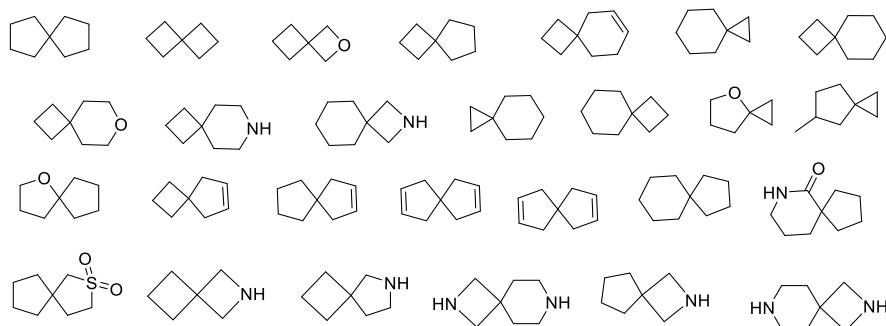


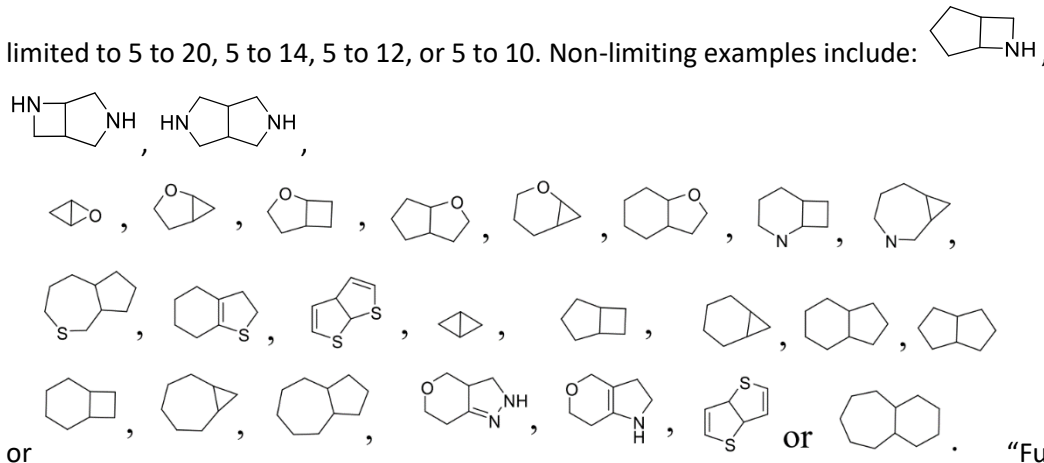


. “Spiro ring” or “spiro

ring group” can be monovalent, divalent, trivalent or tetravalent.

[44] “Fused ring” or “fused ring group” refers to a polycyclic group in which each ring in the system shares an adjacent pair of atoms with other rings in the system, wherein one or more rings may contain 0 or more (including but not limited to 1, 2, 3 or 4) double bonds, and may be substituted or unsubstituted, and each ring in the fused ring system may contain 0 to 5 heteroatoms or groups containing heteroatoms (including but not limited to N, S(=O)_n or O, wherein n is 0, 1 or 2). The number of ring atoms in the fused ring system includes but is not

limited to 5 to 20, 5 to 14, 5 to 12, or 5 to 10. Non-limiting examples include:



. “Fused ring”

or “fused ring group” can be monovalent, divalent, trivalent or tetravalent.

[45] “Bridged ring” or “bridged ring group” refers to a substituted or unsubstituted polycyclic group containing any two atoms that are not directly connected, and may contain 0 or more double bonds. Any ring in the bridged ring system may contain 0 to 5 groups selected from heteroatoms or groups containing heteroatoms (including but not limited to N, S(=O)_n or O, wherein n is 0, 1 or 2). The number of ring atoms includes but is not limited to 5 to 20, 5 to 14, 5 to 12 or 5 to 10. Non-limiting examples include

separation was carried out and the organic phase was dried over anhydrous sodium sulfate and concentrated under reduced pressure. The crude was separated and purified by silica gel column chromatography (ethyl acetate /petroleum ether (v/v) = 1:20) to obtain 6b (1.40 g, yield 21%).

[149] LCMS m/z = 270.0 $[M+1]^+$.

Step 2: **Preparation of 6c**

[150] Under nitrogen protection, 6b (1.3 g, 4.81 mmol), 1A (3.01 g, 7.21 mmol), 1,4-dioxane (60 mL), water (20 mL), Pd(dppf)Cl₂.DCM (0.39 g, 0.48 mmol) and cesium carbonate (4.70 g, 14.43 mmol) were sequentially added to a 50 mL single-necked flask, and the mixture was subjected to nitrogen replacement three times, and reacted at 100°C for 12 h. The reaction liquid was cooled to room temperature and poured into 30 mL of water. The mixture was extracted with 200 mL of ethyl acetate three times, and the organic phases were combined, dried over anhydrous sodium sulfate, and concentrated under reduced pressure. The crude was separated and purified by silica gel column chromatography (ethyl acetate /petroleum ether (v/v) = 1:5) to obtain 6c (1.5 g, yield 65%).

[151] LCMS m/z = 481.1 $[M+1]^+$.

Step 3: **Preparation of 6d**

[152] 6c (1.5 g, 3.12 mmol), 10% palladium on carbon (0.8 g), and 10% palladium hydroxide on carbon (1.0 g) were dissolved in 30 mL of tetrahydrofuran and 30 mL of methanol. The mixture was subjected to hydrogen replacement three times, and reacted at 30°C under the atmosphere of hydrogen (balloon) for 16 h. The reaction liquid was cooled to room temperature and filtered with celite. The filter cake was washed with 50 mL of methanol three times, and the organic phases were combined, dried over anhydrous sodium sulfate, and concentrated under reduced pressure to obtain the crude 6d (800 mg).

[153] LCMS m/z = 273.2 $[M+1]^+$.

Step 4: **Preparation of 6e**

[154] The above-mentioned crude 6d (400 mg), KI (0.37 g, 2.23 mmol), CuI (0.406 g, 2.13 mmol) and iodine (560 mg, 2.21 mmol) were dissolved in acetonitrile (5 mL), and cooled to 0°C. Isoamyl nitrite (260 mg, 2.21 mmol) was slowly added. The mixture was reacted at 30°C for 6 h under nitrogen protection. To the reaction liquid was added 10 mL of saturated ammonium chloride solution, and the mixture was extracted with 50 mL of dichloromethane. Liquid separation was carried out and the organic phase was dried over anhydrous sodium sulfate and

separated and purified by silica gel column chromatography (ethyl acetate /petroleum ether (v/v) = 1:10) to obtain 7c (1.6 g, yield 59%).

[167] LCMS m/z = 470.2 $[M+1]^+$.

Step 3: Preparation of 7d

[168] 7c (1.6 g, 3.41 mmol), 10% palladium on carbon (0.8 g), and 10% palladium hydroxide on carbon (1.0 g) were dissolved in 30 mL of tetrahydrofuran and 30 mL of methanol. The mixture was subjected to hydrogen replacement three times, and reacted at 30°C under the atmosphere of hydrogen (balloon) for 16 h. The reaction liquid was cooled to room temperature, and 50 mL of dichloromethane was added. The mixture was stirred for 5 min and filtered with celite. The filter cake was washed with 50 mL of methanol three times, and the organic phases were combined, dried over anhydrous sodium sulfate, and concentrated under reduced pressure to obtain the crude 7d (850 mg).

[169] LCMS m/z = 262.1 $[M+1]^+$.

Step 4: Preparation of 7e

[170] The above-mentioned crude 7d (380 mg), KI (0.37 g, 2.23 mmol), CuI (0.406 g, 2.13 mmol) and iodine (560 mg, 2.21 mmol) were dissolved in acetonitrile (5 mL), and cooled to 0°C. Isoamyl nitrite (260 mg, 2.21 mmol) was slowly added. The mixture was reacted at 30°C for 6 h under nitrogen protection. To the reaction liquid was added 10 mL of saturated ammonium chloride solution, and the mixture was extracted with 50 mL of dichloromethane. Liquid separation was carried out and the organic phase was dried over anhydrous sodium sulfate and concentrated under reduced pressure. The crude was separated and purified by silica gel column chromatography (petroleum ether /ethyl acetate (v/v) =2:1-1:1) to obtain 7e (220 mg, two-step yield from 7c: 39%).

Step 5: Preparation of 7f

[171] 7e (100 mg, 0.27 mmol), tert-butyl 4-(prop-2-yn-1-yloxy)piperidine-1-carboxylate (78 mg, 0.326 mmol), CuI (10 mg, 0.0525 mmol), $\text{PdCl}_2(\text{PPh}_3)_2$ (20 mg, 0.0285 mmol) and triethylamine (0.14 g, 1.38 mmol) were dissolved in DMF (5 mL), the mixture was subjected to nitrogen replacement three times, and the mixture was reacted at 60°C for 6 h. The reaction solution was cooled to room temperature, 5 mL of water was added, and the mixture was extracted with 50 mL of dichloromethane. Liquid separation was carried out, and the organic phase was concentrated under reduced pressure. The crude was separated and purified by silica

Claims

1. A compound or a stereoisomer, deuterated compound, solvate, prodrug, metabolite, pharmaceutically acceptable salt or eutectic crystal thereof, wherein the compound is a compound represented by general formula (I),

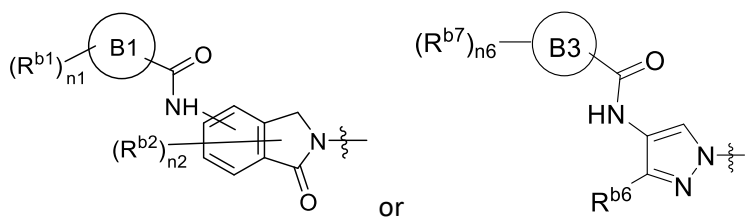
B-L-K (I);

L is selected from -Ak1-Cy1-Ak2-Cy2-Ak3-Cy3-Ak4-Cy4-Ak5-;

Ak1, Ak2, Ak3, Ak4 and Ak5 are each independently selected from $-(CH_2)_q-$, O, $-(CH_2)_qNR^L$, $NR^LC=O$, $C=ONR^L$, $C=O$, $-R^LC=CR^L-$, $C\equiv C$ or a bond;

R^L is selected from H or C_{1-6} alkyl;

Cy1, Cy2, Cy3 and Cy4 are each independently selected from a bond, 4- to 7-membered mono-heterocyclic ring, 4- to 10-membered fused-heterocyclic ring, 5- to 12-membered spiro-heterocyclic ring, 7- to 10-membered bridged-heterocyclic ring, 3- to 7-membered monocycloalkyl, 4- to 10-membered fused cycloalkyl, 5- to 12-membered spiro cycloalkyl, 7- to 10-membered bridged cycloalkyl, 5- to 10-membered heteroaryl or 6- to 10-membered aryl, wherein the aryl, heteroaryl, cycloalkyl, mono-heterocyclic ring, fused-heterocyclic ring, spiro-heterocyclic ring or bridged-heterocyclic ring is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, $C(=O)OH$, CN, NH_2 , $=O$, C_{1-4} alkyl, halogen-substituted C_{1-4} alkyl, hydroxyl-substituted C_{1-4} alkyl or C_{1-4} alkoxy, and the heteroaryl, mono-heterocyclic ring, fused-heterocyclic ring, spiro-heterocyclic ring or bridged-heterocyclic ring contains 1 to 4 heteroatoms selected from O, S, or N;



B is selected from

B1 and B3 are each independently selected from C_{6-10} aryl, 5- to 10-membered heteroaryl or 4- to 10-membered heterocyclyl, wherein the heteroaryl or heterocyclyl contains 1 to 4 heteroatoms selected from O, S or N;

R^{b1} and R^{b7} are each independently selected from H, F, Cl, Br, I, $=O$, OH, NH_2 , CN, CF_3 , $C(=O)OH$, CHF_2 , C_{1-4} alkyl, C_{1-4} alkoxy, C_{3-6} cycloalkyl, $-(CH_2)_n-R^{b21}$, $-OR^{b21}$, $-N(R^{b21})_2$, C_{6-10} aryl, 5- to 10-membered heteroaryl or 4- to 10-membered heterocyclyl, wherein the alkyl, alkoxy, cycloalkyl, heterocyclyl, aryl or heteroaryl is optionally further substituted with 0 to 4 substituents selected

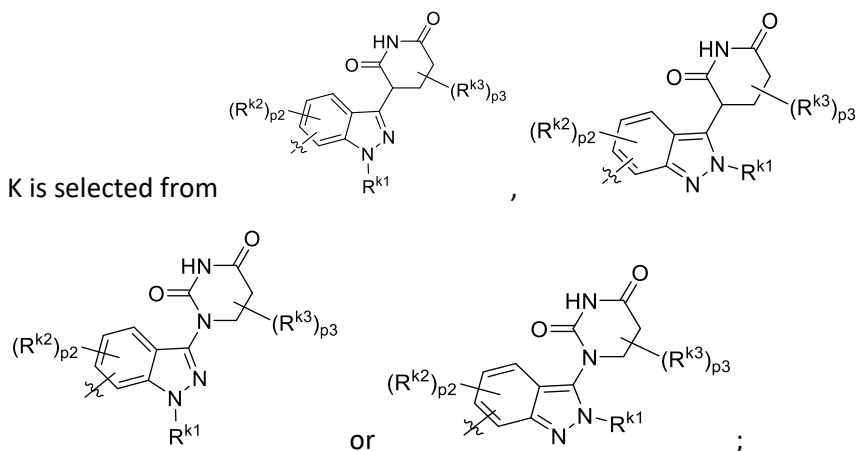
from H, F, Cl, Br, I, OH, =O, -N(R^{b21})₂, CN, CF₃, C(=O)OH, C₁₋₄ alkyl, C₁₋₄ alkoxy, C₃₋₆ cycloalkyl, 5- to 10-membered heteroaryl, 4- to 10-membered heterocyclyl or R^{b7a}, and the heteroaryl or heterocyclyl contains 1 to 4 heteroatoms selected from O, S, or N;

R^{b7a} is selected from C₁₋₄ alkyl, -C₃₋₆ cycloalkyl, 4- to 10-membered heterocyclyl, -C₁₋₄ alkylene -C₃₋₆ cycloalkyl, -C₁₋₄ alkylene 4- to 10-membered heterocyclyl, -O-C₃₋₆ cycloalkyl, -O-4- to 10-membered heterocyclyl, -NH-C₃₋₆ cycloalkyl, -NH-4- to 10-membered heterocyclyl, -N(C₁₋₄ alkyl)-C₃₋₆ cycloalkyl or -N(C₁₋₄ alkyl)-4- to 10-membered heterocyclyl, wherein the R^{b7a} is optionally substituted with 1 to 4 substituents selected from H, F, Cl, Br, I, OH, =O, -N(R^{b21})₂, CN, CF₃, C(=O)OH, C₁₋₄ alkyl, C₁₋₄ alkoxy, C₃₋₆ cycloalkyl or 4- to 10-membered heterocyclyl, and the heterocyclyl contains 1 to 4 heteroatoms selected from O, S, or N;

R^{b2} and R^{b6} are each independently selected from H, F, Cl, Br, I, =O, OH, -C(=O)N(R^{b21})₂, -N(R^{b21})₂, CN, CF₃, C(=O)OH, CHF₂, C₁₋₄ alkyl, C₁₋₄ alkoxy, C₃₋₆ cycloalkyl, -(CH₂)_n-R^{b21}, -OR^{b21}, C₆₋₁₀ aryl, 5- to 10-membered heteroaryl or 4- to 10-membered heterocyclyl, wherein the alkyl, alkoxy, cycloalkyl, aryl, heteroaryl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, =O, NH₂, CN, CF₃, C(=O)OH, C₁₋₄ alkyl, C₁₋₄ alkoxy, C₃₋₆ cycloalkyl, 5- to 10-membered heteroaryl or 4- to 10-membered heterocyclyl, and the heteroaryl or heterocyclyl contains 1 to 4 heteroatoms selected from O, S, or N;

each R^{b21} is independently selected from H, C₁₋₆ alkyl, C₁₋₄ alkoxy, C₃₋₆ cycloalkyl, C₆₋₁₀ aryl, 5- to 10-membered heteroaryl or 4- to 10-membered heterocyclyl, wherein the alkyl, alkoxy, cycloalkyl, aryl, heteroaryl or heterocyclyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, =O, NH₂, CN, CF₃, C(=O)OH, C₁₋₄ alkyl, C₃₋₆ cycloalkyl or C₁₋₄ alkoxy, and the heteroaryl or heterocyclyl contains 1 to 4 heteroatoms selected from O, S, or N;

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



each R^{k1} is independently selected from H, C_{1-4} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl or 3- to 6-membered heterocycloalkyl, wherein the alkyl, cycloalkyl or heterocycloalkyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, NH_2 , CN, CF_3 , C_{1-6} alkyl, C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl or C_{3-6} cycloalkyl;

R^{k2} and R^{k3} are each independently selected from H, F, Cl, Br, I, OH, =O, NH_2 , CF_3 , CN, $C(=O)OH$, $C(=O)NH_2$, C_{1-4} alkyl or C_{1-4} alkoxy, wherein the alkyl or alkoxy is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, or NH_2 ;

or two R^{k3} together with the carbon atoms or ring backbones to which they are directly attached form 3- to 6-membered carbocycle or 3- to 7-membered heterocycle, wherein the carbocycle or heterocycle is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, =O, NH_2 , CN, $C(=O)OH$, $C(=O)NH_2$, C_{1-4} alkyl or C_{1-4} alkoxy, and the heterocycle contains 1 to 4 heteroatoms selected from O, S or N;

q is selected from 0, 1, 2, 3 or 4;

n_1 , n_2 and n_6 are each independently selected from 0, 1, 2 or 3;

p_2 and p_3 are each independently selected from 0, 1, 2, 3 or 4;

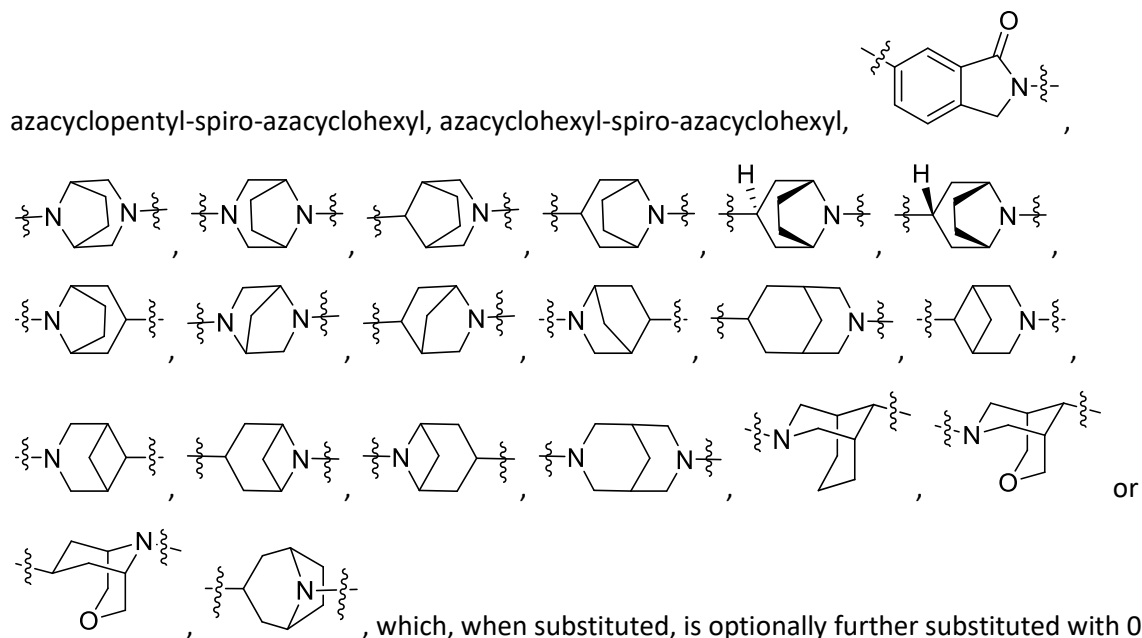
optionally, 0 to 50 H of the compound represented by general formula (I) are replaced by 0 to 50 D.

- The compound or the stereoisomer, deuterated compound, solvate, prodrug, metabolite, pharmaceutically acceptable salt or eutectic crystal thereof according to claim 1, wherein Cy_1 , Cy_2 , Cy_3 and Cy_4 are each independently selected from a bond, 4- to 7-membered nitrogen-containing mono-heterocyclic ring, 4- to 10-membered nitrogen-containing fused-heterocyclic ring, 5- to 12-membered nitrogen-containing spiro-heterocyclic ring, 7- to 10-membered nitrogen-containing bridged-heterocyclic ring, 3- to 7-membered monocycloalkyl, 4-

to 10-membered fused cycloalkyl, 5- to 12-membered spiro cycloalkyl, 7- to 10-membered bridged cycloalkyl, 5- to 10-membered heteroaryl or 6- to 10-membered aryl, wherein the mono-heterocyclic ring, fused-heterocyclic ring, bridged-heterocyclic ring, spiro-heterocyclic ring, cycloalkyl, aryl or heteroaryl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, C(=O)OH, CN, NH₂, =O, C₁₋₄ alkyl, halogen-substituted C₁₋₄ alkyl, hydroxyl-substituted C₁₋₄ alkyl or C₁₋₄ alkoxy, and the mono-heterocyclic ring, fused-heterocyclic ring, bridged-heterocyclic ring, spiro-heterocyclic ring or heteroaryl contains 1 to 4 heteroatoms selected from O, S, or N.

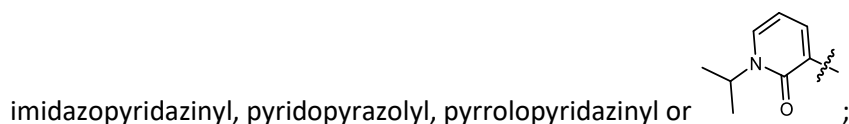
3. The compound or the stereoisomer, deuterated compound, solvate, prodrug, metabolite, pharmaceutically acceptable salt or eutectic crystal thereof according to claim 2, wherein R¹ is selected from H, methyl or ethyl;

Cy1, Cy2, Cy3 and Cy4 are each independently selected from a bond or one of the following substituted or unsubstituted groups: cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, azetidiny, azacyclopentyl, piperidyl, morpholinyl, piperazinyl, phenyl, cyclopropyl-fused-cyclopropyl, cyclopropyl-fused-cyclobutyl, cyclopropyl-fused-cyclopentyl, cyclopropyl-fused-cyclohexyl, cyclobutyl-fused-cyclobutyl, cyclobutyl-fused-cyclopentyl, cyclobutyl-fused-cyclohexyl, cyclopentyl-fused-cyclopentyl, cyclopentyl-fused-cyclohexyl, cyclohexyl-fused-cyclohexyl, cyclopropyl-spiro-cyclopropyl, cyclopropyl-spiro-cyclobutyl, cyclopropyl-spiro-cyclopentyl, cyclopropyl-spiro-cyclohexyl, cyclobutyl-spiro-cyclobutyl, cyclobutyl-spiro-cyclopentyl, cyclobutyl-spiro-cyclohexyl, cyclopentyl-spiro-cyclopentyl, cyclopentyl-spiro-cyclohexyl, cyclohexyl-spiro-cyclohexyl, cyclopropyl-fused-azetidiny, cyclopropyl-fused-azacyclopentyl, cyclopropyl-fused-azacyclohexyl, cyclobutyl-fused-azetidiny, cyclobutyl-fused-azacyclopentyl, cyclobutyl-fused-azacyclohexyl, cyclopentyl-fused-azetidiny, cyclopentyl-fused-azacyclopentyl, cyclopentyl-fused-azacyclohexyl, cyclohexyl-fused-azetidiny, cyclohexyl-fused-azacyclopentyl, cyclohexyl-fused-azacyclohexyl, azetidiny-fused-azetidiny, azetidiny-fused-azacyclopentyl, azetidiny-fused-azacyclohexyl, azacyclopentyl-fused-azacyclopentyl, azacyclopentyl-fused-azacyclohexyl, azacyclohexyl-fused-azacyclohexyl, cyclobutyl-spiro-azetidiny, cyclobutyl-spiro-azacyclopentyl, cyclobutyl-spiro-azacyclohexyl, cyclopentyl-spiro-azetidiny, cyclopentyl-spiro-azacyclopentyl, cyclopentyl-spiro-azacyclohexyl, cyclohexyl-spiro-azetidiny, cyclohexyl-spiro-azacyclopentyl, cyclohexyl-spiro-azacyclohexyl, azetidiny-spiro-azetidiny, azetidiny-spiro-azacyclopentyl, azetidiny-spiro-azacyclohexyl, azacyclopentyl-spiro-azacyclopentyl,

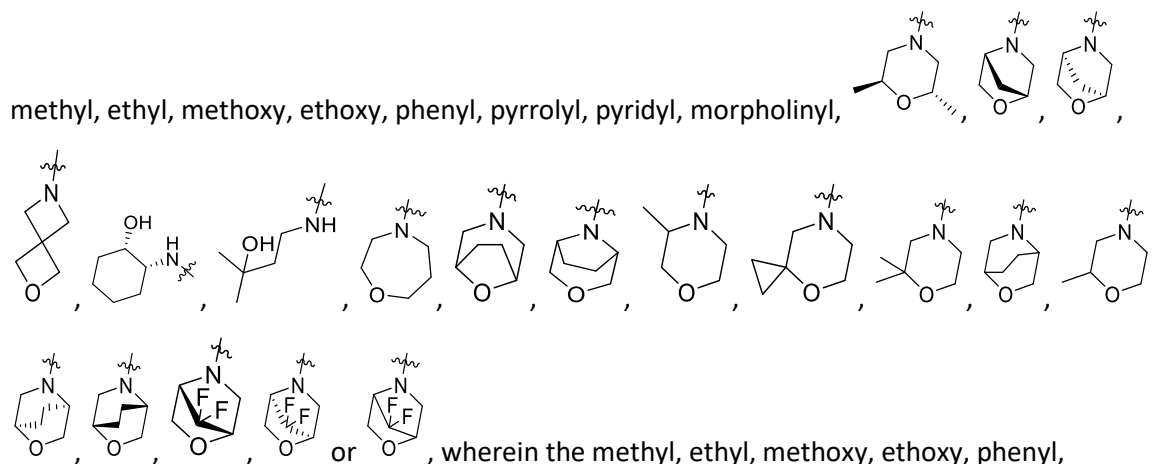


to 4 substituents selected from H, F, Cl, Br, I, OH, NH₂, C(=O)OH, CN, =O, C₁₋₄ alkyl, halogen-substituted C₁₋₄ alkyl, hydroxyl-substituted C₁₋₄ alkyl or C₁₋₄ alkoxy;

B1 and B3 are each independently selected from pyrazolyl, oxazolyl, dioxazolyl, oxadiazolyl, triazolyl, imidazolyl, tetrazolyl, pyrrolyl, thienyl, thiazolyl, thiadiazolyl, pyridyl, phenyl, pyrazinyl, pyrimidyl, pyridazinyl, thienopyrazinyl, benzimidazolyl, pyridotriazolyl, pyrimidopyrazolyl,



R^{b1} and R^{b7} are each independently selected from H, F, Cl, Br, I, =O, OH, NH₂, CN, CF₃, CHF₂, CH₂F,

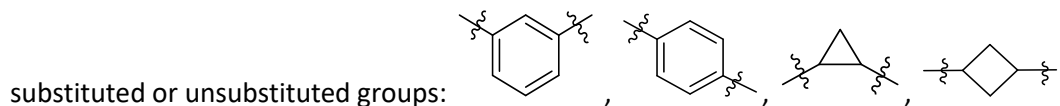


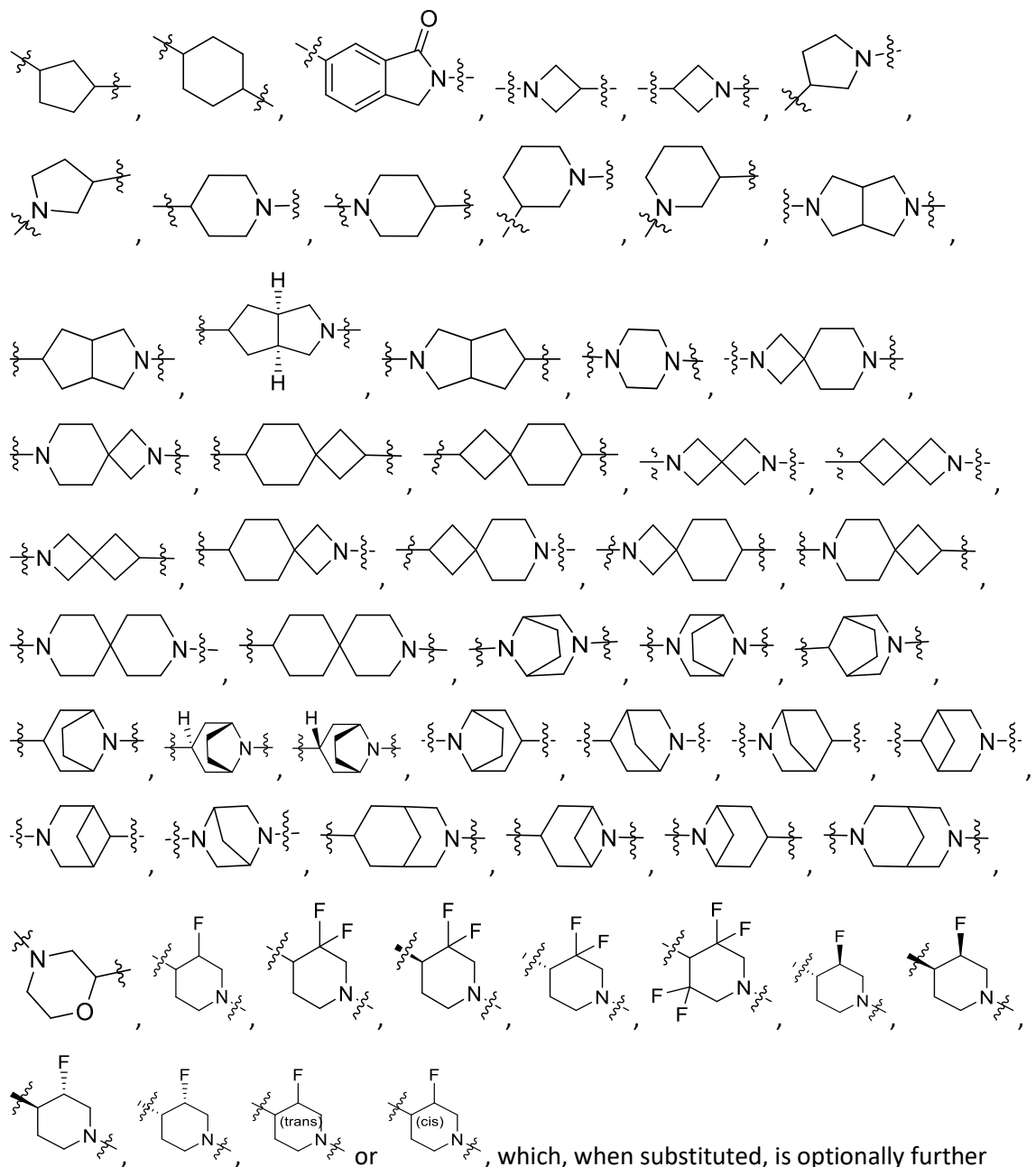
pyrrolyl, pyridyl or morpholinyl is optionally further substituted with 0 to 4 substituents selected

from H, F, Cl, Br, I, OH, CN, CF₃, NH₂, NHC₁₋₄ alkyl, N(C₁₋₄ alkyl)₂, NHCH₂C₃₋₆ cycloalkyl, C₁₋₄ alkyl, C₁₋₄ alkoxy, C₃₋₆ cycloalkyl or R^{b7a};

or R^{b1} and R^{b7} are each independently selected from azetidiny, azacyclopentyl, piperidyl, piperazinyl, morpholinyl or 2-oxa-5-azabicyclo[2.2.1]heptanyl, wherein the R^{b1} and R^{b7} are optionally substituted with 1 to 4 substituents selected from F, Cl, Br, I, OH, =O, CN, CF₃, NH₂, NHC₁₋₄ alkyl, N(C₁₋₄ alkyl)₂, NHCH₂C₃₋₆ cycloalkyl, halogen-substituted C₁₋₄ alkyl, cyano-substituted C₁₋₄ alkyl, -C₁₋₄ alkylene -OH, C₁₋₄ alkyl, C₁₋₄ alkoxy, -CH₂-O-C₁₋₄ alkyl, -CH₂-C₃₋₆ cycloalkyl, -O-C₃₋₆ cycloalkyl, -NH-C₃₋₆ cycloalkyl, C₃₋₆ cycloalkyl, -CH₂-4- to 7-membered heterocycloalkyl, -O-4- to 7-membered heterocycloalkyl, -NH-4- to 7-membered heterocycloalkyl, or 4- to 7-membered heterocycloalkyl, and the heterocycloalkyl contains 1 to 4 heteroatoms selected from O, S, or N; R^{b2} and R^{b6} are each independently selected from H, F, Cl, Br, I, =O, CF₃, CHF₂, OH, NH₂, NH(methyl), NH(ethyl), NH(propyl), NH(isopropyl), N(methyl)₂, N(ethyl)₂, CN, methyl, ethyl, methoxy, ethoxy, propoxy, isopropoxy, morpholinyl, piperazinyl, pyrrolidyl, piperidyl or oxazolidinyl, wherein the methyl, ethyl, methoxy, ethoxy, propoxy, isopropoxy, morpholinyl, piperazinyl, pyrrolidyl, piperidyl or oxazolidinyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, CN, CF₃, C₁₋₄ alkyl, C₁₋₄ alkoxy or C₃₋₆ cycloalkyl; each R^{k1} is independently selected from H, methyl, ethyl, propyl, isopropyl, ethenyl, propenyl, allyl, ethynyl, propynyl, propargyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, azetidiny, azacyclopentyl, piperidyl, oxacyclobutyl, oxacyclopentyl or oxacyclohexyl, wherein the methyl, ethyl, propyl, isopropyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, azetidiny, azacyclopentyl, piperidyl, oxacyclobutyl, oxacyclopentyl or oxacyclohexyl is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH, CN, CF₃, C₁₋₄ alkyl, C₁₋₄ alkoxy, ethenyl, propenyl, allyl, ethynyl, propynyl, propargyl or C₃₋₆ cycloalkyl; R^{k2} and R^{k3} are each independently selected from H, F, Cl, Br, I, OH, =O, NH₂, CF₃, CN, C(=O)OH, C(=O)NH₂, methyl, ethyl, methoxy or ethoxy, wherein the methyl, ethyl, methoxy or ethoxy is optionally further substituted with 0 to 4 substituents selected from H, F, Cl, Br, I, OH or NH₂; each p2 or p3 is independently selected from 0, 1 or 2.

4. The compound or the stereoisomer, deuterated compound, solvate, prodrug, metabolite, pharmaceutically acceptable salt or eutectic crystal thereof according to claim 3, wherein Cy1, Cy2, Cy3 and Cy4 are each independently selected from a bond or one of the following

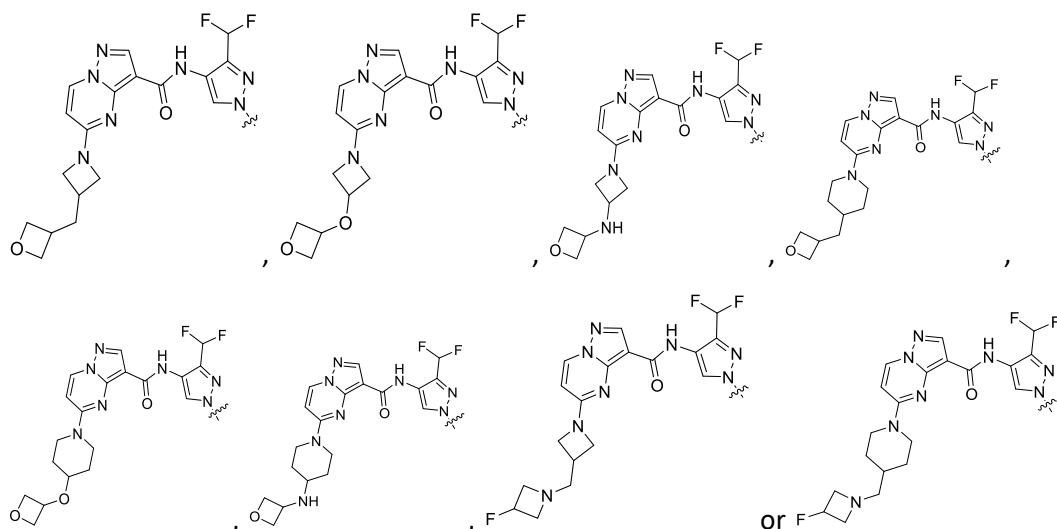




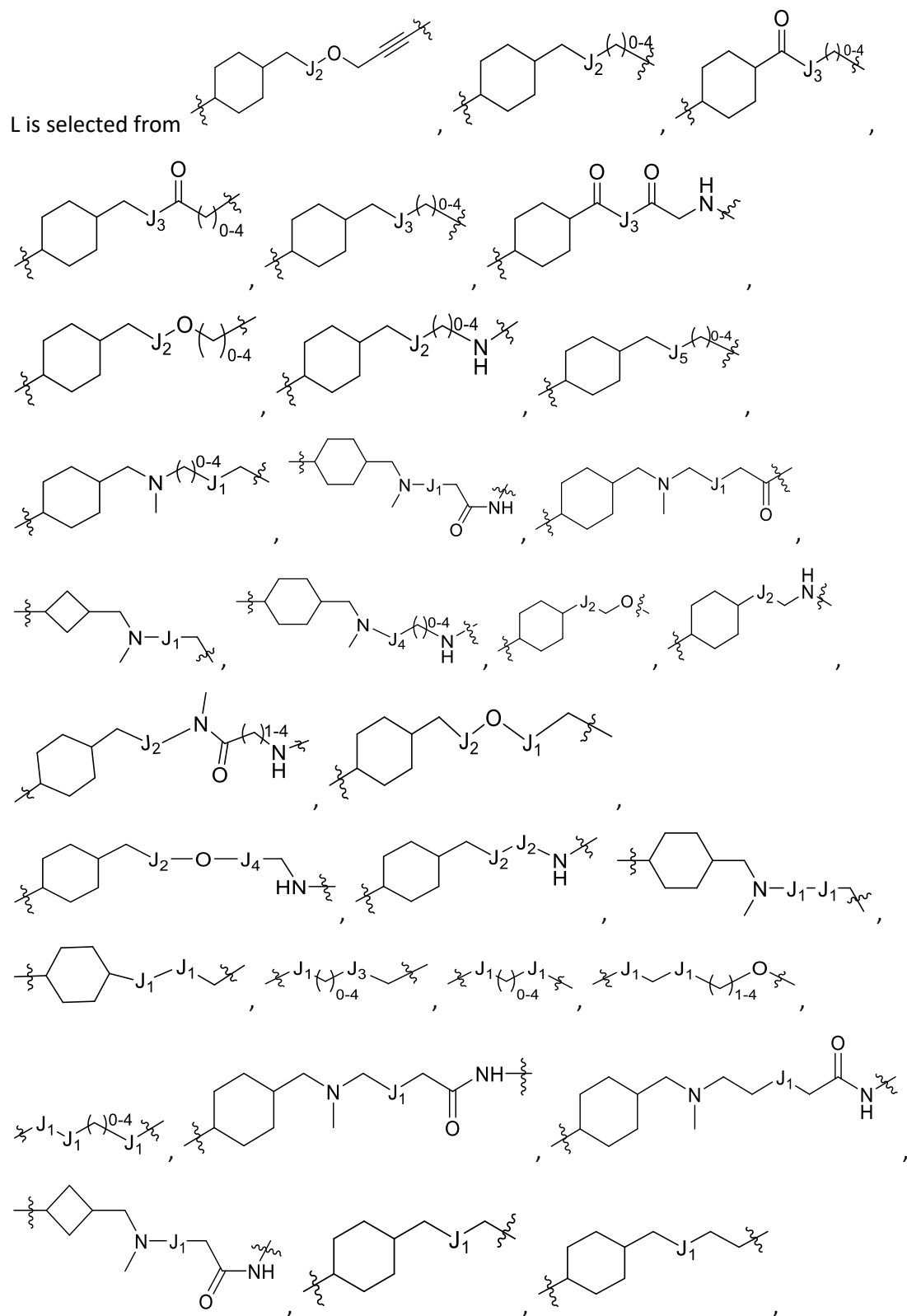
which, when substituted, is optionally further substituted with 0 to 4 substituents selected from H, F, CF₃, methyl, =O, hydroxymethyl, C(=O)OH, CN or NH₂;

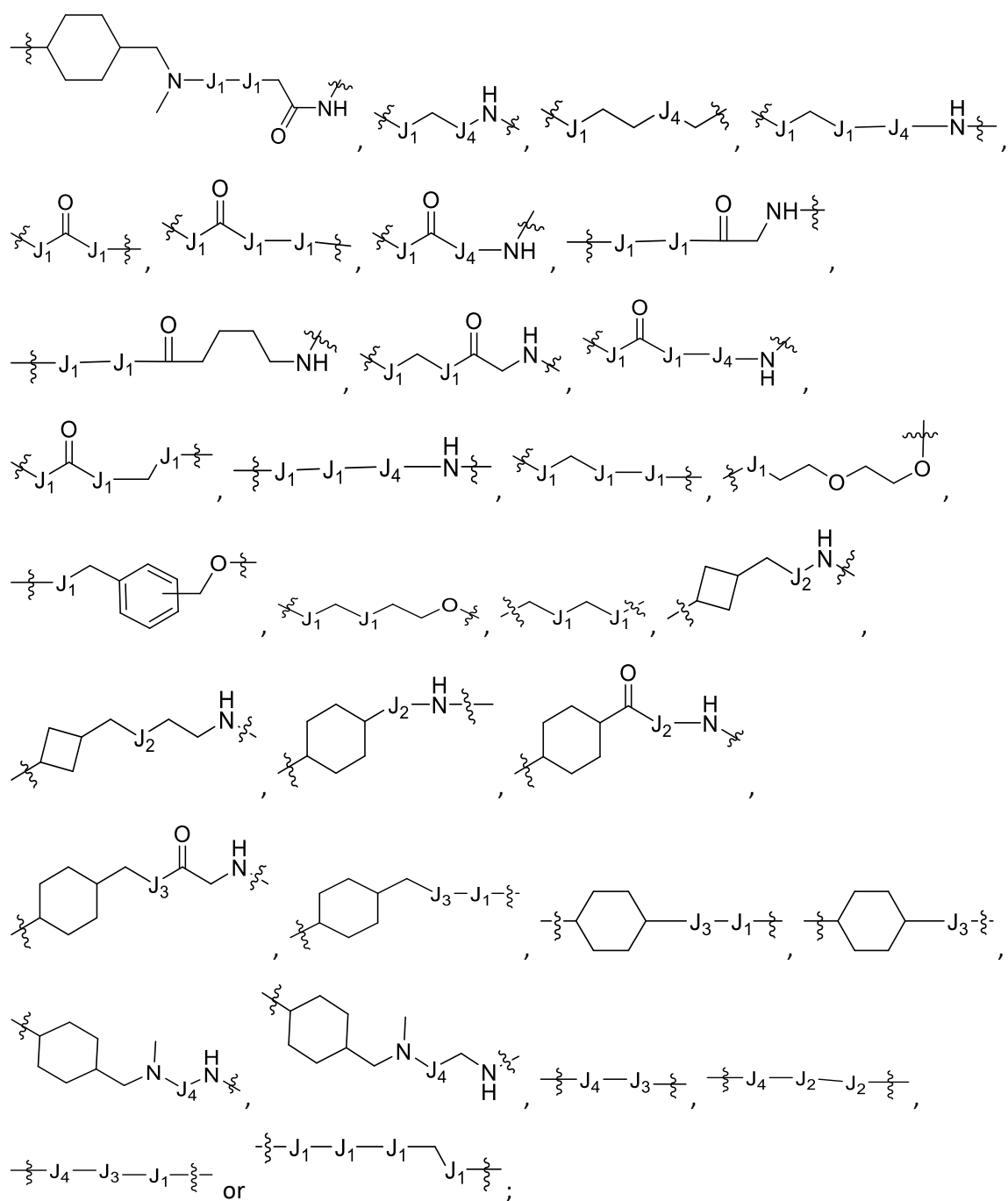


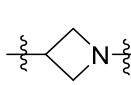
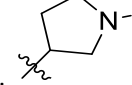
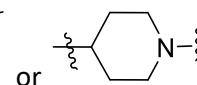




5. The compound or the stereoisomer, deuterated compound, solvate, prodrug, metabolite, pharmaceutically acceptable salt or eutectic crystal thereof according to claim 4, wherein L is selected from a bond, -Cy1-, -Cy1-Ak2-, -Cy1-Ak2-Ak3-, -Cy1-Ak2-Ak3-Ak4-Ak5-, -Cy1-Cy2-, -Cy1-Ak2-Cy2-, -Cy1-Cy2-Ak3-, -Cy1-Cy2-Ak3-Cy4-, -Cy1-Ak2-Cy2-Ak3-, -Cy1-Ak2-Cy2-Ak3-Ak4-, -Cy1-Ak2-Cy2-Cy3-Ak4-, -Cy1-Cy2-Ak3-Ak4-, -Cy1-Cy2-Ak3-Ak4-Ak5-, -Cy1-Ak2-Cy2-Ak3-Ak4-Ak5-, -Cy1-Ak2-Ak3-Cy3-Ak4-, -Cy1-Ak2-Ak3-Cy3-Ak4-Ak5-, -Cy1-Ak2-Ak3-Ak4-Cy4-Ak5-, -Cy1-Cy2-Cy3-, -Cy1-Ak2-Cy2-Cy3-, -Cy1-Cy2-Cy3-Ak4-, -Cy1-Ak2-Cy2-Cy3-Ak4-, -Cy1-Ak2-Cy2-Ak3-Cy3-, -Cy1-Ak2-Cy2-Cy3-Ak4-Ak5-, -Cy1-Ak2-Cy2-Ak3-Cy3-Ak4-Ak5-, -Cy1-Cy2-Cy3-Cy4-, -Cy1-Cy2-Ak3-Cy3-Cy4-, -Cy1-Cy2-Cy3-Ak4-Cy4-, -Ak1-Cy1-Ak2-Cy2-, -Ak1-Cy1-Ak2-Cy2-Ak3-, -Ak1-Ak2-Cy2-Ak3-, -Ak1-Ak2-Cy2-, -Ak1-Ak2-Cy2-Cy3-Ak4-, -Ak1-Ak2-Ak3-Cy3-Ak4-, -Ak1-Cy1-Ak2-, -Ak1-Cy1-Cy2-Ak3-Ak4-, -Ak1-Cy1-Cy2-Ak3-, -Ak1-Cy1-Ak2-Ak3-Ak4-, -Ak1-Cy1-, -Ak1-Cy1-Ak2-Ak3-, -Ak1-Ak2-Cy2-Ak3-Ak4-, -Ak1-Cy1-Ak2-Cy2-Ak3-Ak4-, -Cy1-Ak2-Ak3-Cy3-Cy4-Ak5-, -Ak1-Cy1-Ak2-Ak3-Ak4-Ak5-, -Cy1-Ak1-Ak2-Ak3-, -Ak1-Cy1-Cy2-, -Ak1-Ak2-Ak3-Ak4- or -Cy1-Ak2-Cy2-Ak3-Cy3-Ak4-; Ak1, Ak2, Ak3, Ak4 and Ak5 are each independently selected from O, C≡C, CH₂, CH₂CH₂, CH₂CH₂CH₂, CH₂CH₂CH₂CH₂, CH₂N(CH₃), CH₂CH₂N(CH₃), N(CH₃), NH, C(=O), C(=O)N(CH₃), N(CH₃)C(=O), C(=O)NH or NHC(=O).
6. The compound or the stereoisomer, deuterated compound, solvate, prodrug, metabolite, pharmaceutically acceptable salt or eutectic crystal thereof according to claim 4, wherein

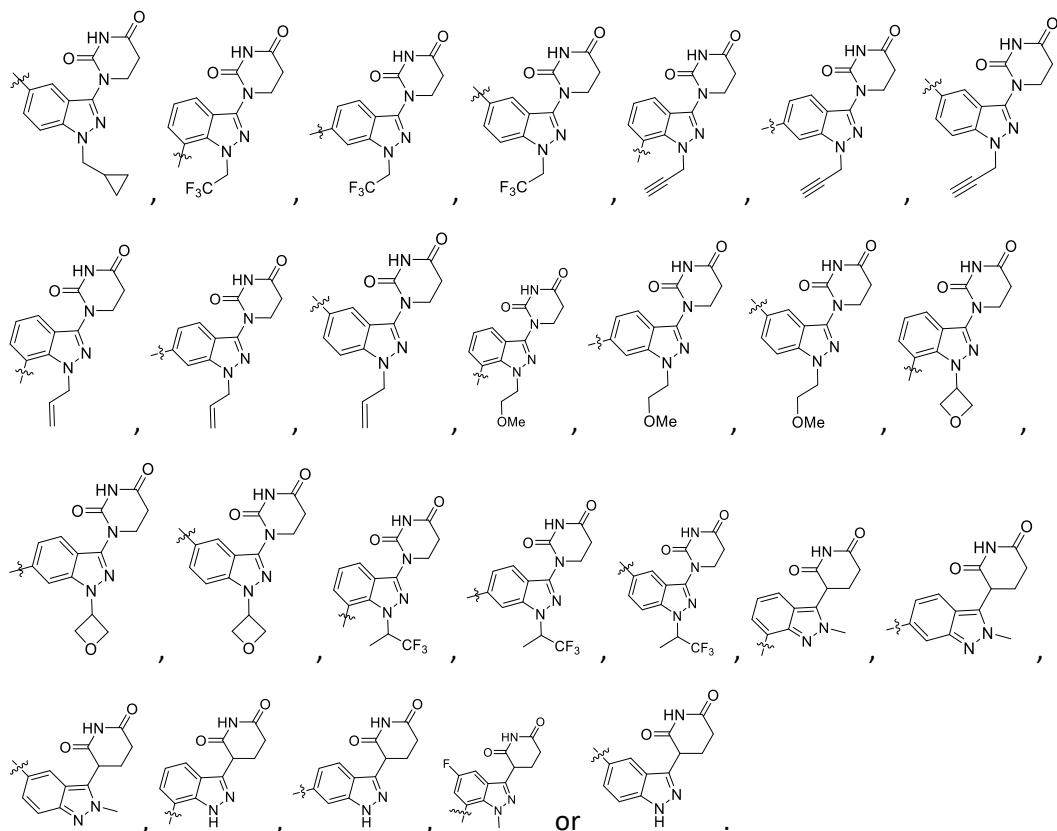




each J_1 is independently selected from
 
,
 
 or
 
;

K is selected from

Chemical structures representing various substituents K, including phenyl, naphthyl, and various alkyl and functionalized groups.



9. The compound or the stereoisomer, deuterated compound, solvate, prodrug, metabolite, pharmaceutically acceptable salt or eutectic crystal thereof according to claim 1, wherein the compound is selected from one of the structures shown in Table P-1.
10. A pharmaceutical composition, comprising the compound or the stereoisomer, deuterated compound, solvate, prodrug, metabolite, pharmaceutically acceptable salt or eutectic crystal thereof according to any one of claims 1-9, and a pharmaceutically acceptable carrier, wherein preferably, the pharmaceutical composition comprises 1-1500 mg of the compound or the stereoisomer, deuterated compound, solvate, prodrug, metabolite, pharmaceutically acceptable salt, or eutectic crystal thereof according to any one of claims 1-9.
11. Use of the compound or the stereoisomer, deuterated compound, solvate, prodrug, metabolite, pharmaceutically acceptable salt or eutectic crystal thereof according to any one of claims 1 to 9, or the pharmaceutical composition according to claim 10 in the preparation of a medicament for the treatment of a disease related to the activity or expression quantity of IRAK4.
12. Use of the compound or the stereoisomer, deuterated compound, solvate, prodrug, metabolite, pharmaceutically acceptable salt or eutectic crystal thereof according to any one of claims 1 to

- 9, or the pharmaceutical composition according to claim 10 in the preparation of a medicament for the treatment of a disease related to the inhibition or degradation of IRAK4.
13. The use according to claim 12, wherein the disease is selected from an autoimmune disease, an inflammatory disease or cancer.