} haloalkyl, -NHC$_{1-6}$ alkyl, -N(C_{1-6} alkyl)$_2$, C_{1-6} alkoxy, C_{1-6} haloalkoxy, C_{3-10} saturated or partially unsaturated cyclohydrocarbyl, 4- to 10-membered heterocyclyl, C_{6-10} aryl and 5- to 10-membered heteroaryl are each optionally substituted with 1, 2 or more R; and

R is independently selected from: H, halogen, -OH, -CN, -NH_2, an oxo group, -COOH, C_{1-6} alkyl, C_{1-6} haloalkyl, -C_{1-6} alkyl substituted with 1 or 2 OH, C_{1-6} alkoxy, -C_{1-6} alkyleneoxy-C_{1-6} alkoxy, -C(=O)NH-C_{1-6} alkyl, -C(=O)NH-C_{3-10} cycloalkyl, -C(=O)-C_{1-6} alkyl, -NHC(=O)-C_{1-6} alkyl, -N=S(=O)$R^{s1}R^{s2}$, -NH-S(=O)$_2$$C_{1-6}$ alkyl, -S(=O)$_2$-C_{1-6} alkyl, -S(=O)$_2$-4- to 10-membered heterocyclyl, -S(=O)$_2$NH-C_{1-6} alkyl, -S(=O)$_2$NH-C_{3-10} cycloalkyl, -C_{3-10} cycloalkylene-COOH, -C(=O)-4- to 10-membered heterocyclyl, 4- to 10-membered heterocyclyl, C_{6-10} aryl and 5- to 10-membered heteroaryl, wherein the 4- to 10-membered heterocyclyl is optionally substituted with 1, 2 or more substituents independently selected from C_{1-6} alkyl, -NH_2, =NH and an oxo group, the C_{6-10} aryl and 5- to 10-membered heteroaryl are each optionally substituted with 1, 2 or more substituents independently selected from halogen, -OH, -CN, -NH_2, -C_{1-6} alkylene-OH, -C_{1-6} alkylene-CN and -C_{1-6} alkylene-NH_2, and R^{s1} and R^{s2} are each C_{1-6} alkyl, alternatively, R^{s1} and R^{s2}, together with the S atom to which they are attached, form 4- to 6-membered heterocycloalkyl; provided that:

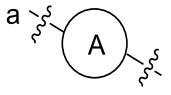
(1) the compound of formula (I) is not the following compound:

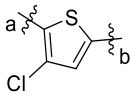


(including


), or a stereoisomer, a tautomer, a diastereomer, a racemate, a cis-trans isomer, an isotopically labelled compound, an N-oxide, a metabolite, an ester, a prodrug, a crystal form, a hydrate, a solvate or a pharmaceutically acceptable salt thereof; and

(2) when ring A is a thiazole ring, L^3 is -NR^{L3}-, and R^2 is substituted or unsubstituted phenyl, L^1 is not -CR^aR^b-;

(3) when -L^1-X^1-L^2-, as a whole, is -NH-, 

is 

, and R^2 is C_{6-10} aryl, wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

(4) when ring A is a thiazole ring and L^3 is absent, R^2 is not unsubstituted biphenyl.

2. The compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to claim 1, wherein

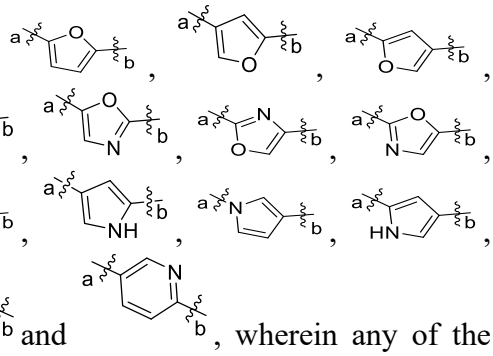
ring A is selected from a benzene ring and a 5- to 6-membered aromatic heterocyclic ring, and the benzene ring and 5- to 6-membered aromatic heterocyclic ring are each optionally substituted with 1, 2 or 3 R^A;

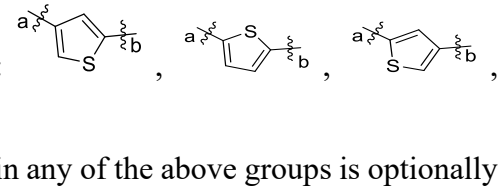
preferably, ring A is selected from phenyl, furyl, thienyl, oxazolyl, thiazolyl, pyrrolyl, pyrazolyl, imidazolyl and pyridyl, and the phenyl, furyl, thienyl, oxazolyl,

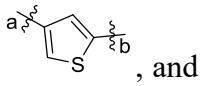
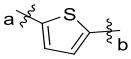
thiazolyl, pyrrolyl, pyrazolyl, imidazolyl and pyridyl are each optionally substituted with 1 or 2 R^A;

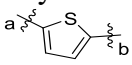
preferably, ring A is selected from phenyl, thienyl, imidazolyl and thiazolyl, and the phenyl, thienyl, imidazolyl and thiazolyl are each optionally substituted with 1 or 2 R^A;

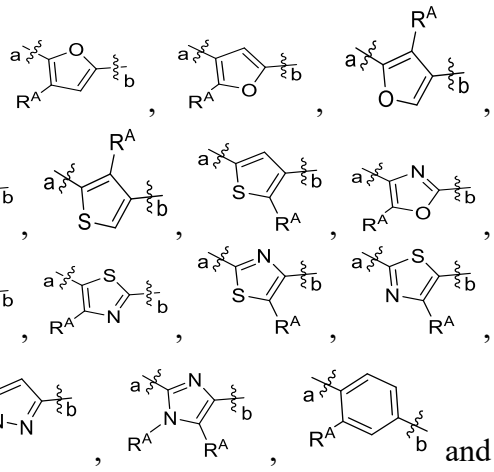
preferably, ring A is thienyl, and the thienyl is optionally substituted with 1 or 2 R^A;

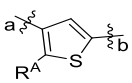
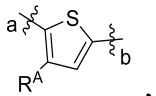
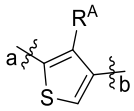
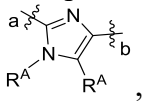
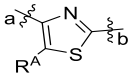
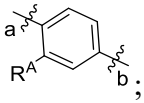
preferably, ring A is selected from:  , wherein any of the above groups is optionally substituted with 1, 2 or 3 (preferably 1 or 2, more preferably 1) R^A, and wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

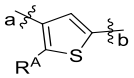
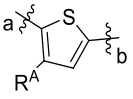
preferably, ring A is selected from:  , wherein any of the above groups is optionally substituted with 1 or 2 R^A;

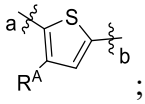
preferably, ring A is selected from:  , and  , wherein any of the above groups is optionally substituted with 1 R^A;

preferably, ring A is  , which is optionally substituted with 1 R^A;

preferably, ring A is selected from:  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

preferably, ring A is selected from:  ,  ,  ,  ,  and  ;

more preferably, ring A is selected from:  and  ;

most preferably, ring A is  ; or

the R^A is independently selected from H, D, halogen, -CN, C_{1-6} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, C_{2-6} haloalkenyl, C_{2-6} haloalkynyl, C_{1-6} haloalkoxy, C_{3-6} cycloalkyl, 3- to 6-membered heterocyclyl, and phenyl; alternatively, where applicable, two adjacent R^A, together with the ring atoms to which they are attached, may form C_{5-6} carbocyclyl, 5- to 6-membered heterocyclyl or 5- to 6-membered heteroaryl;

preferably, the R^A is independently selected from H, D, halogen, -CN, C_{1-4} alkyl, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-4} alkoxy, C_{1-4} haloalkyl, C_{2-4} haloalkenyl, C_{2-4} haloalkynyl, C_{1-4} haloalkoxy, C_{3-4} cycloalkyl, 3- to 4-membered heterocyclyl, and phenyl; alternatively, where applicable, two adjacent R^A, together with the ring atoms to which they are attached, may form C_{5-6} carbocyclyl;

preferably, the R^A is independently selected from H, D, halogen (such as F and Cl), -CN, C_{1-4} alkyl, C_{2-4} alkenyl, C_{2-4} alkynyl, C_{1-4} alkoxy, C_{1-4} haloalkyl, C_{2-4} haloalkenyl, C_{2-4} haloalkynyl, C_{1-4} haloalkoxy, C_{3-4} cycloalkyl, 3- to 4-membered heterocyclyl, and phenyl;

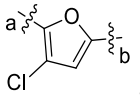
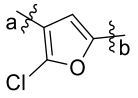
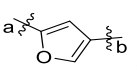
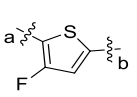
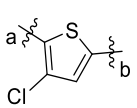
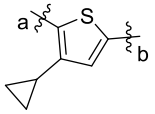
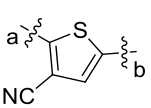
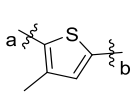
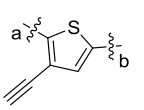
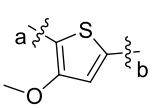
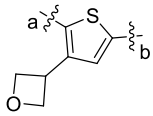
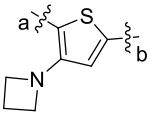
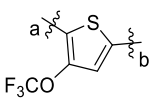
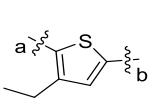
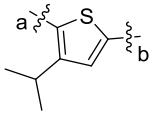
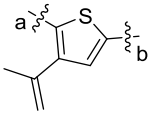
preferably, the R^A is independently selected from H, halogen (such as Cl), C_{1-4} alkyl, C_{3-4} cycloalkyl, and phenyl;

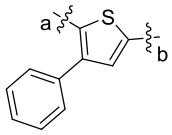
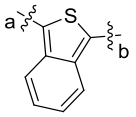
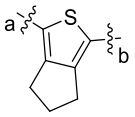
preferably, the R^A is independently selected from H, halogen (such as Cl), and C_{1-4} alkyl;

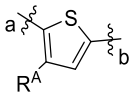
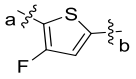
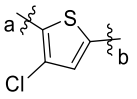
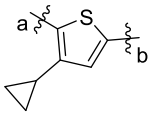
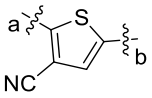
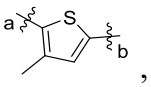
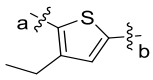
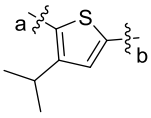
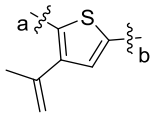
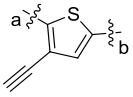
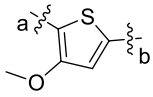
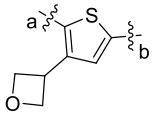
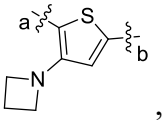
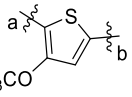
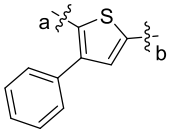
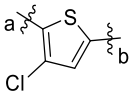
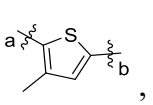
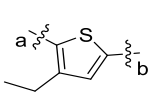
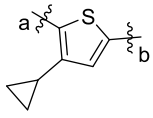
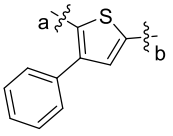
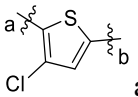
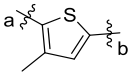
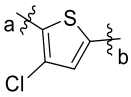
preferably, each of the R^A is independently selected from H, D, F, Cl, -CN, methyl, ethyl, isopropyl, sec-butyl, isobutyl, tert-butyl, vinyl, allyl, ethynyl, propargyl, methoxy, ethoxy, isopropoxy, tert-butoxy, $-CF_3$, $-OCF_3$, cyclopropyl, cyclobutyl, oxetanyl, azetidinyl, and phenyl;

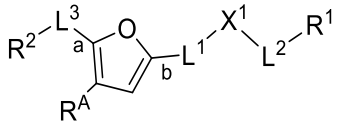
preferably, each of the R^A is independently selected from H, F, Cl, methyl, ethyl, isopropyl, tert-butyl, cyclopropyl, cyclobutyl, and phenyl;

more preferably, each of the R^A is independently selected from Cl and methyl; or

the ring A is selected from:  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,

 ,  ,  ,

preferably, moiety  is selected from  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  and  , preferably  ,  ,  ,  , and  , more preferably  and  , further preferably  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;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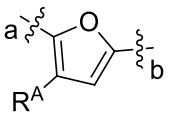
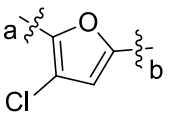
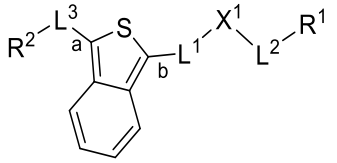
preferably, moiety  is  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;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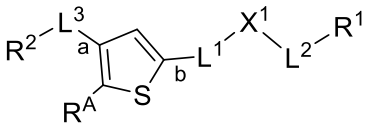
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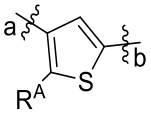
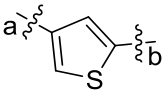
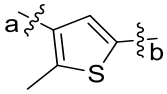
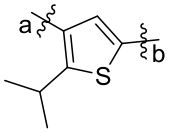
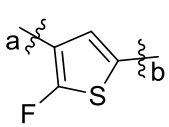
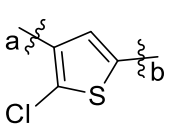
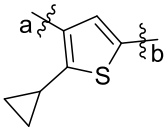
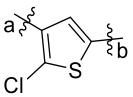
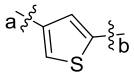
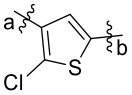
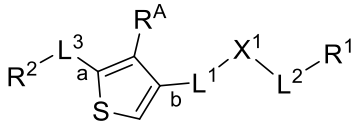
preferably, moiety  is selected from  ,  ,  ,  ,  and  , preferably  , and  , more preferably  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;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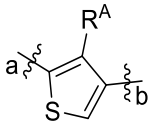
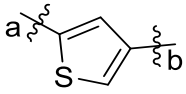
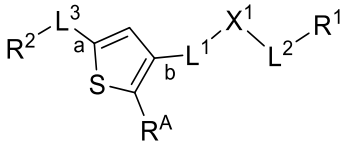
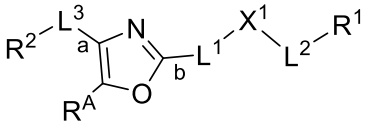
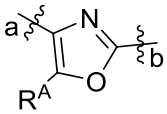
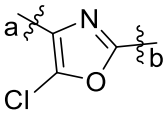
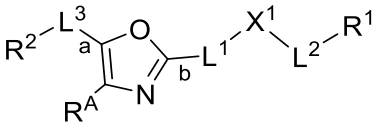
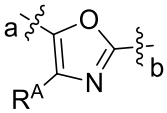
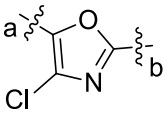
preferably,  is  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

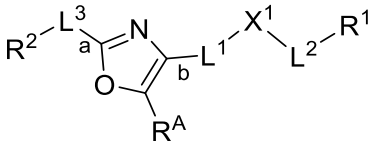

(I-6'),

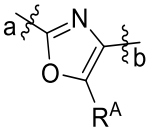
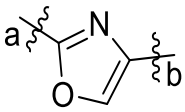

(I-7'),

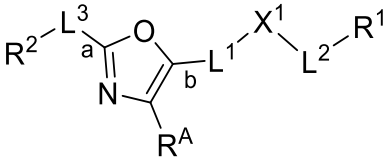
preferably, moiety  is  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

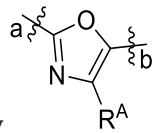
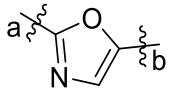

(I-8),

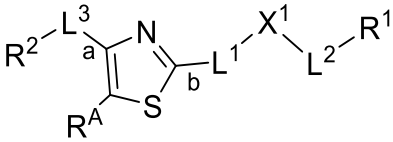
preferably, moiety  is  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

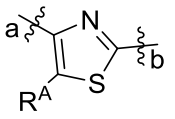
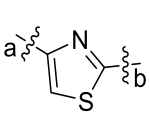
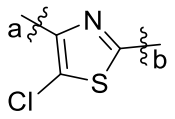
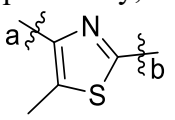
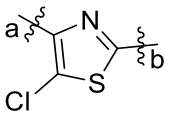

(I-9),

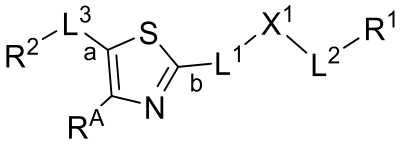
preferably, moiety  is  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

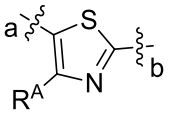
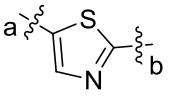

(I-10),

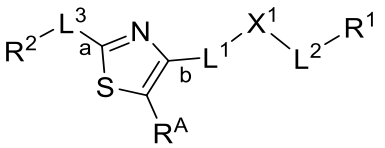
preferably, moiety  is  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

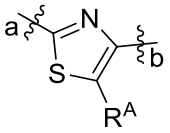
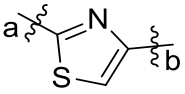

(I-11),

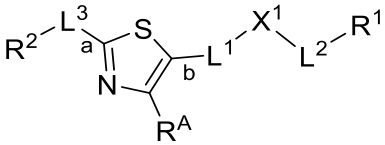
preferably, moiety  is selected from  , 
and  , preferably  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

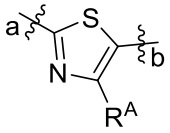
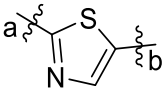

(I-12)
,

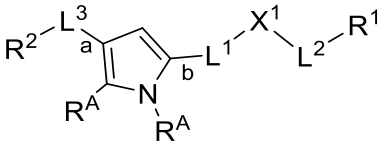
preferably, moiety  is  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

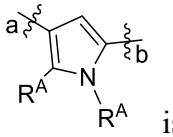
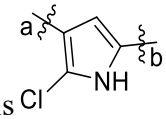

(I-13)
,

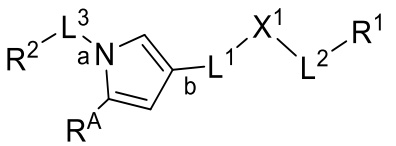
preferably, moiety  is  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

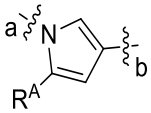
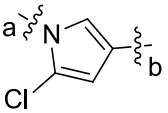

(I-14)
,

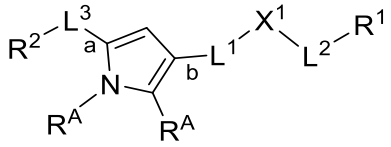
preferably, moiety  is  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

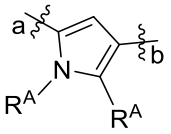
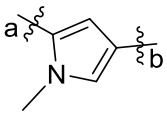

(I-15)
,

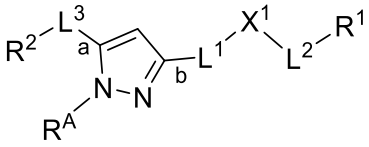
preferably, moiety  is  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

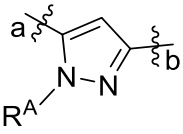
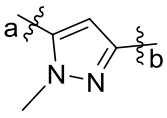

(I-16)
,

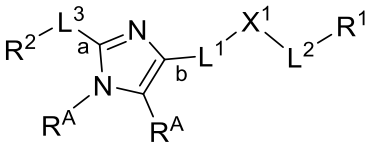
preferably, moiety  is  , wherein the bond labelled “a” is attached to L^3 and the bond labelled “b” is attached to L^1;

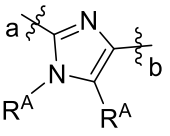
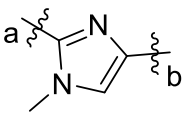

(I-17),

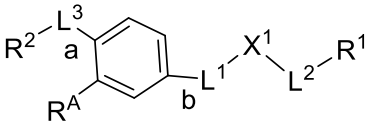
preferably, moiety  is  , wherein the bond labelled “a” is attached to L^3 and the bond labelled “b” is attached to L^1;

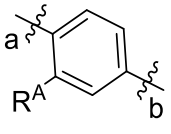
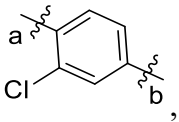

(I-18),

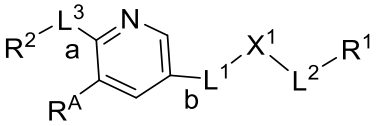
preferably, moiety  is  , wherein the bond labelled “a” is attached to L^3 and the bond labelled “b” is attached to L^1;

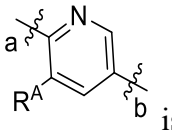
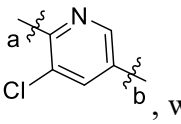

(I-19),

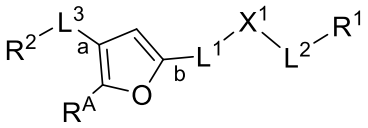
preferably, moiety  is  , wherein the bond labelled “a” is attached to L^3 and the bond labelled “b” is attached to L^1;

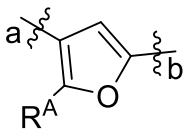
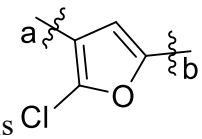

(I-20),

preferably, moiety  is  , wherein the bond labelled “a” is attached to L^3 and the bond labelled “b” is attached to L^1;

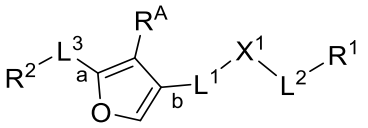

(I-21),

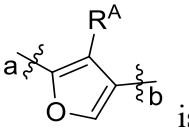
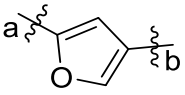
preferably, moiety  is  , wherein the bond labelled “a” is attached to L^3 and the bond labelled “b” is attached to L^1;


(I-22),

preferably, moiety  is  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1;

or


(I-23'),

preferably, moiety  is  , wherein the bond labelled "a" is attached to L^3 and the bond labelled "b" is attached to L^1.

4. The compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to any of claims 1-3, wherein

L^3 is selected from a bond and ethynylene;

preferably, L^3 is a bond.

5. The compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to any of claims 1-4, wherein

R^2 is selected from C_{3-6} cycloalkyl, phenyl, 5- to 6-membered heteroaryl, 9-membered heteroaryl, 9- to 10-membered heterocyclyl and C_{9-10} partially unsaturated cyclohydrocarbyl, and the C_{3-6} cycloalkyl, phenyl, 5- to 6-membered heteroaryl, 9-membered heteroaryl, 9- to 10-membered heterocyclyl and C_{9-10} partially unsaturated cyclohydrocarbyl are optionally substituted with 1, 2, 3, 4, or 5 groups each independently selected from R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e};

preferably, R^2 is selected from C_{3-6} cycloalkyl, phenyl, 5- to 6-membered heteroaryl, and 9-membered heteroaryl, and the C_{3-6} cycloalkyl, phenyl, 5- to 6-membered heteroaryl, and 9-membered heteroaryl are optionally substituted with 1, 2, 3, 4, or 5 groups each independently selected from R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e};

preferably, R^2 is selected from C_{3-6} cycloalkyl, phenyl, and 9-membered heteroaryl, and the C_{3-6} cycloalkyl, phenyl, and 9-membered heteroaryl are optionally substituted with 1, 2, 3, 4, or 5 groups each independently selected from R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e};

preferably, R^2 is selected from phenyl and 9-membered heteroaryl, and the phenyl and 9-membered heteroaryl are optionally substituted with 1, 2, 3, 4, or 5 groups each independently selected from R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e};

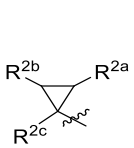
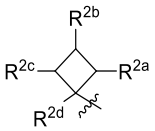
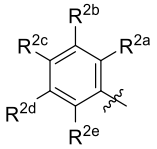
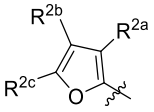
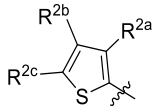
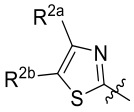
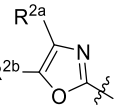
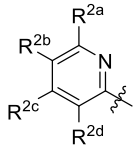
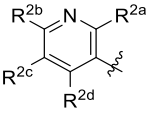
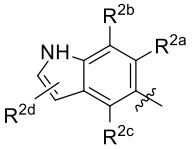
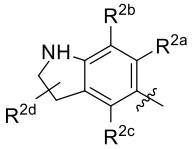
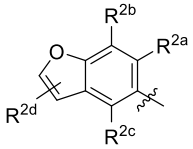
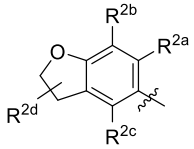
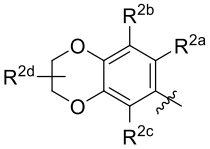
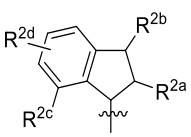
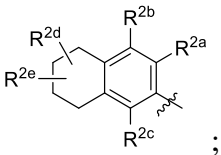
preferably, R^2 is selected from cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, phenyl, thienyl, furyl, pyrrolyl, thiazolyl, oxazolyl, pyridyl, pyrimidyl, pyrazinyl, indolyl, indolinyl, benzofuryl, 2,3-dihydrobenzofuryl, 2,3-dihydrobenzodioxanyl, 2,3-dihydroindenyl and 1,2,3,4-tetrahydronaphthyl, and the cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, phenyl, thienyl, furyl, pyrrolyl, thiazolyl, oxazolyl, pyridyl, pyrimidyl, pyrazinyl, indolyl, indolinyl, benzofuryl, 2,3-dihydrobenzofuryl, 2,3-dihydrobenzodioxanyl, 2,3-dihydroindenyl and 1,2,3,4-tetrahydronaphthyl are each optionally substituted with 1, 2, 3, 4, or 5 groups each independently selected from R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e};

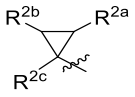
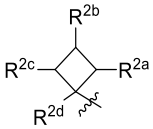
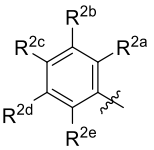
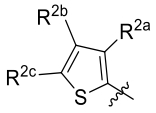
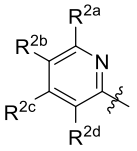
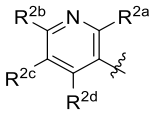
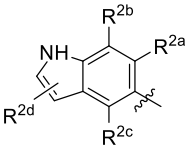
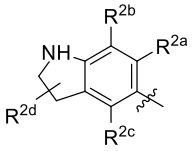
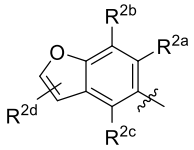
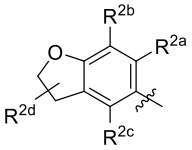
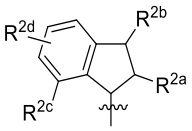
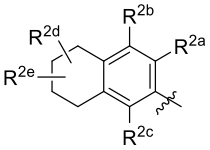
preferably, R^2 is selected from cyclopropyl, cyclobutyl, phenyl, furyl, thienyl, thiazolyl, oxazolyl, pyridyl, indolyl, indolinyl, benzofuryl, 2,3-dihydrobenzofuryl, 2,3-dihydrobenzodioxanyl, 2,3-dihydroindenyl and 1,2,3,4-tetrahydronaphthyl, and the cyclopropyl, cyclobutyl, phenyl, thienyl, thiazolyl, oxazolyl, pyridyl, indolyl, indolinyl, 2,3-dihydrobenzofuryl, 2,3-dihydrobenzodioxanyl, 2,3-dihydroindenyl and 1,2,3,4-tetrahydronaphthyl are each optionally substituted with 1, 2, 3, 4, or 5 groups each independently selected from R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e};

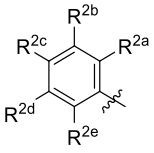
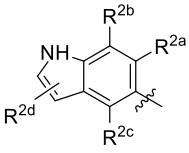
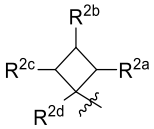
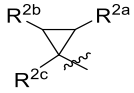
preferably, R^2 is selected from cyclopropyl, cyclobutyl, phenyl, thienyl, pyridyl, indolyl, indolinyl, benzofuryl, 2,3-dihydrobenzofuryl, 2,3-dihydroindenyl and 1,2,3,4-tetrahydronaphthyl, and the cyclopropyl, cyclobutyl, phenyl, thienyl, pyridyl, indolyl, indolinyl, benzofuryl, 2,3-dihydrobenzofuryl, 2,3-dihydroindenyl and 1,2,3,4-tetrahydronaphthyl are each optionally substituted with 1, 2, 3, 4, or 5 groups each independently selected from R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e};

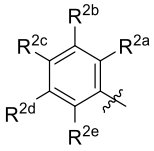
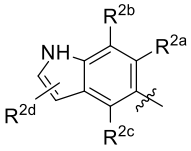
preferably, R^2 is selected from cyclopropyl, cyclobutyl, phenyl, and indolyl, and the cyclopropyl, cyclobutyl, phenyl and indolyl are each optionally substituted with 1, 2, 3, 4, or 5 groups each independently selected from R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e};

preferably, R^2 is selected from phenyl and indolyl, and the phenyl and indolyl are each optionally substituted with 1, 2, 3, 4, or 5 groups each independently selected from R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e};

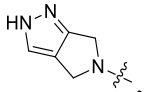
preferably, R^2 is selected from  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  and ;

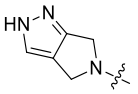
preferably, R^2 is selected from  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  , and  ;

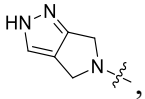
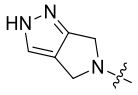
preferably, R^2 is selected from  ,  ,  , and  ;

more preferably, R^2 is selected from  and  ; or

R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e} are each independently selected from H, halogen, -OH, -CN, C_{1-4} alkyl, C_{1-4} haloalkyl, $-NH_2$, $-NHC_{1-4}$ alkyl, $-N(C_{1-4}$ alkyl$)_2$, C_{1-4} alkoxy, C_{1-4} haloalkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkenyl, 4- to 6-membered monocyclic heterocyclyl, 8- to 10-membered bicyclic heterocyclyl, phenyl and 5- to 6-membered heteroaryl, wherein the C_{1-4} alkyl, C_{1-4} haloalkyl, $-NHC_{1-4}$ alkyl, $-N(C_{1-4}$ alkyl$)_2$, C_{1-4} alkoxy, C_{1-4} haloalkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkenyl, 4- to 6-membered monocyclic heterocyclyl, 8- to 10-membered bicyclic heterocyclyl, phenyl and 5- to 6-membered heteroaryl are each optionally substituted with 1, 2 or 3 R; preferably, R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e} are each independently selected from H, -OH, C_{1-4} alkyl, C_{1-4} alkoxy, C_{3-6} cycloalkyl, 4- to 6-membered monocyclic heterocyclyl, phenyl and 5- to 6-membered heteroaryl, and the C_{1-4} alkyl, C_{1-4} alkoxy, C_{3-6} cycloalkyl, 4- to 6-membered monocyclic heterocyclyl, phenyl and 5- to 6-membered heteroaryl are each optionally substituted with 1, 2 or 3 R;

preferably, R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e} are each independently selected from H, F, Cl, Br, -OH, -CN, methyl, ethyl, propyl, butyl, halomethyl, haloethyl, halopropyl, halobutyl, $-NH_2$, -NH-methyl, -NH-ethyl, -NH-propyl, -NH-butyl, $-N(CH_3)_2$, $-N(CH_3)(CH_2CH_3)$, $-N(CH_2CH_3)_2$, methoxy, ethoxy, propoxy, butoxy, halomethoxy, haloethoxy, halopropoxy, halobutoxy, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cyclopentenyl, cyclohexenyl, oxetanyl, azetidinyl, tetrahydrofuryl, pyrrolidyl, tetrahydropyranyl, piperidyl, morpholinyl, dihydrotriazolyl,  , phenyl, imidazolyl, pyrazolyl, thienyl, furyl, pyrrolyl, thiazolyl, thiadiazolyl, oxazolyl, oxadiazolyl, triazolyl, tetrazolyl, pyridyl, pyrimidyl and pyrazinyl, and the methyl, ethyl, propyl, butyl, halomethyl, haloethyl, halopropyl, halobutyl, $-NH_2$, -NH-methyl, -NH-ethyl, -NH-propyl, -NH-butyl, $-N(CH_3)_2$, $-N(CH_3)(CH_2CH_3)$, -

$N(CH_2CH_3)_2$, methoxy, ethoxy, propoxy, butoxy, halomethoxy, haloethoxy, halopropoxy, halobutoxy, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cyclopentenyl, cyclohexenyl, oxetanyl, azetidinyl, tetrahydrofuryl, pyrrolidyl, tetrahydropyranyl, piperidyl, morpholinyl, dihydrotriazolyl,  , phenyl, imidazolyl, pyrazolyl, thienyl, furyl, pyrrolyl, thiazolyl, thiadiazolyl, oxazolyl, oxadiazolyl, triazolyl, tetrazolyl, pyridyl, pyrimidyl and pyrazinyl are each optionally substituted with 1, 2 or 3 R;

preferably, R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e} are each independently selected from H, F, -OH, $-CH_3$, $-CH_2CH_3$, $-CH_2CH_2CH_3$, $-CH_2CH_2CH_2CH_3$, $-CH(CH_3)_2$, $-C(CH_3)_3$, $-N(CH_3)_2$, $-OCH_3$, $-OCH_2CH_3$, $-OCH_2CH_2CH_3$, $-OCH(CH_3)_2$, $-OCF_3$, cyclopropyl, cyclobutyl, cyclohexenyl, azetidinyl, oxetanyl, piperidyl, morpholinyl, tetrahydrofuryl, pyrrolidyl, tetrahydropyranyl,  , phenyl and pyridyl, and the $-CH_3$, $-CH_2CH_3$, $-CH_2CH_2CH_3$, $-CH_2CH_2CH_2CH_3$, $-CH(CH_3)_2$, $-C(CH_3)_3$, $-N(CH_3)_2$, $-OCH_3$, $-OCH_2CH_3$, $-OCH_2CH_2CH_3$, $-OCH(CH_3)_2$, $-OCF_3$, cyclopropyl, cyclobutyl, cyclohexenyl, azetidinyl, oxetanyl, piperidyl, morpholinyl, tetrahydrofuryl, pyrrolidyl, tetrahydropyranyl,  , phenyl and pyridyl are each optionally substituted with 1, 2 or 3 R;

preferably, R^{2a}, R^{2b}, R^{2c}, R^{2d} and R^{2e} are each independently selected from H, -OH, $-CH_3$, $-CH_2CH_3$, $-CH_2CH_2CH_3$, $-OCH_3$, $-OCH_2CH_3$, $-OCH_2CH_2CH_3$, cyclopropyl, cyclobutyl, phenyl, pyridyl, pyrrolidyl, morpholinyl, tetrahydropyranyl, and piperidyl, and the $-CH_3$, $-CH_2CH_3$, $-CH_2CH_2CH_3$, $-OCH_3$, $-OCH_2CH_3$, $-OCH_2CH_2CH_3$, cyclopropyl, cyclobutyl, phenyl, pyridyl, pyrrolidyl, morpholinyl, tetrahydropyranyl and piperidyl are each optionally substituted with 1, 2 or 3 R; or

R is a group selected from the following (1) to (3):

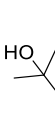
(1) H, halogen, -OH, -CN, $-NH_2$, an oxo group, -COOH, C_{1-4} alkyl, C_{1-4} haloalkyl, $-C_{1-4}$ alkyl substituted with 1 or 2 OH, C_{1-4} alkoxy, $-C_{1-4}$ alkyleneoxy-C_{1-4} alkoxy, $-C(=O)NH-C_{1-4}$ alkyl, $-C(=O)NH-C_{3-6}$ cycloalkyl, $-C(=O)-C_{1-4}$ alkyl, $-NHC(=O)-C_{1-4}$ alkyl, $-N=S(=O)R^{s1}R^{s2}$, $-NH-S(=O)_2C_{1-4}$ alkyl, $-S(=O)_2-C_{1-4}$ alkyl, $-S(=O)_2$-4- to 6-membered heterocyclyl, $-S(=O)_2NH-C_{1-4}$ alkyl, $-S(=O)_2NH-C_{3-6}$ cycloalkyl, $-C_{3-6}$ cycloalkylene-COOH and -C(=O)-4- to 6-membered heterocyclyl, wherein R^{s1} and R^{s2} are each C_{1-4} alkyl, alternatively, R^{s1} and R^{s2}, together with the S atom to which they are attached, form 4- to 6-membered heterocycloalkyl;

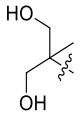
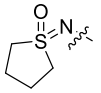
(2) 4- to 6-membered heterocyclyl, wherein the 4- to 6-membered heterocyclyl is optionally substituted with 1, 2 or more substituents independently selected from C_{1-4} alkyl, $-NH_2$, =NH and an oxo group; and

(3) phenyl and 5- to 6-membered heteroaryl, wherein the phenyl and 5- to 6-membered heteroaryl are each optionally substituted with 1, 2 or more substituents independently selected from halogen, -OH, -CN, $-NH_2$, $-C_{1-4}$ alkylene-OH, $-C_{1-4}$ alkylene-CN and $-C_{1-4}$ alkylene-NH_2; preferably, R is selected from: H, $-NH_2$, -OH, $-C_{1-4}$ alkyl substituted with one OH, C_{1-4} alkyl, $-S(=O)_2-C_{1-4}$ alkyl, and 4- to 6-membered heterocyclyl;

preferably, R is a group selected from the following (1) to (3):

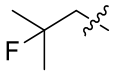
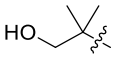
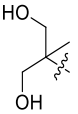
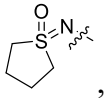
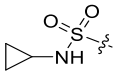
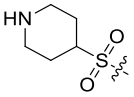
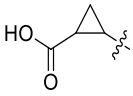
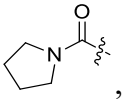
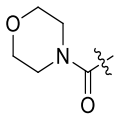
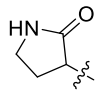
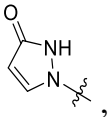
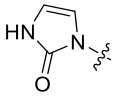
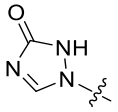
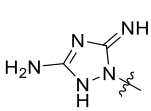
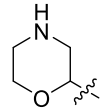
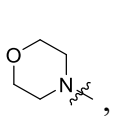
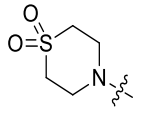
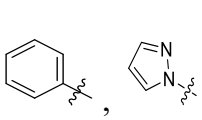
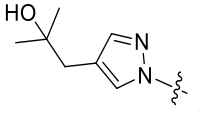
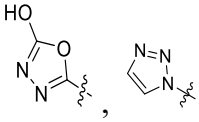
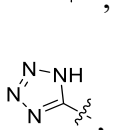
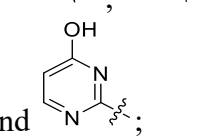
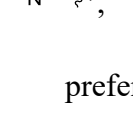
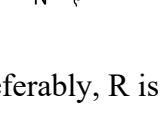
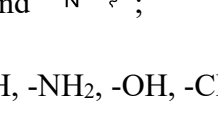
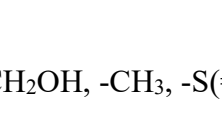
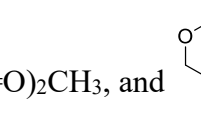
(1) H, halogen, -OH, -CN, $-NH_2$, an oxo group, -COOH, methyl, ethyl, propyl, butyl, halomethyl, haloethyl, halopropyl, halobutyl, $-CH_2OH$, -ethylene-OH,  ,




, methoxy, ethoxy, propoxy, butoxy, -methyleneoxy-methoxy, -methyleneoxy-ethoxy, -methyleneoxy-propoxy, -ethyleneoxy-methoxy, -ethyleneoxy-ethoxy, -ethyleneoxy-propoxy, -C(=O)-NH-methyl, -C(=O)-NH-ethyl, -C(=O)-NH-propyl, -C(=O)-NH-butyl, -N=S(=O)(methyl)$_2$, -N=S(=O)(methyl)(ethyl), -N=S(=O)(methyl)(propyl), -N=S(=O)(methyl)(butyl), -N=S(=O)(ethyl)$_2$, -N=S(=O)(ethyl)(propyl), -(NH)$_p$-W-methyl, -(NH)$_p$-W-ethyl, -(NH)$_p$-W-propyl, -(NH)$_p$-W-butyl, -W-NH-cyclopropyl, -W-oxetanyl, -W-azetidinyl, -W-tetrahydrofuryl, -W-pyrrolidyl, -W-tetrahydropyranyl, -W-piperidyl, -W-morpholinyl, -cyclopropylene-COOH and  , wherein each W is independently C(=O) or S(=O)$_2$, and each p is independently 0 or 1;

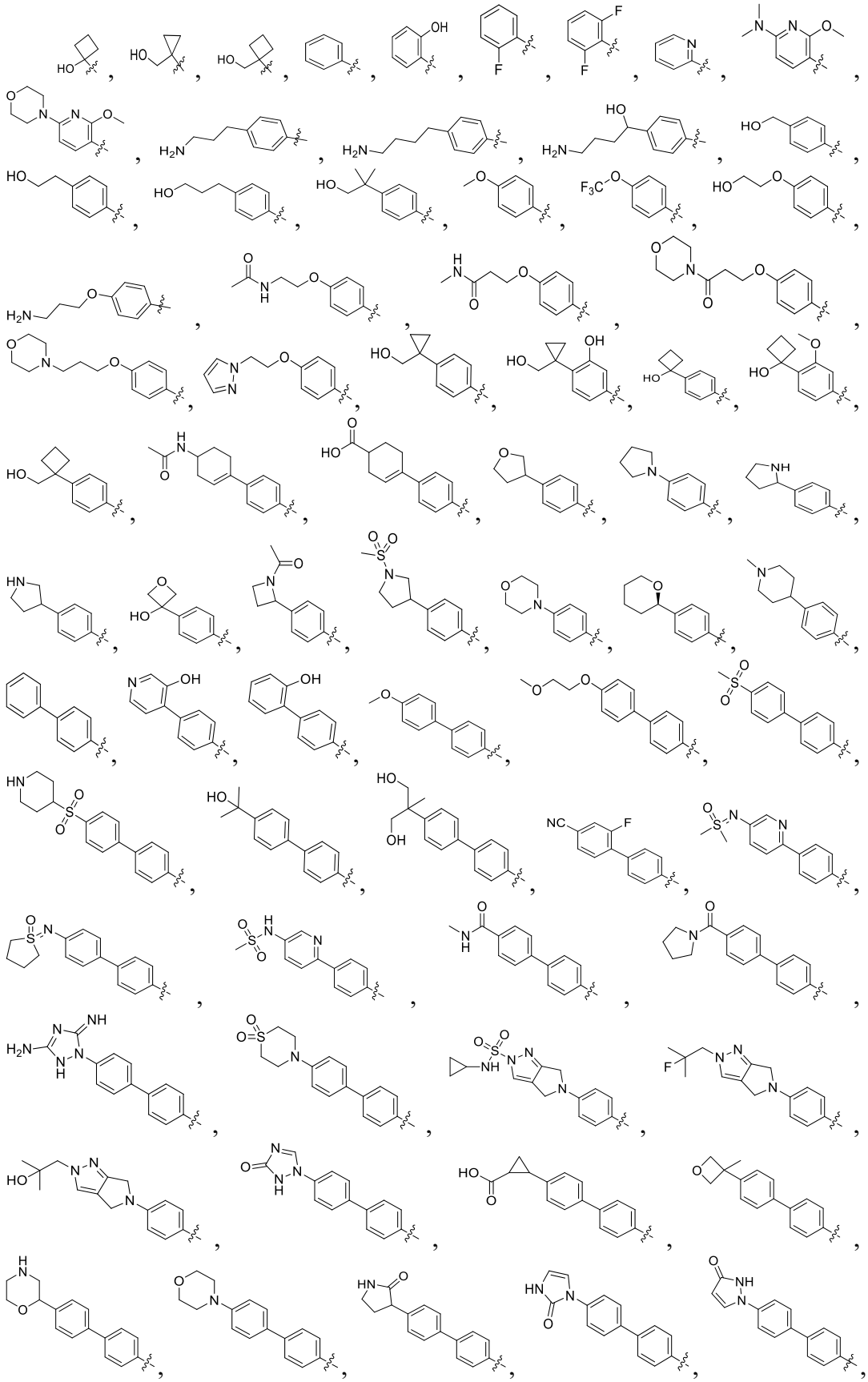
(2) oxetanyl, azetidinyl, tetrahydrofuryl, pyrrolidyl, tetrahydropyranyl, piperidyl, morpholinyl, thiomorpholinyl, dihydropyrazolyl, dihydroimidazolyl and dihydrotriazolyl, wherein the oxetanyl, azetidinyl, tetrahydrofuryl, pyrrolidyl, tetrahydropyranyl, piperidyl, morpholinyl, thiomorpholinyl, dihydropyrazolyl, dihydroimidazolyl and dihydrotriazolyl are each optionally substituted with 1, 2 or more substituents independently selected from methyl, ethyl, propyl, tert-butyl, -NH$_2$, =NH and an oxo group; and

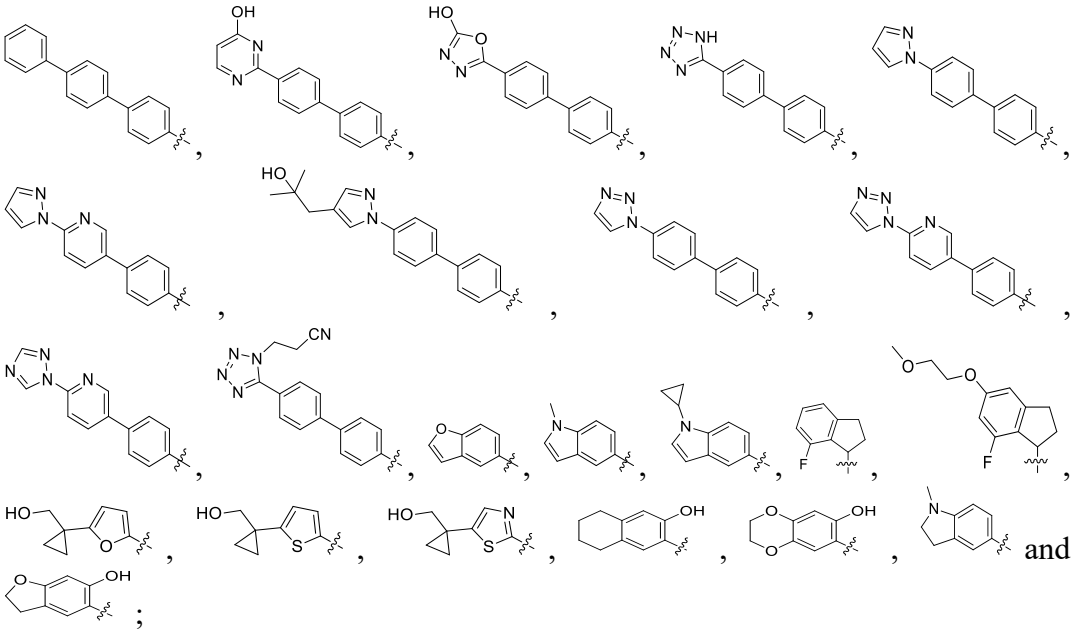
(3) phenyl, thienyl, furyl, pyrrolyl, pyrazolyl, thiazolyl, thiadiazolyl, oxazolyl, oxadiazolyl, triazolyl, tetrazolyl, pyridyl, pyrimidyl and pyrazinyl, wherein the phenyl, thienyl, furyl, pyrrolyl, pyrazolyl, thiazolyl, thiadiazolyl, oxazolyl, oxadiazolyl, triazolyl, tetrazolyl, pyridyl, pyrimidyl and pyrazinyl are each optionally substituted with 1, 2 or more substituents independently selected from halogen, -OH, -CN, -NH$_2$, -C$_{1-4}$ alkylene-OH, -C$_{1-4}$ alkylene-CN and -C$_{1-4}$ alkylene-NH$_2$;

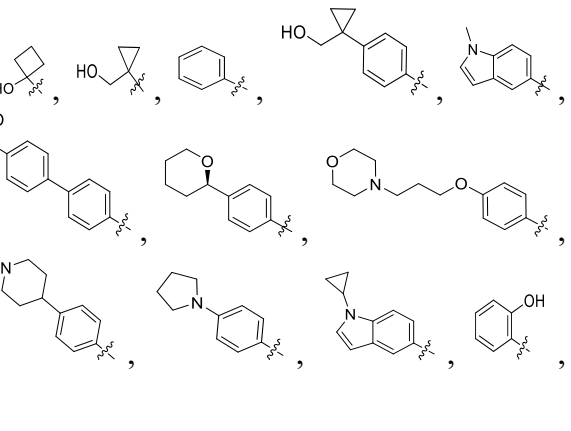
preferably, R is selected from: H, F, -OH, -CN, -NH$_2$, an oxo group, -COOH, -CH$_3$,  , -CH$_2$OH,  ,  ,  ,  , -OCH$_3$, -OCH$_2$CH$_2$OCH$_3$, -C(=O)CH$_3$, -C(=O)NHCH$_3$, -NHC(=O)CH$_3$, -N=S(=O)(CH$_3$)$_2$,  , -NH-S(=O)$_2$CH$_3$, -S(=O)$_2$CH$_3$,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  , ,  , , ,  ,  ,  ,  ,  , and ;

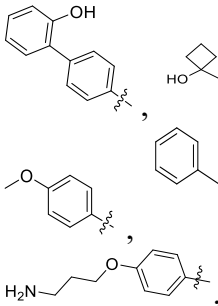
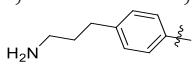
preferably, R is H, -NH$_2$, -OH, -CH$_2$OH, -CH$_3$, -S(=O)$_2$CH$_3$, and  ;

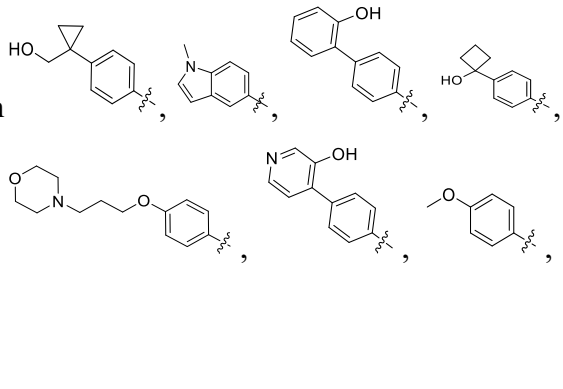
more preferably, R is H, -OH, -CH_2OH, -CH_3, -$S(=O)_2CH_3$, and  ; or R^2 is selected from:

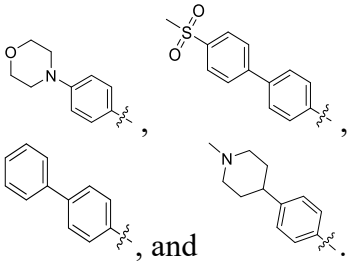




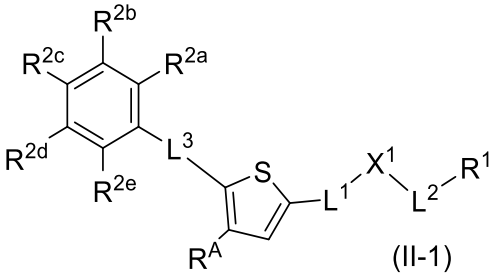
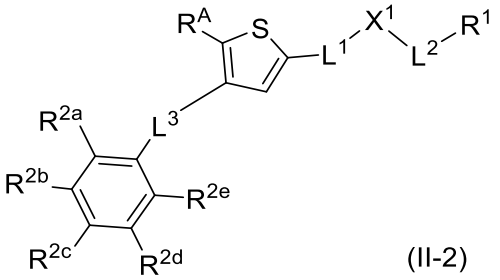
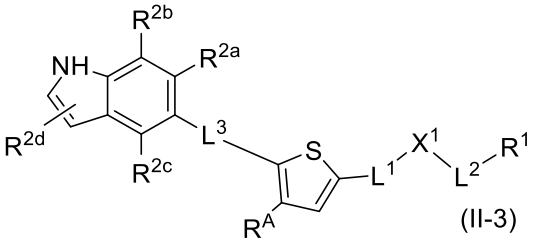
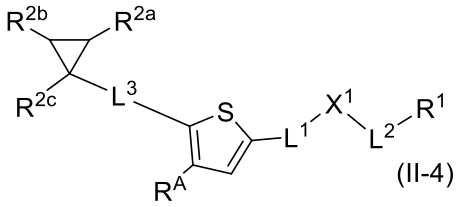
preferably, R^2 is selected from 

 ; and  ;

more preferably, R^2 is selected from 

 , and .

6. The compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to any of claims 1-5, wherein the compound has a structure shown in any of formulas (II-1) to (II-9):


(II-1),

(II-2),

(II-3),

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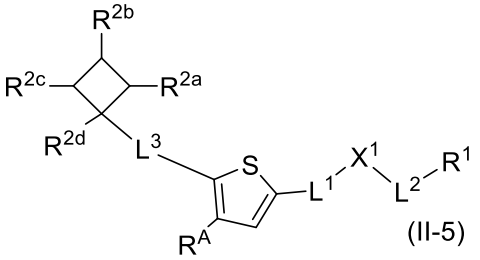
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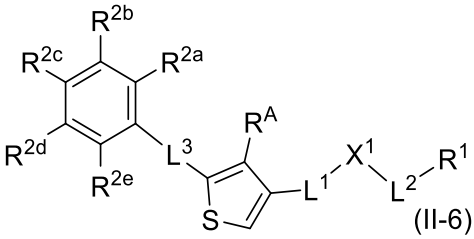
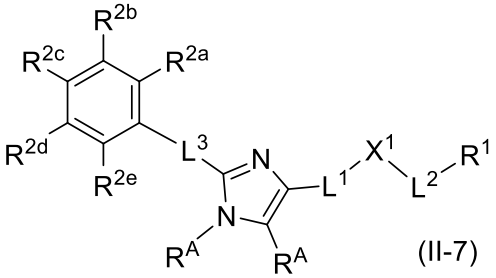
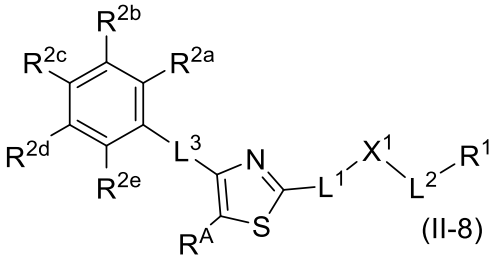
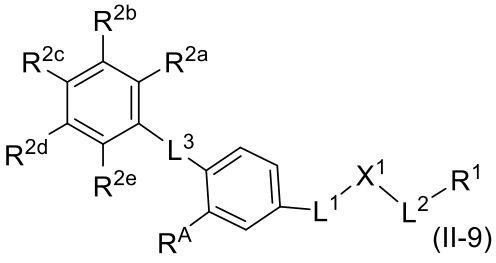
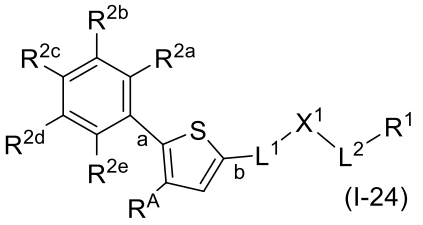
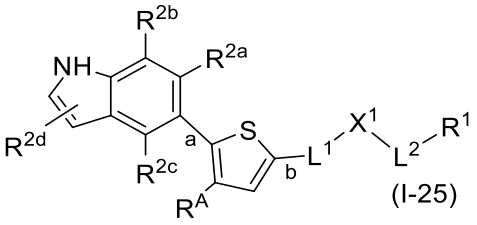
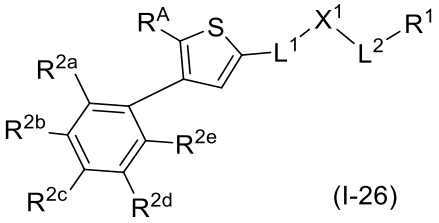
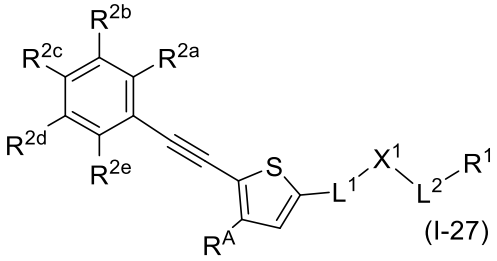
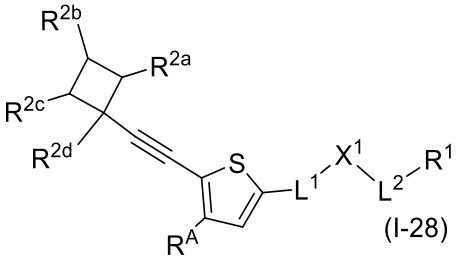
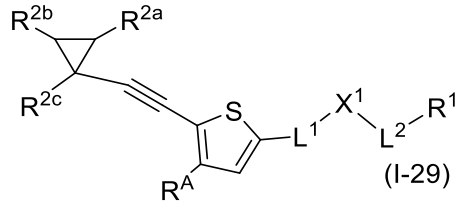
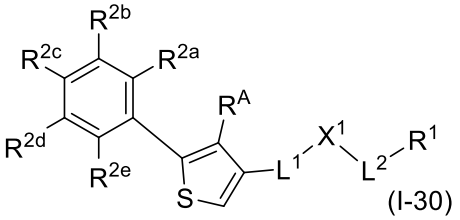
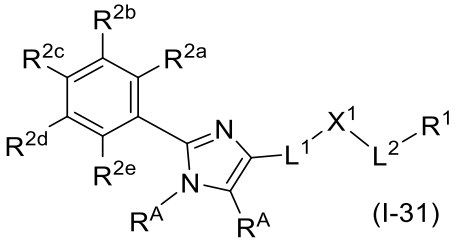
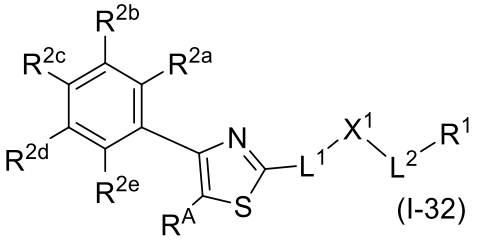
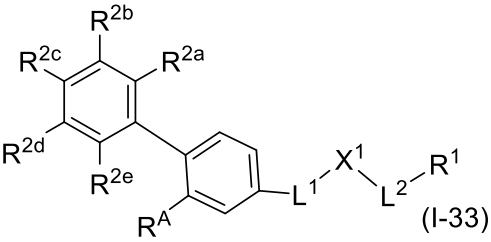
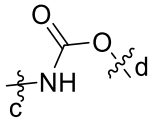
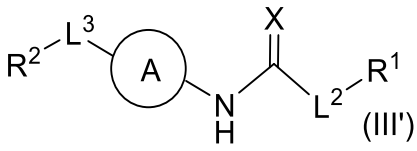

(II-6),

(II-7),

(II-8), or

(II-9);

preferably, the compound has a structure shown in any of formulas (I-24) to (I-33):


(I-24),

(I-25),

(I-26),

(I-27),

(I-28),

(I-29),

(I-30),

(I-31),

(I-32), or

(I-33).

7. The compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to any of claims 1-6, wherein R^c, at each occurrence, is independently selected from H, D, C_{1-4} alkyl, C_{1-4} haloalkyl and C_{3-4} cycloalkyl; preferably, R^c, at each occurrence, is independently H and C_{1-4} alkyl, preferably H, methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, isobutyl and tert-butyl, more preferably H and methyl; or moiety $-L^1-X^1-L^2-$ is  , wherein the bond labelled "c" is attached to ring A and the bond labelled "d" is attached to R^1.

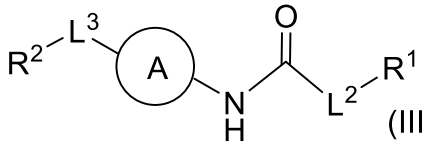
8. The compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to any of claims 1-7, wherein the compound has a structure shown in formula (III'):



(III');

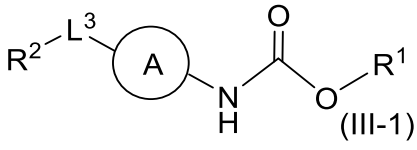
wherein X is selected from O and S; preferably, X is O;

preferably, the compound has a structure shown in formula (III):



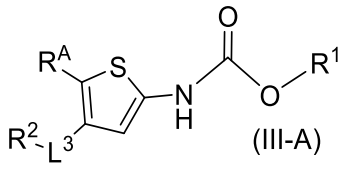
(III);

preferably, the compound has a structure shown in formula (III-1):

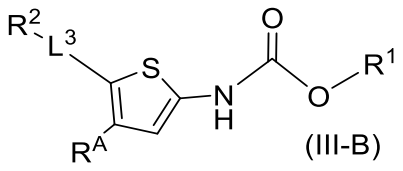


(III-1);

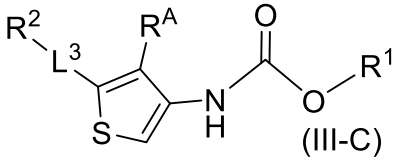
preferably, the compound has a structure shown in any of formulas (III-A) to (III-F):



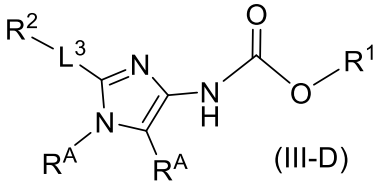
(III-A),



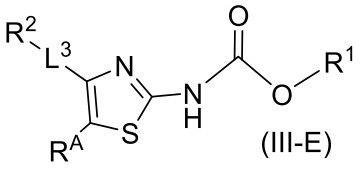
(III-B),



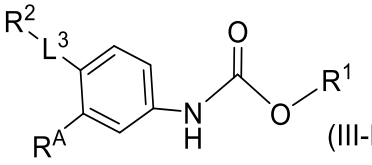
(III-C),



(III-D),

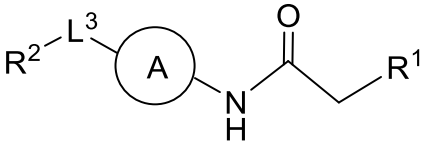


(III-E), or

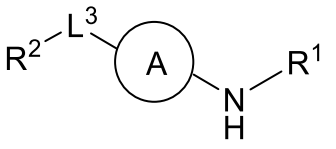


(III-F).

9. The compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to any of claims 1-8, wherein the compound has a structure shown in formula (III-2) or (III-3):

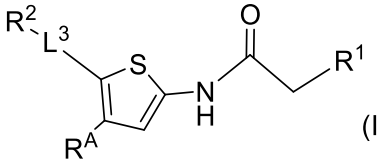


(III-2) or

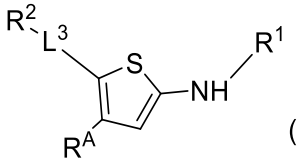


(III-3);

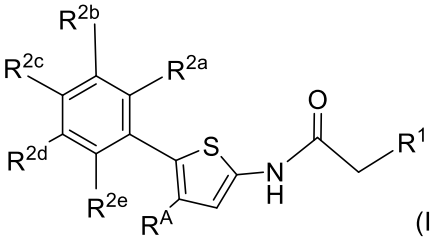
preferably, the compound has a structure shown in formula (III-G) or (III-H):


(III-G)

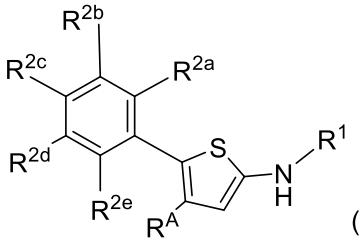
or


(III-H);

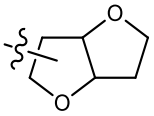
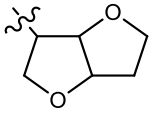
more preferably, the compound has a structure shown in formula (III-I) or (III-J):

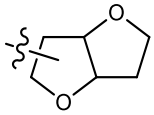
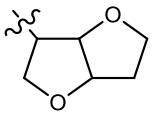

(III-I)

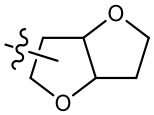
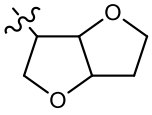
or

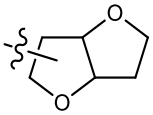
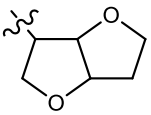

(III-J).

10. The compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to any of claims 1-9, wherein

R^1 is selected from n-propyl, cyclopentyl, cyclohexyl, oxadiazolyl, thiadiazolyl, pyrimidyl, phenyl and  (preferably ), wherein any of the above groups is optionally substituted with 1, 2 or 3 R^{1a};

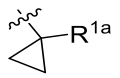
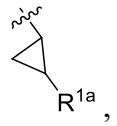
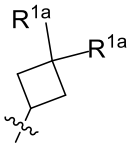
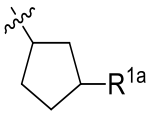
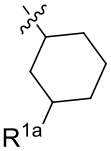
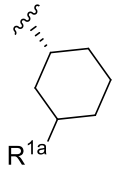
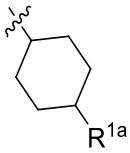
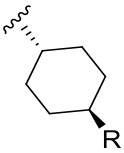
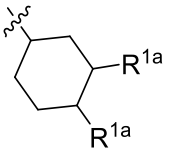
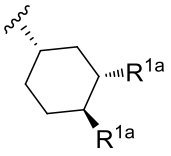
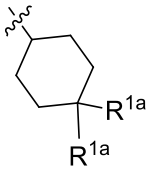
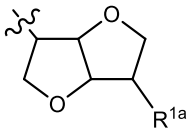
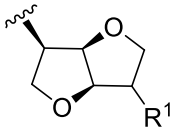
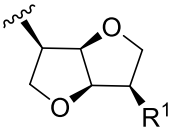
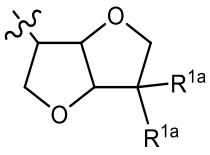
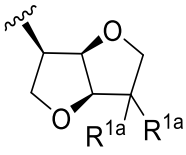
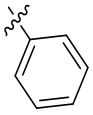
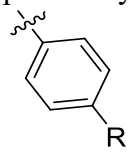
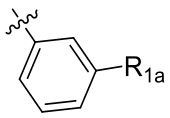
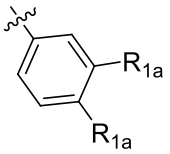
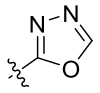
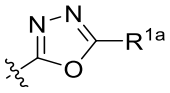
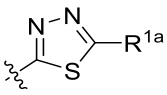
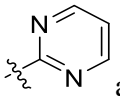
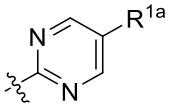
preferably, R^1 is selected from n-propyl, cyclopentyl, cyclohexyl and  (preferably ), wherein any of the above groups is optionally substituted with 1, 2 or 3 R^{1a};

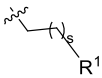
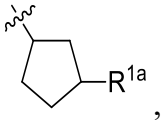
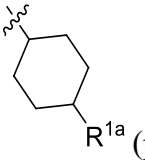
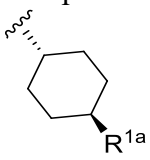
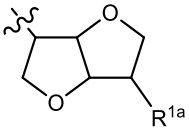
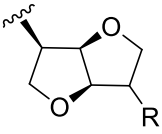
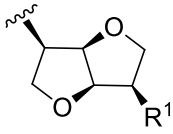
preferably, R^1 is selected from cyclopentyl and  (preferably ), wherein any of the above groups is optionally substituted with 1, 2 or 3 R^{1a};

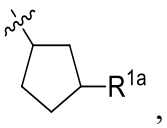
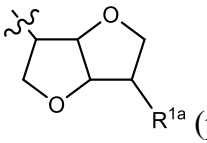
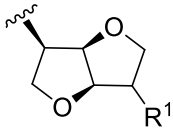
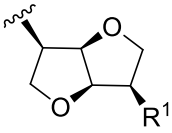
preferably, R^1 is  (preferably ), which is optionally substituted with 1, 2 or 3 R^{1a};

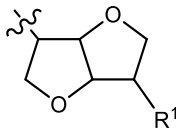
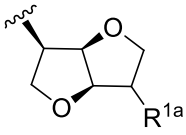
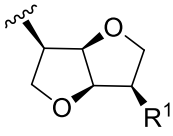
preferably, R^1 is a group selected from the following (1) to (2):

(1) methyl, ethyl and n-propyl, and the methyl, ethyl and n-propyl are each optionally substituted with 1, 2 or 3 R^{1a};

(2)  ,  ,  ,  ,  ,  (preferably ),  (preferably ),  (preferably ),  ,  (preferably  , more preferably ),  (preferably ),  ,  ,  ,  ,  ,  ,  ,  ,  and  ;

preferably, R^1 is selected from:  ,  ,  (preferably ), and  (preferably  , more preferably ), wherein s is selected from 0, 1 or 2, preferably, s is 2;

preferably, R^1 is selected from:  , and  (preferably  , more preferably );

more preferably, R^1 is  (preferably  , more preferably ); or

each R^{1a} is independently selected from -OH, -$COOR^c$, and -C_{1-4} alkylene-OH;

preferably, each R^{1a} is independently selected from -OH and -C_{1-2} alkylene-OH;

preferably, each R^{1a} is independently selected from F, Cl, Br, -OH, an oxo group, -COOH, methyl, ethyl, isopropyl, tert-butyl, -CH_2-OH, -CH_2CH_2-OH, -$C(CH_3)_2$-OH, -CH_2-COOH, -CH_2CH_2-COOH, -$C(CH_3)_2$-COOH, -$S(=O)_2$-CH_3 and  ;

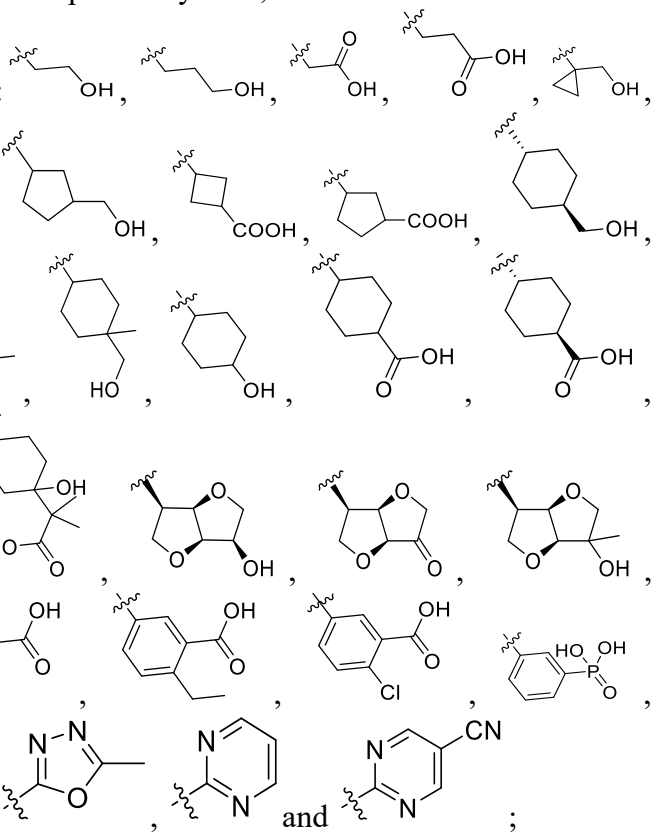
preferably, each R^{1a} is independently selected from Cl, -OH, -CN, an oxo group, -COOH, -COOEt, methyl, ethyl, -CH_2-OH, -CH_2CH_2-OH, -OCH_2CH_2-OH, -$C(CH_3)_2$-OH, -CH_2-COOH, -CH_2CH_2-COOH, -$C(CH_3)_2$-COOH, -$S(=O)_2$-CH_3 and  ;

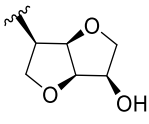
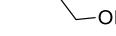
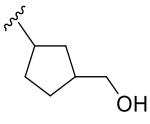
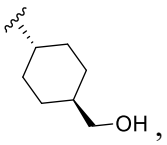
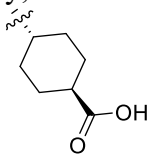
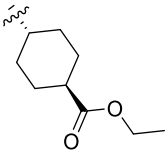
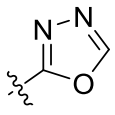
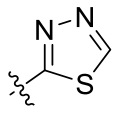
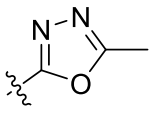
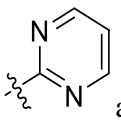
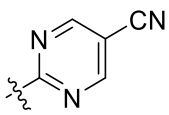
preferably, each R^{1a} is independently selected from -OH, -CH_2-OH, -COOH, and -COOEt;

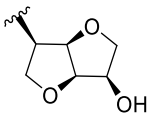
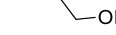
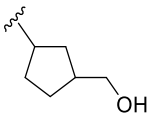
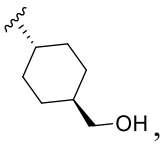
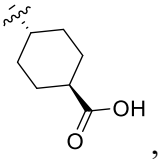
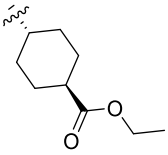
preferably, each R^{1a} is independently selected from -OH, -CH_2-OH, and -COOH;

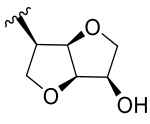
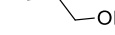
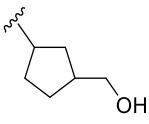
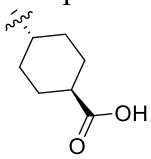
preferably, each R^{1a} is independently selected from -OH and -CH_2-OH;

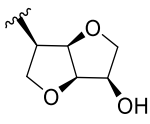
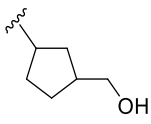
more preferably, each R^{1a} is independently -OH; or

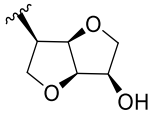
wherein R^1 is selected from:  .

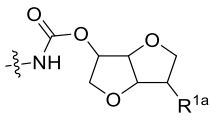
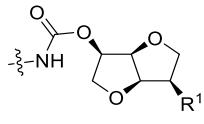
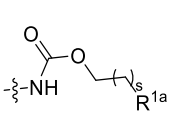
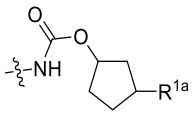
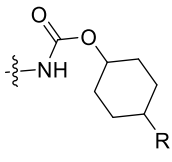
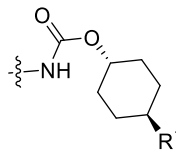
preferably, R^1 is selected from:  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  and  ;

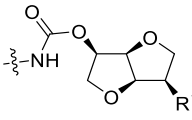
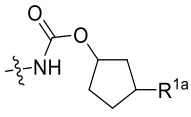
preferably, R^1 is selected from:  ,  ,  ,  ,  , and  ;

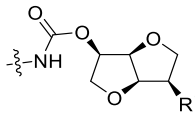
preferably, R^1 is selected from:  ,  ,  , and  ;

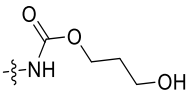
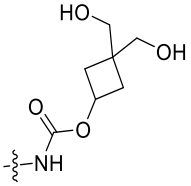
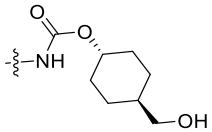
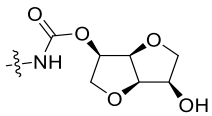
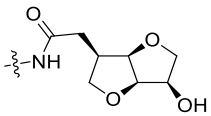
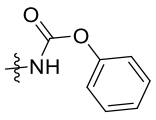
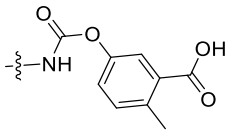
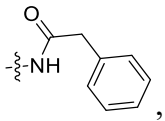
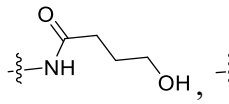
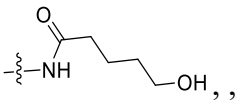
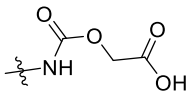
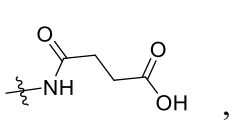
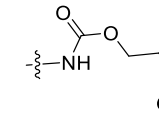
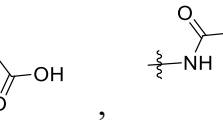
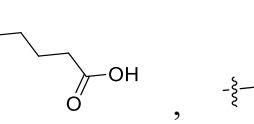
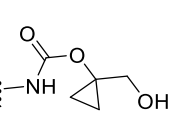
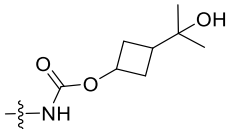
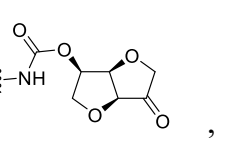
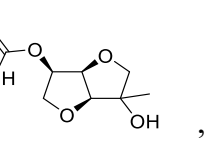
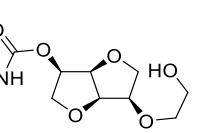
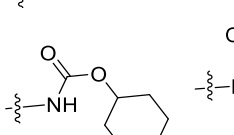
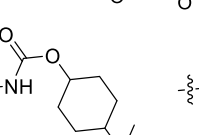
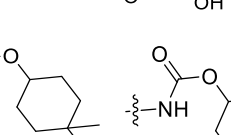
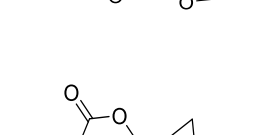
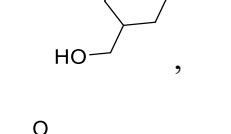
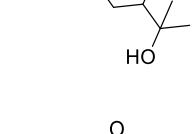
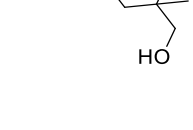
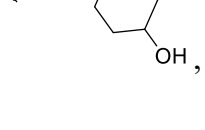
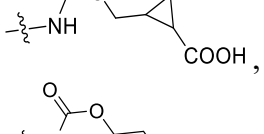
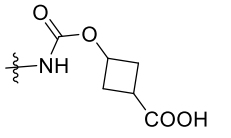
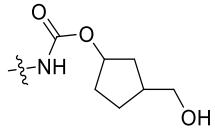
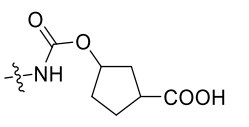
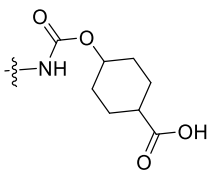
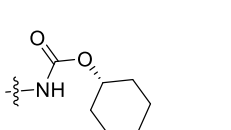
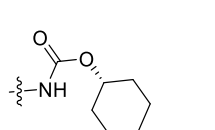
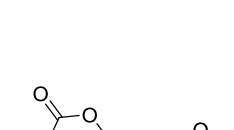
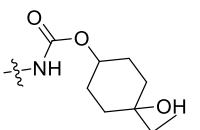
preferably, R^1 is selected from:  , and  ;

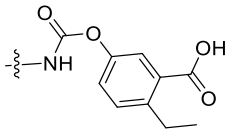
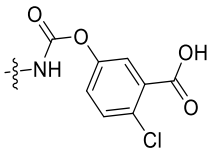
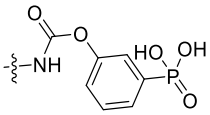
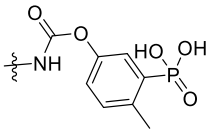
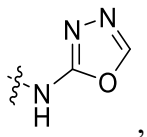
more preferably, R^1 is  ; or

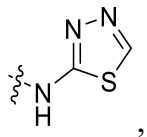
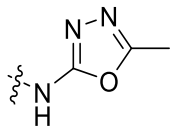
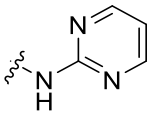
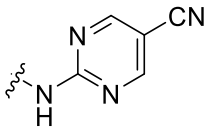
moiety $-L^1-X^1-L^2-R^1$ is selected from:  (preferably ),  ,  , and  (preferably );

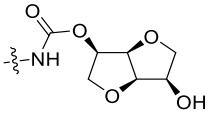
preferably, moiety -L^1-X^1-L^2-R^1 is selected from:  , and  ;

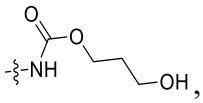
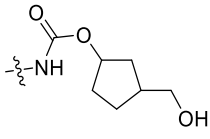
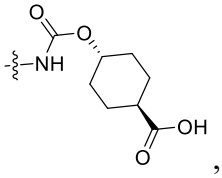
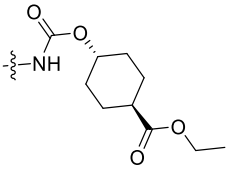
more preferably, moiety -L^1-X^1-L^2-R^1 is  ; or

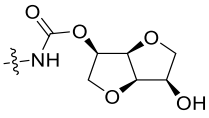
moiety -L^1-X^1-L^2-R^1 is selected from:  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  .

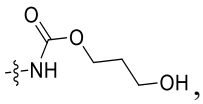
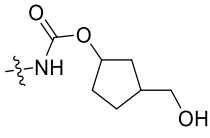
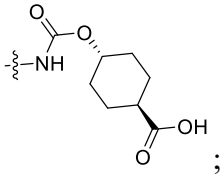
 ,  ,  ,  ,  ,

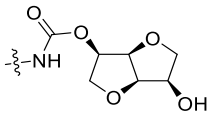
 ,  ,  and  ;

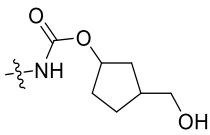
preferably, moiety $-L^1-X^1-L^2-R^1$ is selected from:  ,

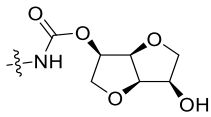
 ,  ,  , and  ;

preferably, moiety $-L^1-X^1-L^2-R^1$ is selected from:  ,

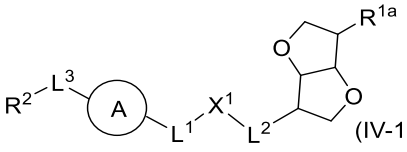
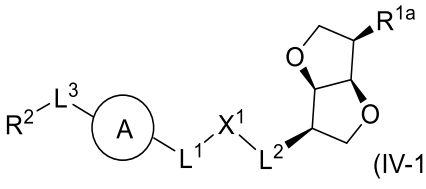
 ,  , and  ;

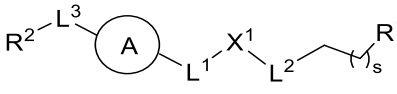
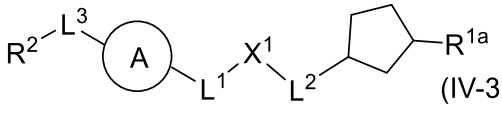
preferably, moiety $-L^1-X^1-L^2-R^1$ is selected from:  , and

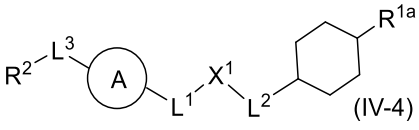
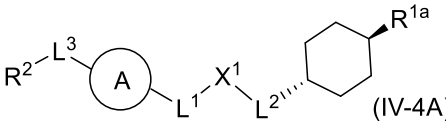
 ;

more preferably, moiety $-L^1-X^1-L^2-R^1$ is  .

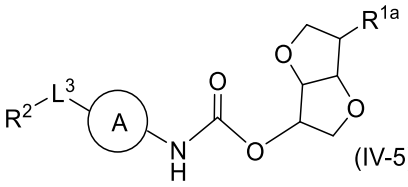
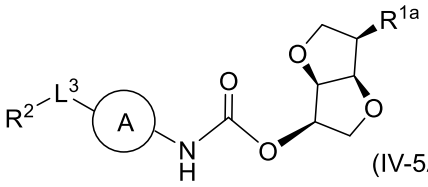
11. The compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to any of claims 1-10, wherein the compound has a structure shown in any of formulas (IV-1) to (IV-4):

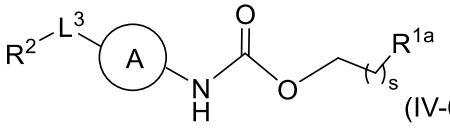
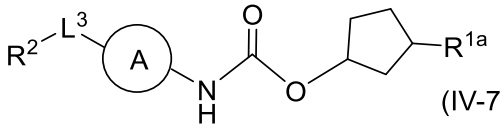

(IV-1) (preferably 
(IV-1A)),

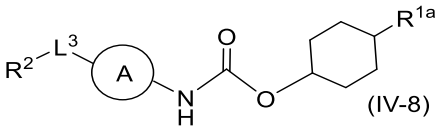
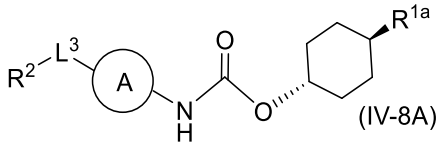

(IV-2), 
(IV-3), or


(IV-4) (preferably 
(IV-4A));

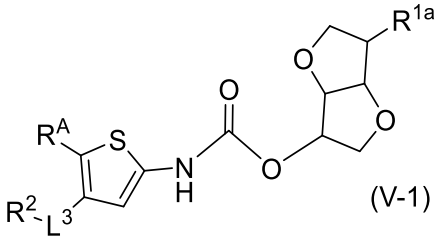
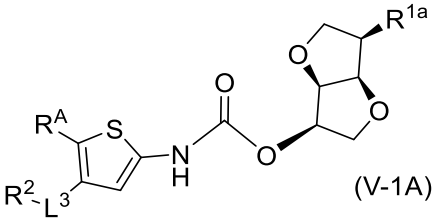
preferably, the compound has a structure shown in any of formulas (IV-5) to (IV-8):

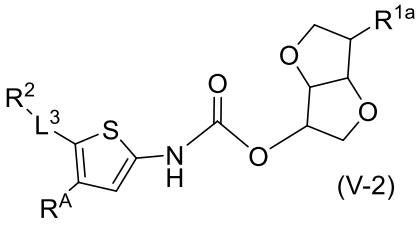
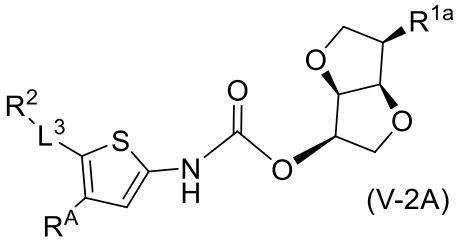

(IV-5) (preferably 
(IV-5A)),

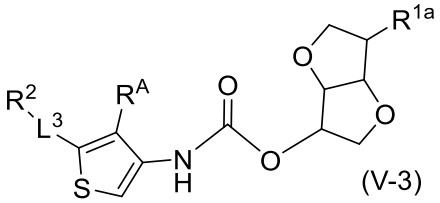
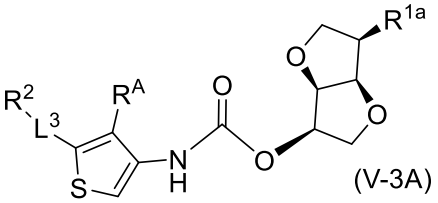

(IV-6), 
(IV-7), or

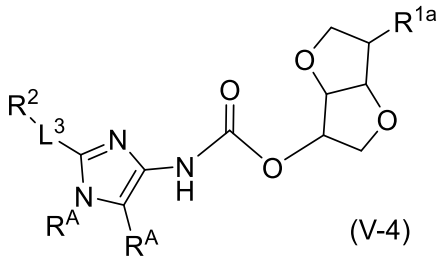
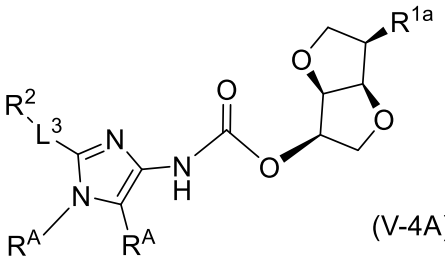

(IV-8) (preferably 
(IV-8A));

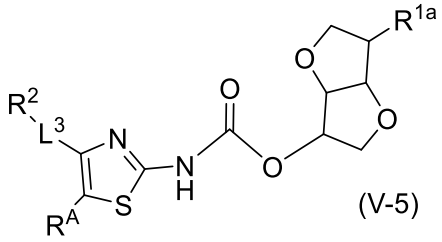
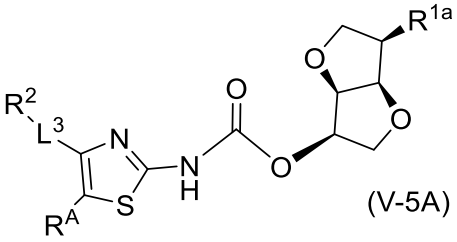
preferably, the compound has a structure shown in any of formulas (V-1) to (V-9):

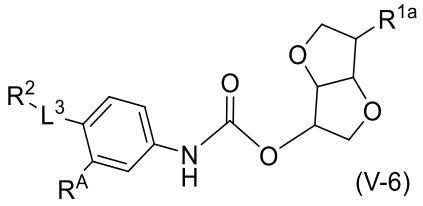
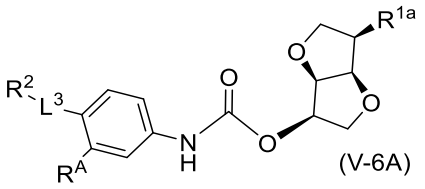

(V-1) (preferably 
(V-1A)),

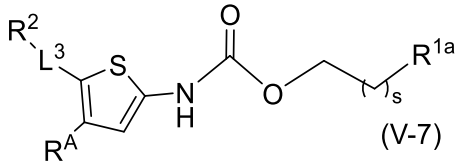
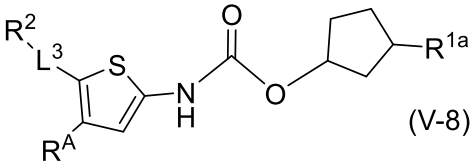

(V-2) (preferably 
(V-2A)),

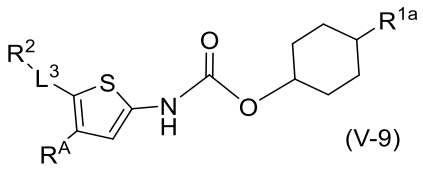
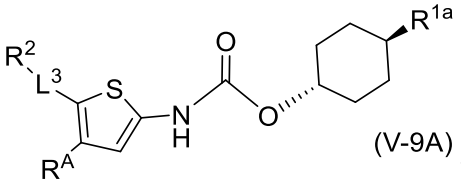

(V-3) (preferably 
(V-3A)),


(V-4) (preferably 
(V-4A)),

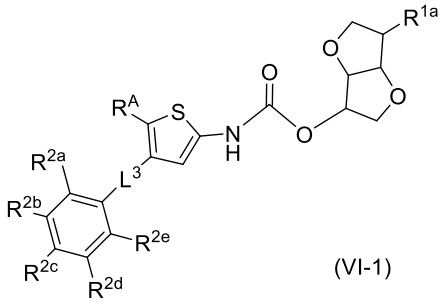
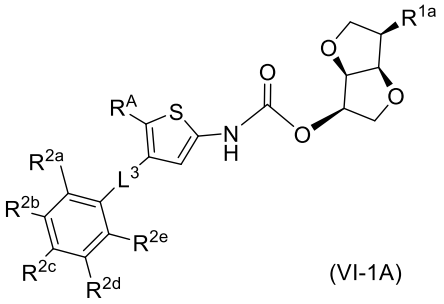

(V-5) (preferably 
(V-5A)),

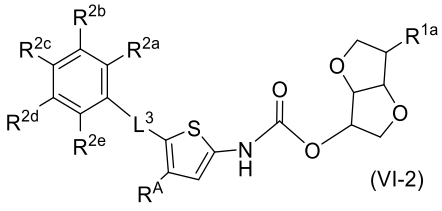
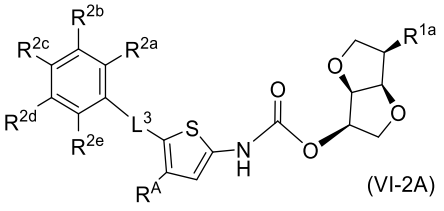

(V-6) (preferably 
(V-6A)),

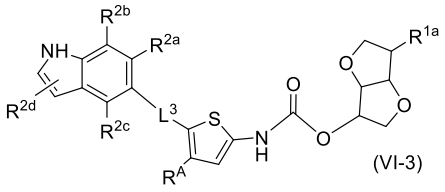
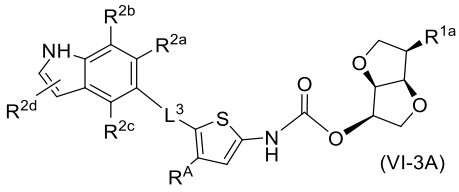

(V-7), 
(V-8), or

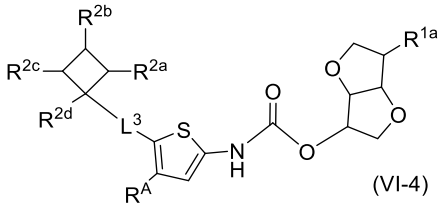
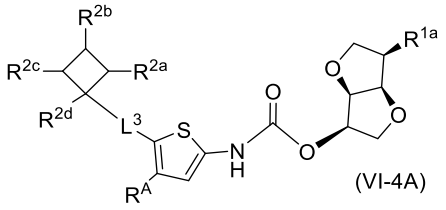

(V-9) (preferably 
(V-9A));

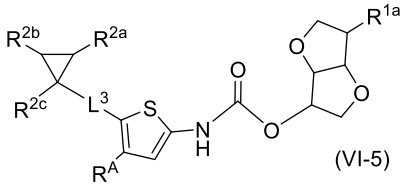
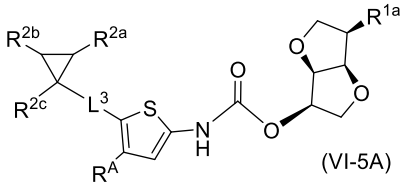
more preferably, the compound has a structure shown in any of formulas (VI-1) to (VI-14):

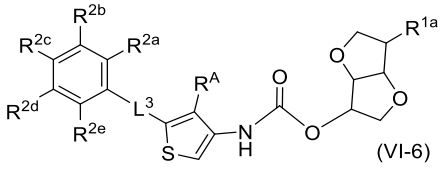
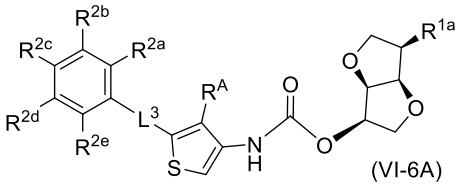

(VI-1) (preferably 
(VI-1A)),

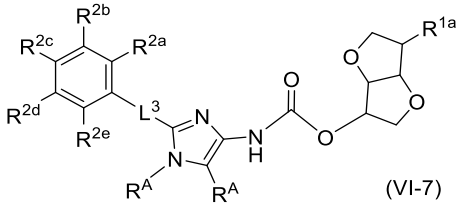
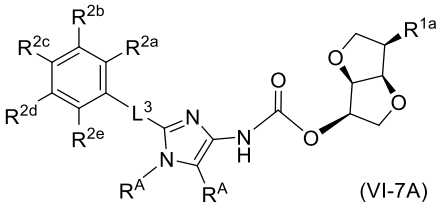

(VI-2) (preferably 
(VI-2A)),

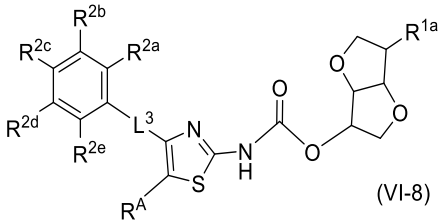
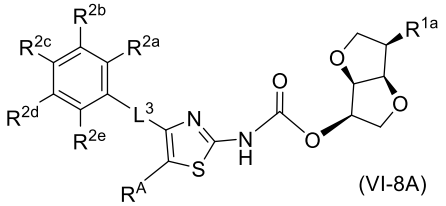

(VI-3) (preferably 
(VI-3A)),

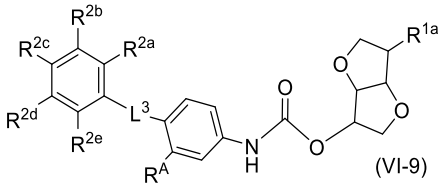
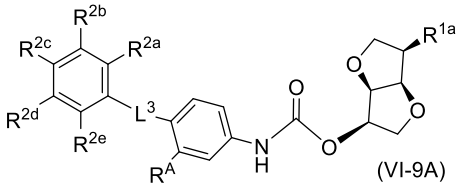

(VI-4) (preferably 
(VI-4A)),

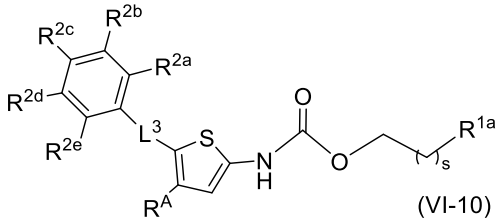
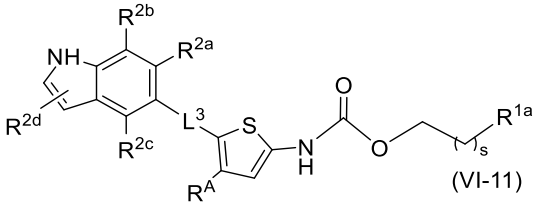

(VI-5) (preferably 
(VI-5A)),


(VI-6) (preferably 
(VI-6A)),


(VI-7) (preferably 
(VI-7A)),


(VI-8) (preferably 
(VI-8A)),


(VI-9) (preferably 
(VI-9A)),


(VI-10), 
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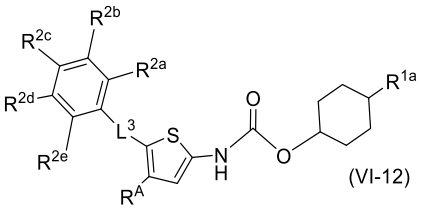
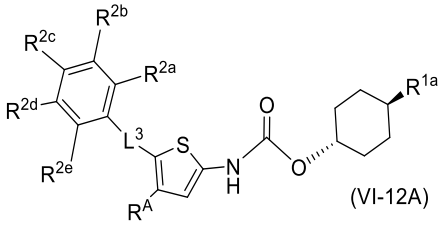
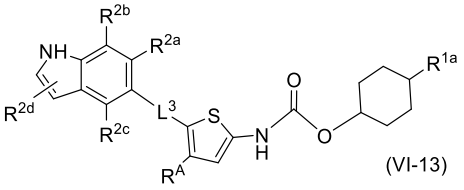
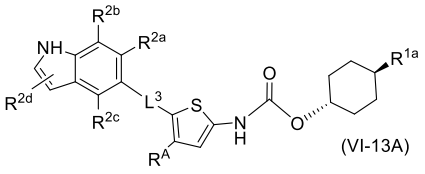
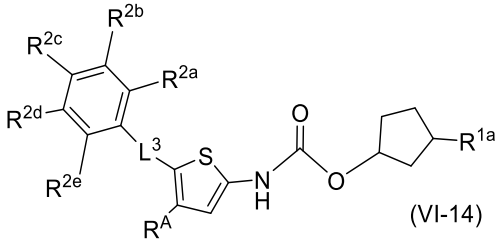
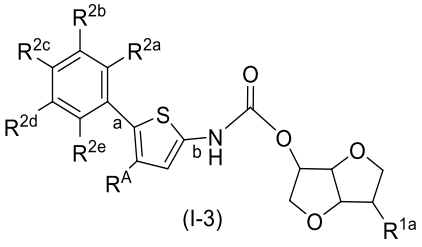
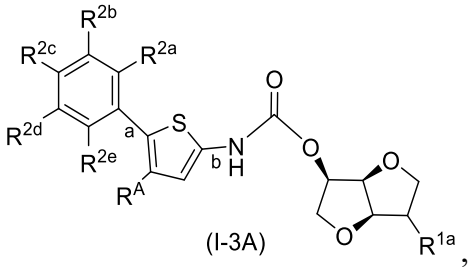

(VI-12) (preferably 
(VI-12A)),


(VI-13) (preferably 
(VI-13A)),


(VI-14)

or .

12. The compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to any of claims 1-11, wherein the compound has a structure shown in any of formulas (I-3) and (X-1) to (X-5):


(I-3) (preferably 
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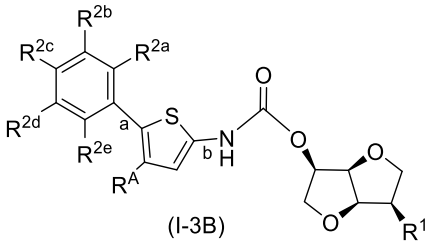
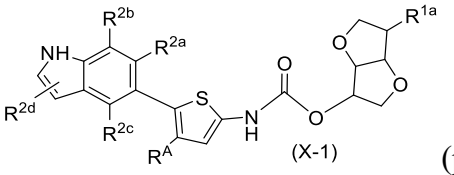
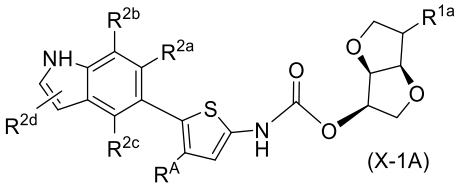

(I-3B)

more preferably),


(X-1) (preferably 
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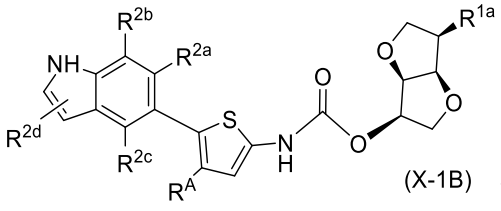
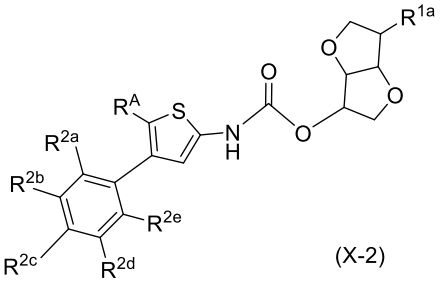
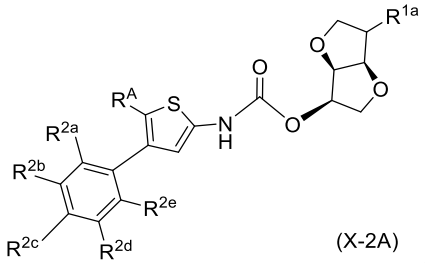
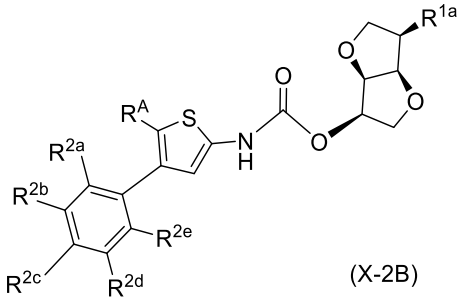
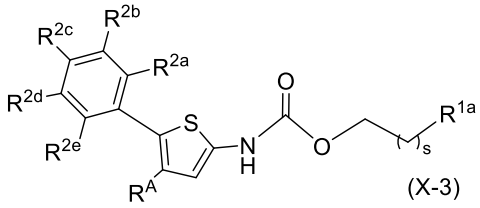
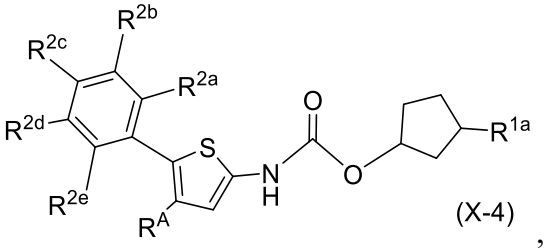
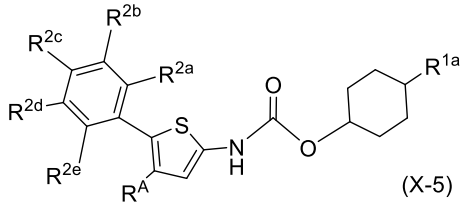
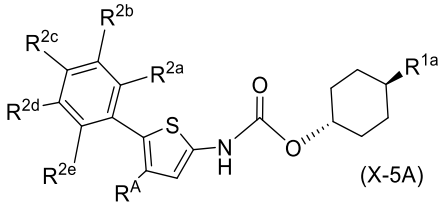
more preferably  (X-1B)),

 (X-2) (preferably  (X-2A) ,

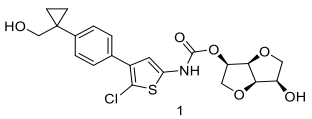
more preferably  (X-2B)),

 (X-3) ,  (X-4) ,

or  (X-5) (preferably

 (X-5A)).

13. The compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to any of claims 1-12, wherein the compound is selected from: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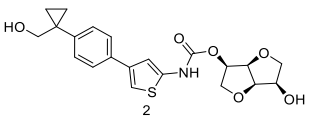
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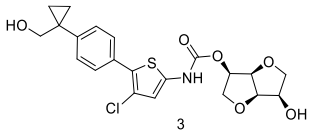
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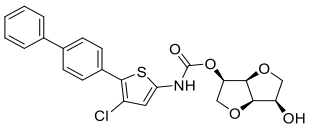
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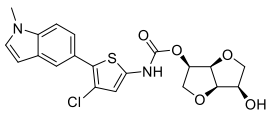
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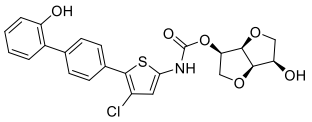
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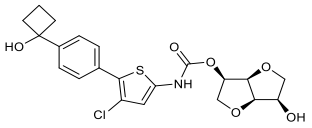
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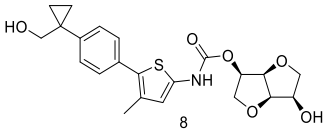
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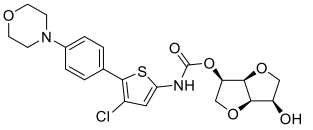
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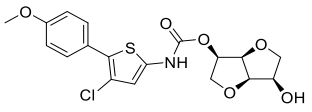
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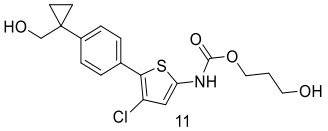
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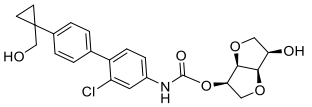
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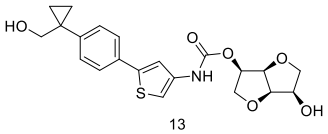
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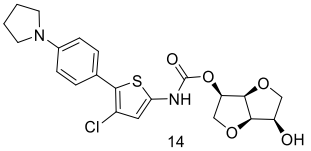
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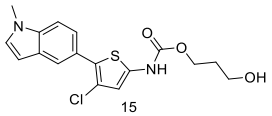
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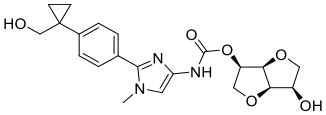
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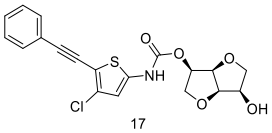
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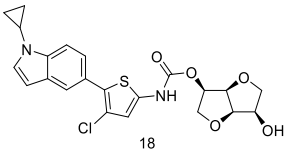
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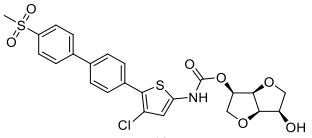
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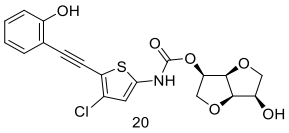
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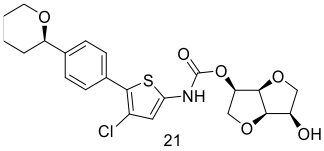
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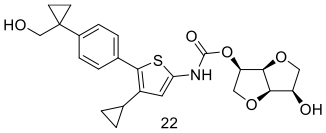
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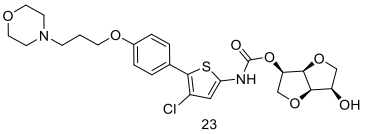
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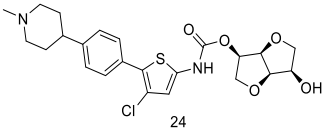
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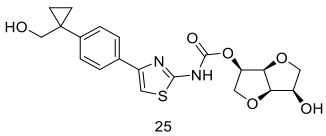
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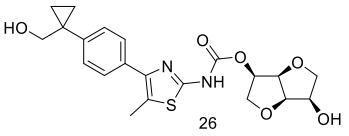
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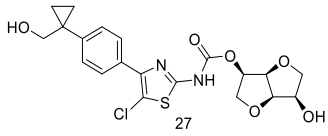
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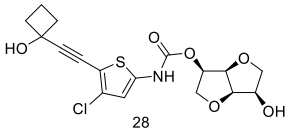
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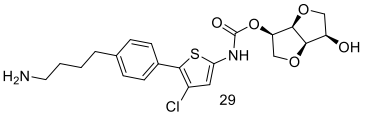
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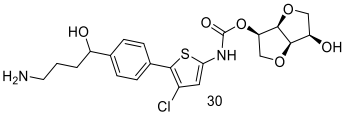
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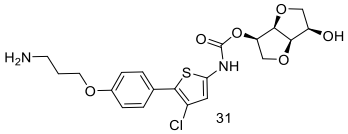
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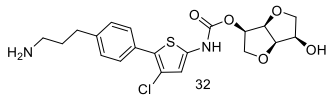
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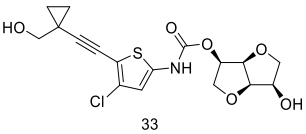
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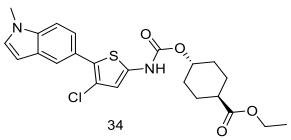
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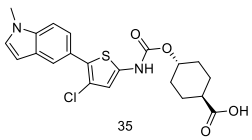
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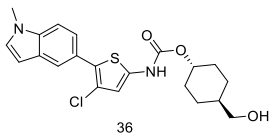
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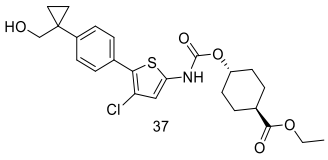
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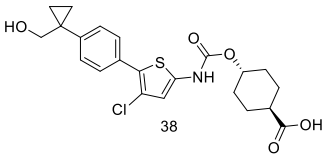
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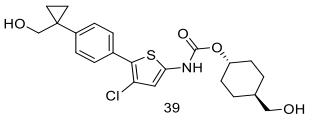
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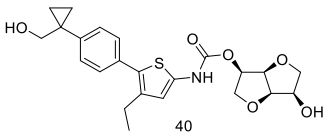
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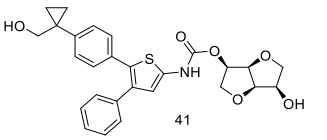
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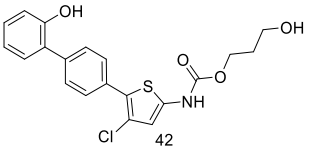
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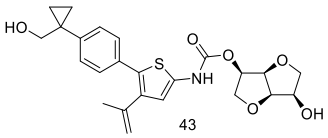
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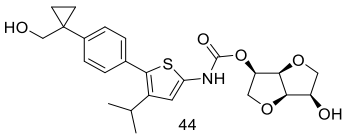
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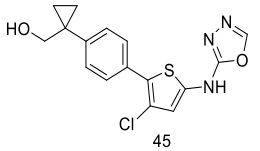
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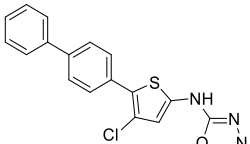
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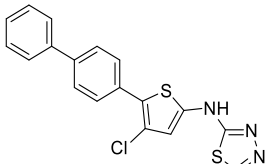
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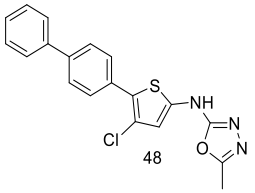
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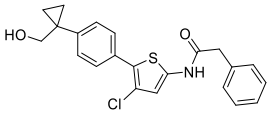
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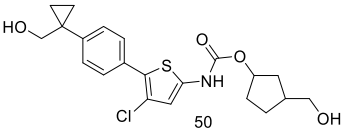
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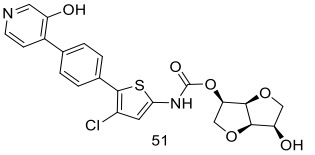
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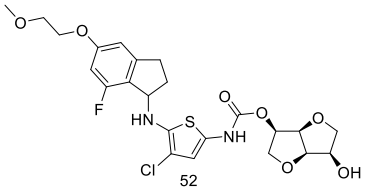
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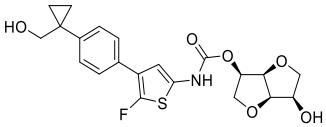
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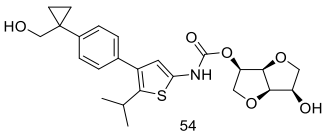
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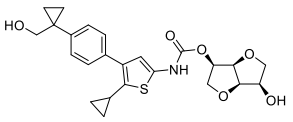
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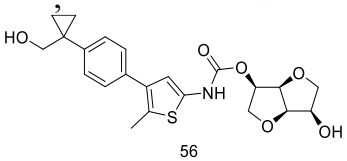
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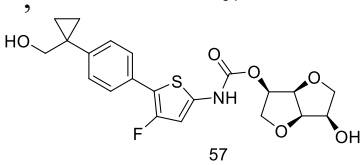
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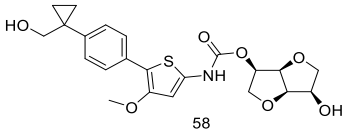
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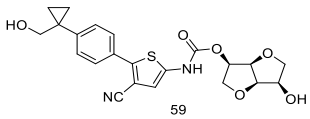
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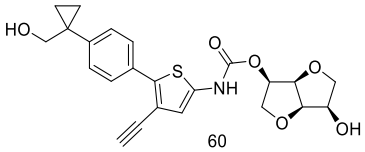
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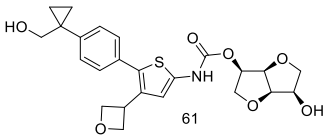
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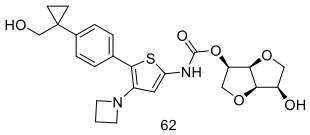
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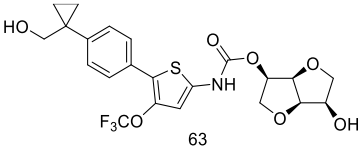
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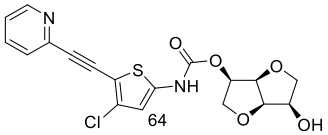
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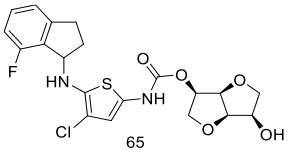
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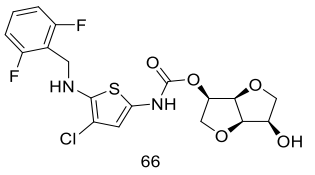
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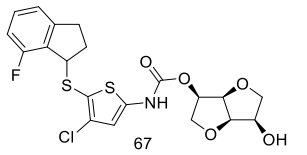
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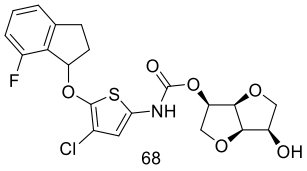
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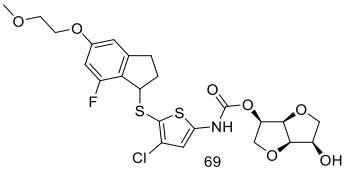
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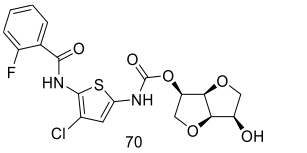
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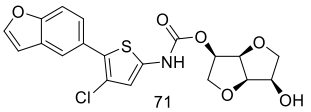
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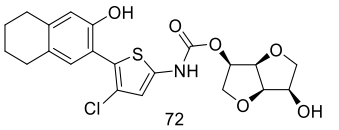
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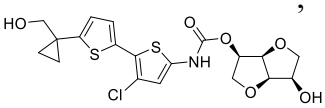
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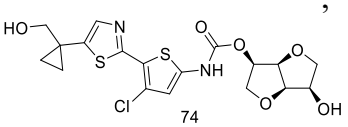
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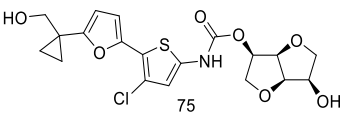
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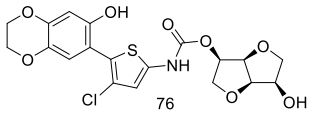
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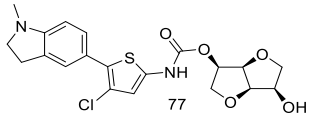
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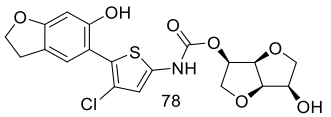
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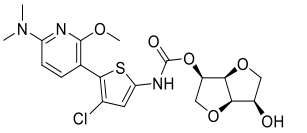
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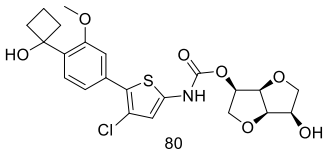
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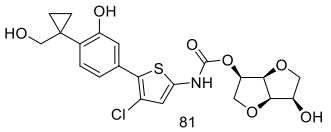
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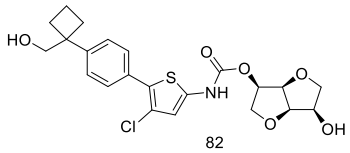
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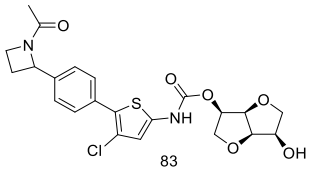
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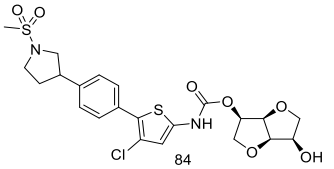
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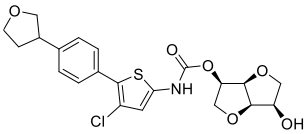
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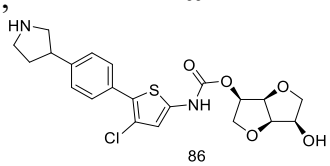
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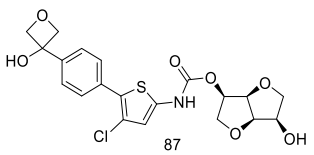
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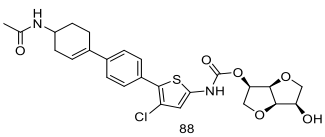
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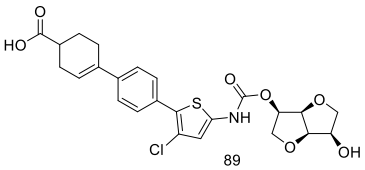
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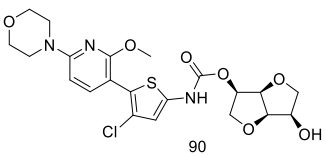
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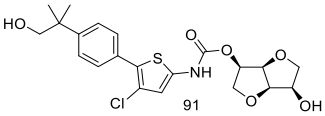
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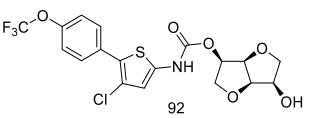
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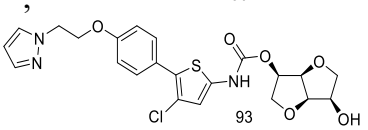
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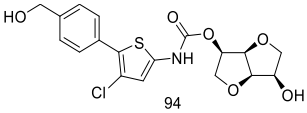
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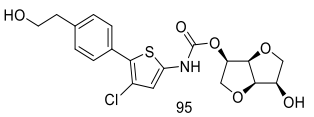
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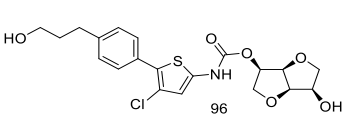
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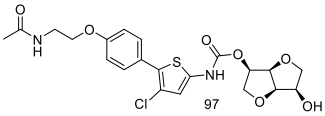
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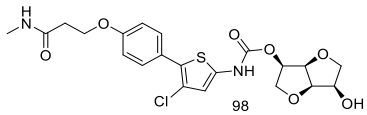
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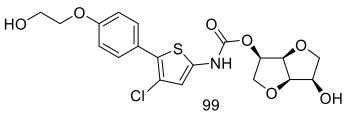
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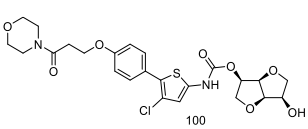
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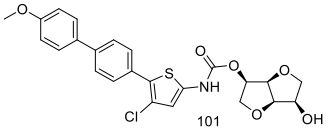
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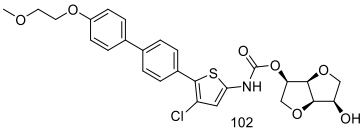
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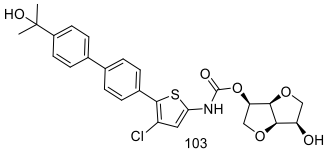
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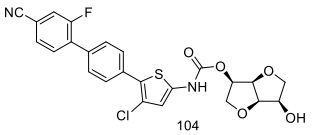
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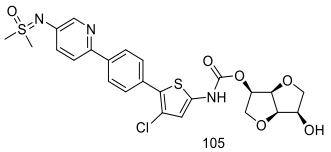
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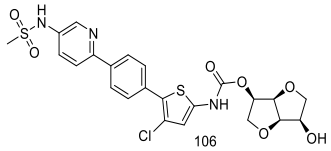
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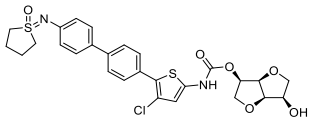
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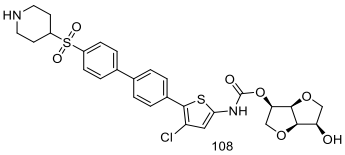
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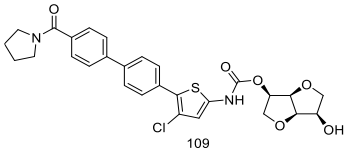
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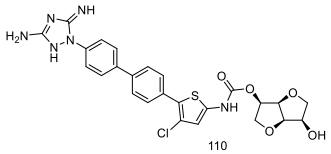
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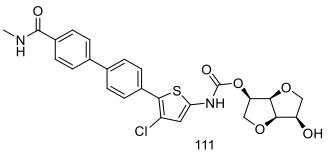
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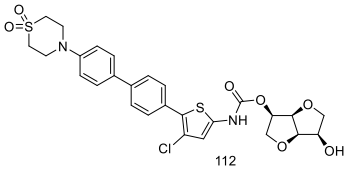
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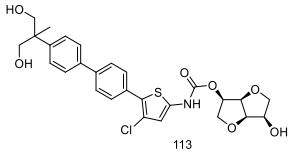
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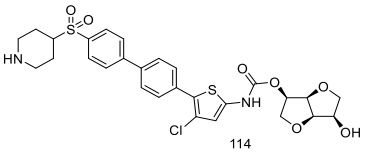
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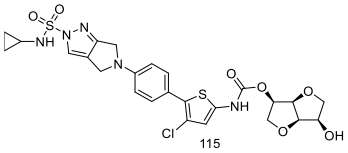
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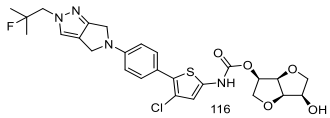
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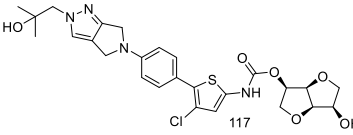
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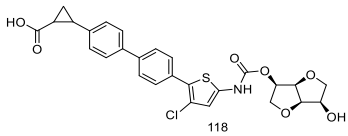
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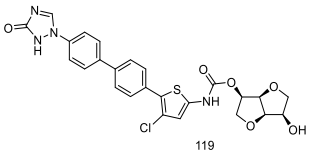
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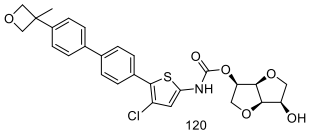
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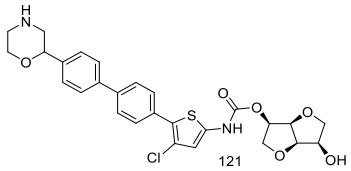
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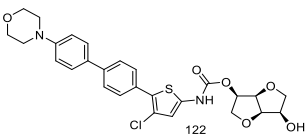
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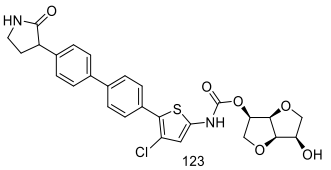
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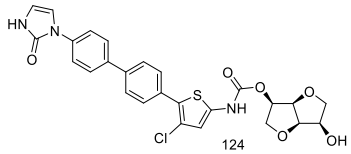
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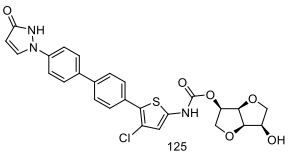
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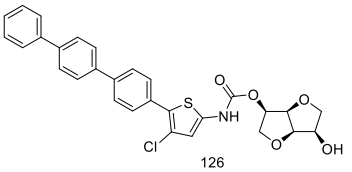
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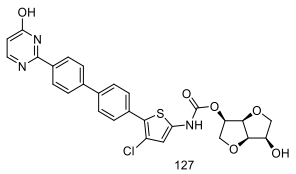
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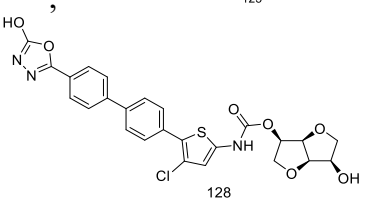
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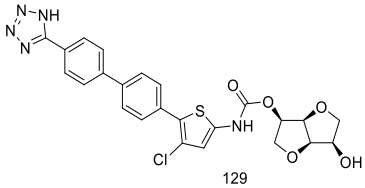
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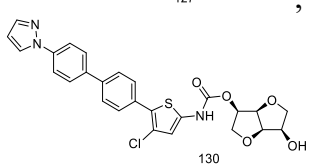
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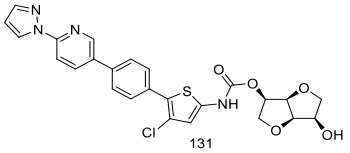
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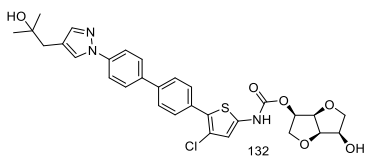
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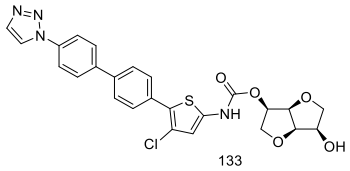
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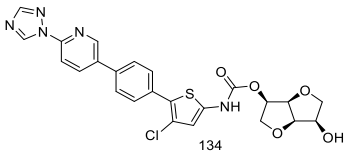
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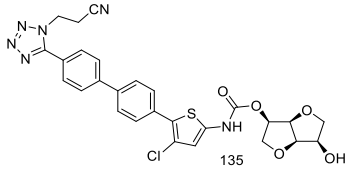
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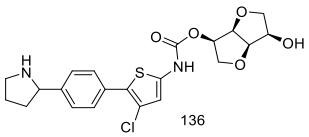
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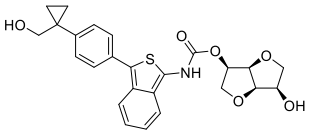
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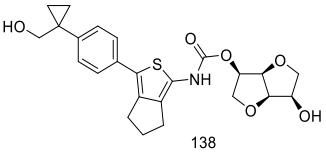
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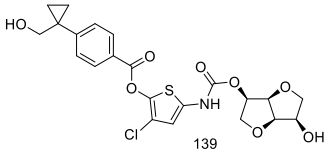
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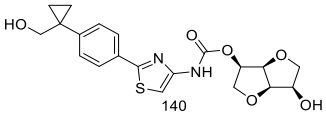
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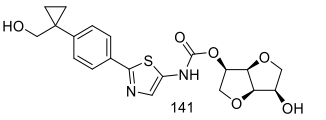
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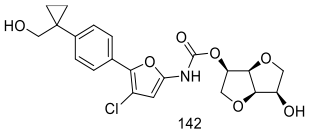
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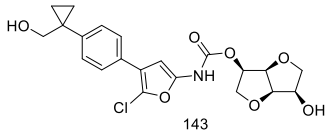
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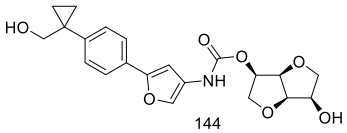
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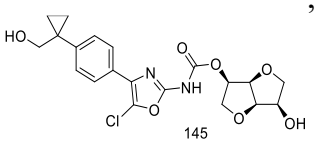
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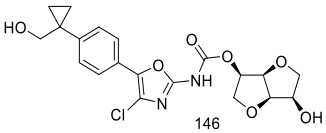
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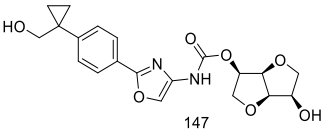
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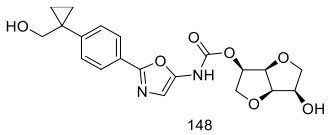
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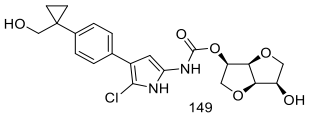
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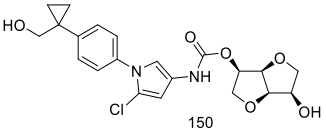
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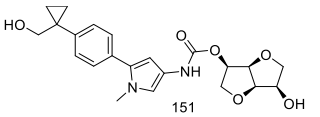
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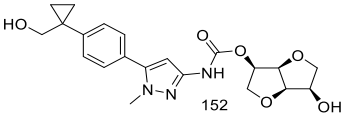
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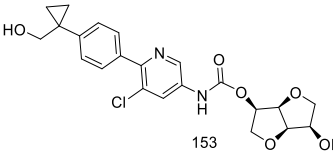
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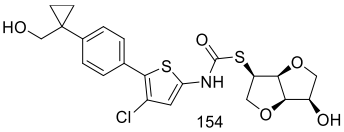
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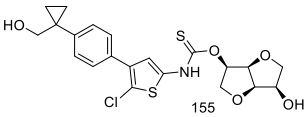
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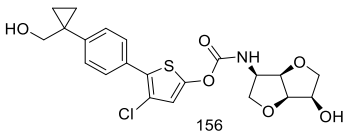
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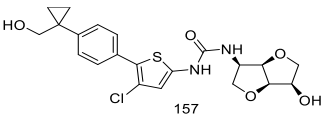
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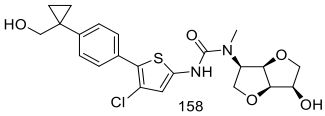
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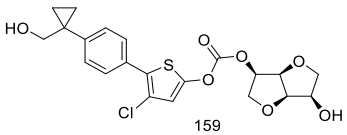
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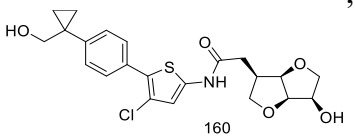
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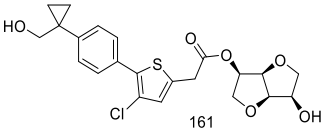
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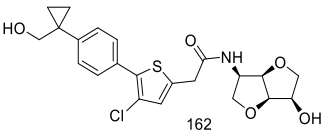
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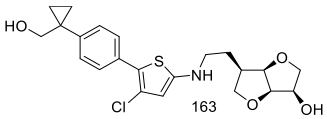
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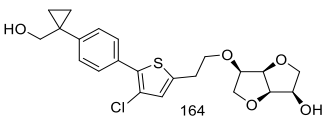
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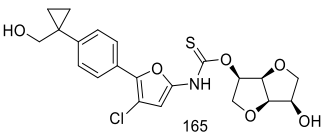
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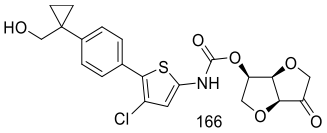
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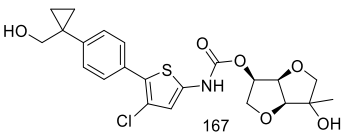
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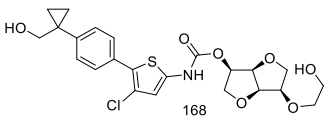
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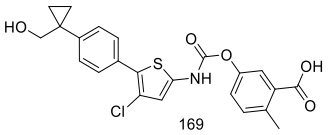
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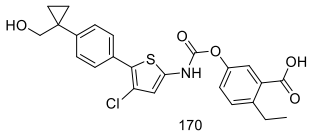
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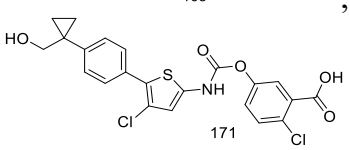
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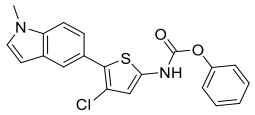
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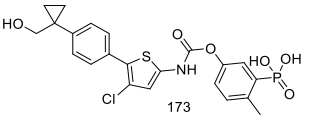
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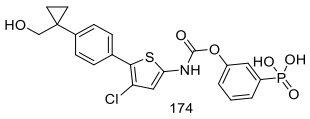
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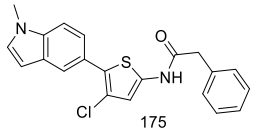
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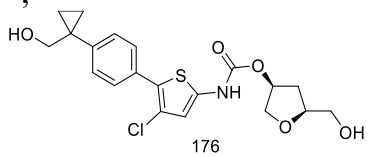
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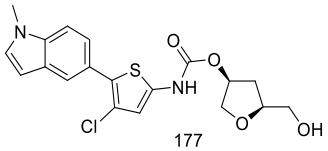
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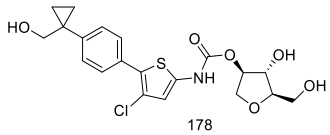
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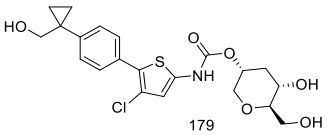
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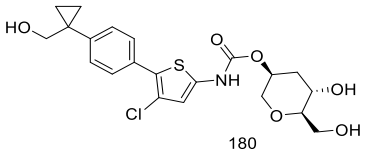
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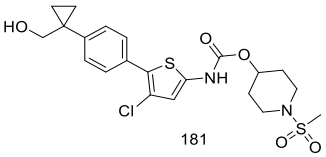
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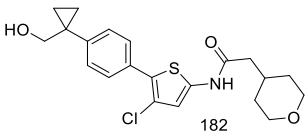
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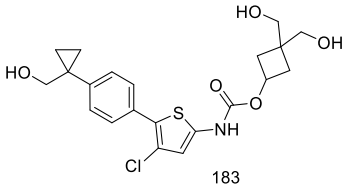
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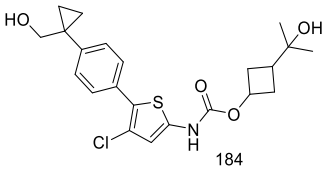
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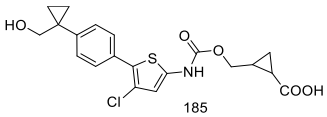
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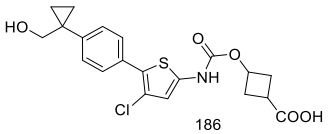
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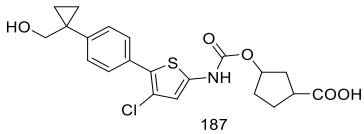
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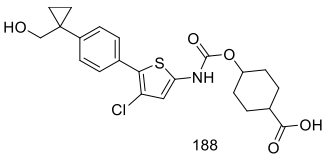
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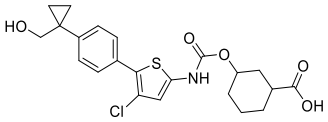
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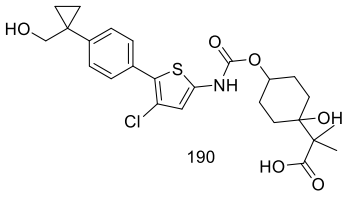
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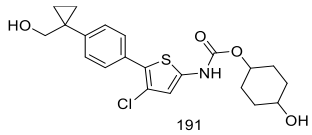
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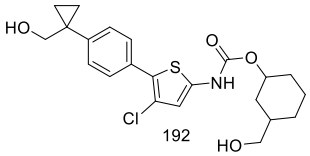
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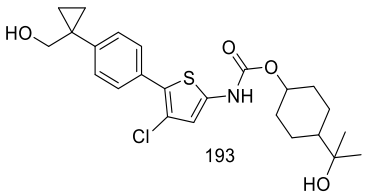
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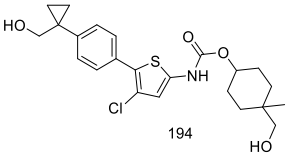
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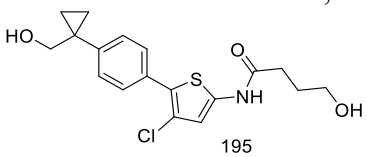
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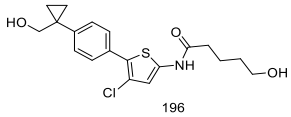
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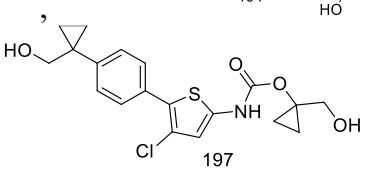
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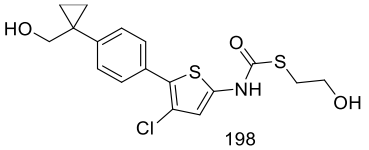
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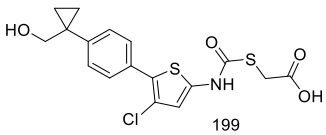
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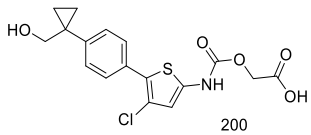
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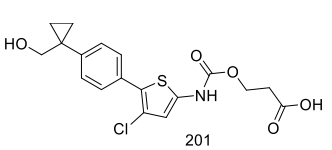

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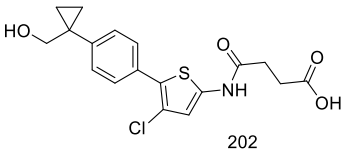

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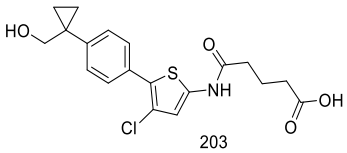

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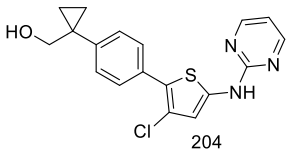

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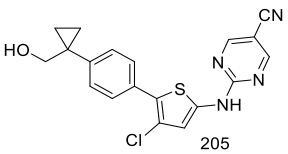

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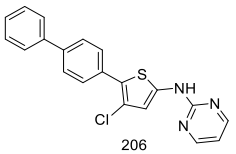

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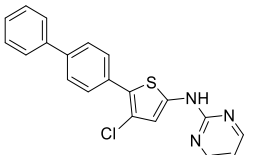

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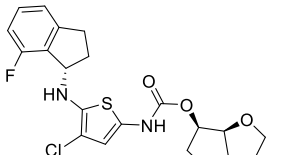

208 .

14. A pharmaceutical composition, wherein comprising the compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to any of claims 1-13, and one or more pharmaceutically acceptable excipients or carriers.

15. Use of the compound, or the stereoisomer, the tautomer, the diastereomer, the racemate, the cis-trans isomer, the isotopically labelled compound (preferably the deuterated compound), the N-oxide, the metabolite, the ester, the prodrug, the crystal form, the hydrate, the solvate or the pharmaceutically acceptable salt thereof according to any of claims 1-13, or the pharmaceutical composition according to claim 14 in the preparation of a medicament for treating and/or preventing a disease, disorder or condition associated with AMPK kinase, wherein the disease, disorder or condition is preferably selected from type II diabetes, dyslipidaemia, obesity, chronic kidney disease, diabetic nephropathy, acute kidney injury, polycystic kidney disease and alopecia.