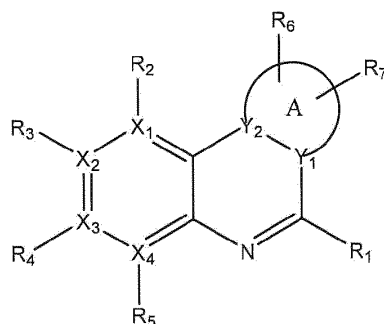


Claims

[Claim 1]

A heterocyclic compound of the following Formula 1, or a pharmaceutically acceptable salt or isomer thereof:

[Formula 1]



wherein

each of X₁, X₂, X₃ and X₄ is independently C or N;

R₁ is a saturated or unsaturated 3-12-membered mono- or poly-heterocyclyl containing 1-3 heteroatoms (preferably the heteroatoms selected from N, O and S), wherein R₁ is unsubstituted or substituted with 1-3 substituents selected from -C₁-C₆ alkyl and -amino-C₁-C₆ alkyl; R₂, R₃, R₄ and R₅ may be the same or different; and each of them is independently selected from -H, -C₁-C₆ alkyl, -C₁-C₆ haloalkyl, -C₁-C₆ perhaloalkyl, -amino-C₁-C₆ alkyl, -C₃-C₈ cycloalkyl, -halogen (-F, -Cl, -Br, -I), -CN, -C₁-C₆ alkoxy, -C₁-C₆ haloalkoxy, -C₁-C₆ perhaloalkoxy, -C₂-C₇ alkenyl, -C₂-C₈ alkynyl, -amino, -aceto, -amido, -sulfonamide, -sulfonyl, -aminosulfonyl-C₁-C₆ alkyl, -C₁-C₆ alkylcarboxyl, -carboxyl (-COOH), -C₁-C₆ acyl, -OH, -nitro (-NO₂), -C₆-C₁₀ aryl, -heterocyclyl, and -O-C₁-C₆ alkyl-heterocyclyl, wherein the heterocyclyl is a saturated or unsaturated 3-6-membered heterocyclyl containing 1-3 heteroatoms (preferably heteroatoms selected from N, O and S);

provided that when X₁ is N, R₂ does not exist; when X₂ is N, R₃ does not exist; when X₃ is N, R₄ does not exist; and when X₄ is N, R₅ does not exist; and when all of X₁, X₂, X₃ and X₄ are C, R₃ is not hydrogen or fluorine (F);

each of Y₁ and Y₂ is independently C or N;

A ring is a saturated or unsaturated 5- or 6-membered heterocycle containing at least 2 heteroatoms (preferably the heteroatoms selected from N, O and S); and

each of R₆ and R₇ is independently oxo (=O) or =NH, and one of R₆ and

R₇ may not exist;

wherein each of the alkyl, cycloalkyl, heterocyclyl, alkoxy, alkenyl, alkynyl, acyl and aryl groups may be independently unsubstituted or substituted with one or more substituents (for example, 1-3 substituents) selected from the group consisting of -C₁-C₄ alkyl, -halogen (-F, -Cl, -Br, -I), -CN, -C₁-C₄ alkoxy, -amino, -amido, -carboxyl (-COOH), -C₁-C₆ acyl, -OH, -nitro (-NO₂), heterocyclyl and phenyl, wherein the heterocyclyl is a saturated or unsaturated 3-6-membered heterocyclyl containing 1-3 heteroatoms (preferably, the heteroatoms selected from N, O and S).

[Claim 2]

The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein

each of X₁, X₂, X₃ and X₄ is independently C or N;

R₁ is a saturated or unsaturated 3-10-membered mono- or poly-heterocyclyl containing 1-3 heteroatoms selected from N, O and S, wherein the heterocyclyl is unsubstituted or substituted with 1 or 2 substituents selected from -C₁-C₆ alkyl and -amino-C₁-C₆ alkyl;

R₂, R₃, R₄ and R₅ may be the same or different; and each of them is independently selected from -H, -C₁-C₆ alkyl, -C₁-C₆ haloalkyl, -C₁-C₆ perhaloalkyl, -amino-C₁-C₆ alkyl, -C₃-C₈ cycloalkyl, -halogen, -CN, -C₁-C₆ alkoxy, -C₁-C₆ haloalkoxy, -C₁-C₆ perhaloalkoxy, -amino, -aceto, -sulfonamino, -sulfonyl, -aminosulfonyl-C₁-C₆ alkyl, -C₁-C₆ alkyl-carboxyl, -carboxyl, -OH, -nitro, -C₆-C₁₀ aryl, -heterocyclyl, and -O-C₁-C₆ alkyl-heterocyclyl, wherein the heterocyclyl is a saturated or unsaturated 3-6-membered heterocyclyl containing 1-3 heteroatoms selected from N, O and S;

each of Y₁ and Y₂ is independently C or N;

A ring is a saturated or unsaturated 5- or 6-membered heterocycle containing 2-4 heteroatoms selected from N, O and S; and

each of R₆ and R₇ is independently oxo or =NH, and one of R₆ and R₇ may not exist.

[Claim 3]

The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein X₁ and X₂ are C, and each of X₃ and X₄ is independently C or N.

[Claim 4]

The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein each of X₁ and X₂ is independently C or N, and X₃ and X₄ are C.

[Claim 5]

The heterocyclic compound, or a pharmaceutically acceptable salt or

- isomer thereof according to Claim 1, wherein R₁ is a saturated or unsaturated 3-10-membered mono- or poly-heterocyclyl containing 1-3 heteroatoms selected from N and O, wherein the heterocyclyl is unsubstituted or substituted with 1 or 2 substituents selected from -C₁-C₄ alkyl and -amino-C₁-C₄ alkyl.
- [Claim 6] The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein R₂, R₃, R₄ and R₅ may be the same or different; and each of them is independently selected from -H, -C₁-C₆ alkyl, -C₁-C₆ haloalkyl, -C₁-C₆ perhaloalkyl, -amino-C₁-C₆ alkyl, -halogen, -CN, -C₁-C₆ alkoxy, -C₁-C₆ haloalkoxy, -C₁-C₆ perhaloalkoxy, -amino, -aceto, -sulfonamino, -sulfonyl, -aminosulfonyl-C₁-C₆ alkyl, -C₁-C₆ alkylcarboxyl, -carboxyl, -OH, -nitro, and -heterocyclyl, wherein the heterocyclyl is a saturated or unsaturated 5 or 6-membered heterocyclyl containing 1-3 heteroatoms selected from N, O and S.
- [Claim 7] The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein A ring is a saturated or unsaturated 5- or 6-membered heterocycle containing 2 or 3 heteroatoms selected from N and S.
- [Claim 8] The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein R₆ is oxo or =NH, and R₇ does not exist.
- [Claim 9] The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein R₆ and R₇ are oxo.
- [Claim 10] The heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof according to Claim 1, wherein the heterocyclic compound is selected from the group consisting of:
 8-bromo-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;
 8-bromo-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;
 (*R*)-8-bromo-4-(3-(methylamino)pyrrolidin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;
 (*S*)-8-bromo-4-(3-(methylamino)pyrrolidin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;
 8-bromo-4-(hexahydropyrrolo[1,2-*a*]pyrazin-2(1*H*)-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;
 8-bromo-4-(4-methylpiperazin-1-yl)pyrido[2,3-*e*][1,2,4]triazolo[4,3-*a*]

pyrazin-1(2*H*)-one;
 8-bromo-4-(4-methylpiperazin-1-yl)pyrido[2,3-*e*][1,2,4]triazolo[1,5-*a*]
 pyrazin-2(1*H*)-one;
 8-bromo-7-chloro-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]
 pyrazin-2(1*H*)-one;
 8-bromo-7-fluoro-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]
 pyrazin-2(1*H*)-one;
 4-(4-methylpiperazin-1-yl)-8-nitroimidazo[1,2-*a*]quinoxalin-2(1*H*)-one
 ;
 8-amino-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one;
 8-bromo-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one;
 8-bromo-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one;
 9-bromo-5-(4-methylpiperazin-1-yl)-1*H*-[1,2,4]triazino[4,3-*a*]quinoxalin-2(3*H*)-one;
 8,9-dibromo-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one;
N-(4-(3-(methylamino)azetidin-1-yl)-2-oxo-1,2-dihydroimidazo[1,2-*a*]quinoxalin-8-yl)methanesulfonamide;
 8-chloro-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;
 8-amino-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one;
 8-chloro-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one;
 8-chloro-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[2,3-*e*]pyrazin-2(1*H*)-one;
 8-bromo-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]quinoxalin-2(1*H*)-one hydrochloride;
 3-chloro-6-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[4,3-*e*]pyrazin-8(9*H*)-one;
 8-chloro-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[3,4-*e*]pyrazin-2(1*H*)-one hydrochloride;
 8-chloro-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[3,4-*e*]pyrazin-2(1*H*)-one;
 8-bromo-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[3,4-*e*]pyrazi

n-2(1*H*)-one;
 8-bromo-4-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[3,4-*e*]pyrazin-2(1*H*)-one;
 8-bromo-4-(4-methylpiperazin-1-yl)-1*H*-pyrido[2,3-*e*][1,2,4]thiadiazolo[4,3-*a*]pyrazine 2,2-dioxide;
 8-chloro-4-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[3,4-*e*]pyrazin-2(1*H*)-one hydrochloride;
 2-chloro-6-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[3,2-*e*]pyrazin-8(9*H*)-one;
 2-bromo-6-(4-methylpiperazin-1-yl)imidazo[1,2-*a*]pyrido[3,2-*e*]pyrazin-8(9*H*)-one;
 2-chloro-6-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[3,2-*e*]pyrazin-8(9*H*)-one; and
 2-bromo-6-(3-(methylamino)azetidin-1-yl)imidazo[1,2-*a*]pyrido[3,2-*e*]pyrazin-8(9*H*)-one.

- [Claim 11] A pharmaceutical composition comprising a heterocyclic compound, or a pharmaceutically acceptable salt or isomer thereof as defined in any one of Claims 1 to 10 as an active ingredient, and a pharmaceutically acceptable carrier.
- [Claim 12] The pharmaceutical composition according to Claim 11, wherein the composition exhibits a human histamine 4 receptor (hH4R) inhibition activity.
- [Claim 13] The pharmaceutical composition according to Claim 11, wherein the composition is for the prevention or treatment of a disease selected from the group consisting of inflammatory diseases, autoimmune diseases, allergic diseases, ocular diseases, skin diseases, respiratory diseases, pain diseases, cardiac diseases, and human histamine 4 receptor (hH4R)-related diseases.
- [Claim 14] The pharmaceutical composition according to Claim 13, wherein the composition is for the prevention or treatment of a disease selected from the group consisting of inflammatory disorder, allergy, pain, nasal polyps, rhinitis, chronic sinusitis, nasal congestion, nasal itch, asthma, chronic obstructive pulmonary disease, rheumatoid arthritis, atopic dermatitis, psoriasis, eczema, pruritus, itchy skin, urticaria, idiopathic chronic urticaria, scleroderma, conjunctivitis, keratoconjunctivitis, ocular inflammation, dry eye, cardiac dysfunction, age-related macular degeneration, arrhythmia, atherosclerosis, multiple sclerosis, inflammatory bowel disease (colitis, Crohn's disease, ulcerative colitis),

inflammatory pain, neuropathic pain, osteoarthritic pain, autoimmune thyroid disease, immune-mediated diabetes, lupus, post-operative adhesions, vestibular disorders and cancer.