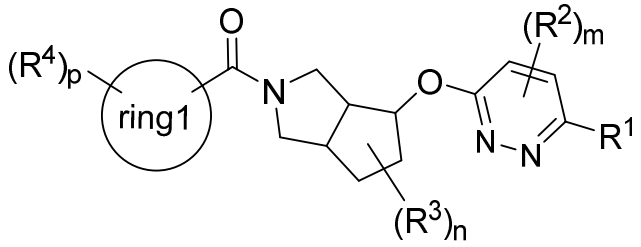
CLAIMS

[Claim 1]

A compound represented by general formula (I) or a pharmaceutically acceptable salt thereof:



(I)

wherein

R^1 represents a halogen atom,

R^2 represents (1) a halogen atom, (2) a C1-6 alkyl group, (3) a C2-6 alkenyl group, (4) a C2-6 alkynyl group, (5) a C1-6 alkoxy group, (6) a C1-6 haloalkyl group, (7) a C2-6 haloalkenyl group, (8) a C2-6 haloalkynyl group, or (9) a C1-6 haloalkoxy group,

1 or 2 carbon atoms in the C1-6 alkyl group, the C2-6 alkenyl group, the C2-6 alkynyl group, the C1-6 alkoxy group, the C1-6 haloalkyl group, the C2-6 haloalkenyl group, the C2-6 haloalkynyl group, or the C1-6 haloalkoxy group may be replaced with a nitrogen atom or an optionally oxidized sulfur atom,

when m represents 2, a plurality of R^2s may be the same or different,

when two R^2s represent C1-6 alkyl groups, C2-6 alkenyl groups, C2-6 alkynyl groups, C1-6 alkoxy groups, C1-6 haloalkyl groups, C2-6 haloalkenyl groups, C2-6 haloalkynyl groups, or C1-6 haloalkoxy groups, the two R^2s, together with a carbon atom to which the two R^2s are bonded, may form a 5- to 6-membered cyclic group,

R^3 represents (1) a halogen atom, (2) a C1-6 alkyl group, (3) a C2-6 alkenyl group, (4) a C2-6 alkynyl group, (5) a C1-6 alkoxy group, (6) a C1-6 haloalkyl group, (7) a C2-6 haloalkenyl group, (8) a C2-6 haloalkynyl group, (9) a C1-6 haloalkoxy group, or (10) a hydroxyl group,

when n is 2 or more, a plurality of R^3s may be the same or different,

when two R^3s present on the same carbon atom represent C1-6 alkyl groups, the two R^3s , together with a carbon atom to which the two R^3s are bonded, may form a C3-6 cycloalkyl group,

ring 1 represents a 3- to 15-membered cyclic group,

R^4 represents (1) a halogen atom, (2) a C1-6 alkyl group, (3) a C2-6 alkenyl group, (4) a C2-6 alkynyl group, (5) a C1-6 alkoxy group, (6) a C1-6 haloalkyl group, (7) a C2-6 haloalkenyl group, (8) a C2-6 haloalkynyl group, (9) a C1-6 haloalkoxy group, (10) a C1-6 alkylthio group, (11) a C1-6 alkylsulfinyl group, (12) a C1-6 alkylsulfonyl group, (13) a C2-6 acyl group, (14) a 3- to 6-membered cyclic group, (15) $-L^{R4}$-(3- to 6-membered cyclic group), (16) a hydroxyl group, (17) a nitro group, (18) a cyano group, (19) an oxo group, (20) $-NR^{401}R^{402}$, (21) $-COOR^{403}$, (22) $CONR^{404}R^{405}$, or (23) $-SO_2NR^{406}R^{407}$, in which 1 or 2 carbon atoms in the C1-6 alkyl group, the C2-6 alkenyl group, the C2-6 alkynyl group, the C1-6 alkoxy group, the C1-6 haloalkyl group, the C2-6 haloalkenyl group, the C2-6 haloalkynyl group, the C1-6 haloalkoxy group, the C1-6 alkylthio group, the C1-6 alkylsulfinyl group, the C1-6 alkylsulfonyl group, or the C2-6 acyl group may be replaced with an oxygen atom or an optionally oxidized sulfur atom,

when p is 2 or more, a plurality of R^4s may be the same or different,

the groups (2) to (15) of R^4 may be substituted with 1 to 9 R^{408}s,

R^{408} represents (1) a halogen atom, (2) a C1-4 alkyl group, (3) a C1-4 alkoxy group, (4) a C2-6 acyl group, (5) a C3-6 cycloalkyl group, (6) a hydroxyl group, or (7) $-NR^{409}R^{410}$,

when the groups (2) to (15) of R^4 are substituted with 2 or more R^{408}s, a plurality of R^{408}s may be the same or different,

L^{R4} represents (1) -O-, (2) -(C1-4 alkylene)-, (3) -O-(C1-4 alkylene)-, (4) -(C1-4 alkylene)-O-, (5) $-NR^{411}$-, (6) -S-, (7) -SO-, or (8) $-SO_2$-,

R^{401}, R^{402}, R^{403}, R^{404}, R^{405}, R^{406}, R^{407}, R^{409}, R^{410}, or R^{411} each independently represent (1) a hydrogen atom, (2) a C1-6 alkyl group, (3) a C2-6 acyl group, or (4) a C1-6 alkylsulfonyl group,

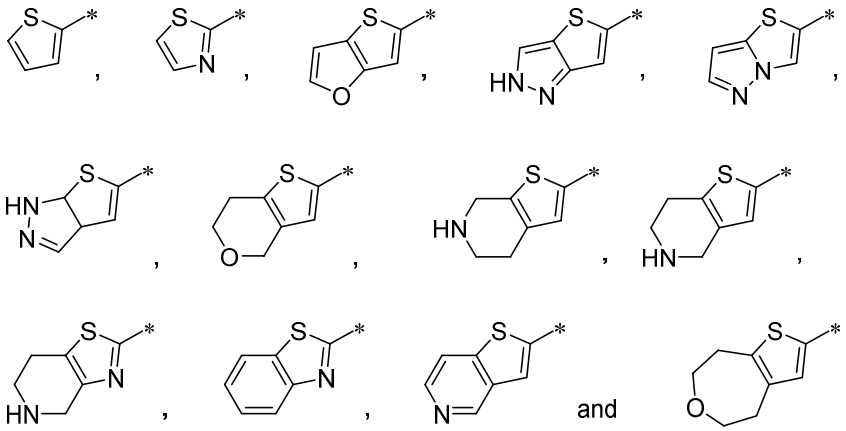
m represents an integer of 0 to 2,

n represents an integer of 0 to 5, and

p represents an integer of 0 to 5.

[Claim 2]

The compound or the pharmaceutically acceptable salt thereof according to claim 1, wherein ring 1 represents a ring structure selected from the group consisting of the following ring structures:



wherein the * mark represents a bonding position with a carbonyl group, and a hydrogen atom represented by NH may be replaced with R^4.

[Claim 3]

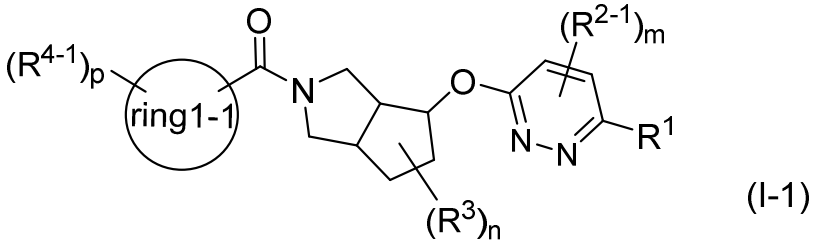
The compound or the pharmaceutically acceptable salt thereof according to claim 1, wherein R^4 is (1) a halogen atom, (2) a C1-6 alkyl group, (3) a C1-6 alkoxy group, (4) a C1-6 haloalkyl group, (5) a C1-6 haloalkoxy group, (6) a cyclopropyl group, (7) a benzene ring, (8) a pyridine ring, (9) -$COOCH_3$, (10) -COOtBu, or (11) a cyano group.

[Claim 4]

The compound or the pharmaceutically acceptable salt thereof according to claim 1, wherein R^2 is (1) a C1-6 alkyl group, (2) a C1-6 alkoxy group, (3) a C1-6 haloalkyl group, or (4) a C1-6 haloalkoxy group.

[Claim 5]

The compound or the pharmaceutically acceptable salt thereof according to claim 1, wherein the compound represented by general formula (I) is a compound represented by general formula (I-1):

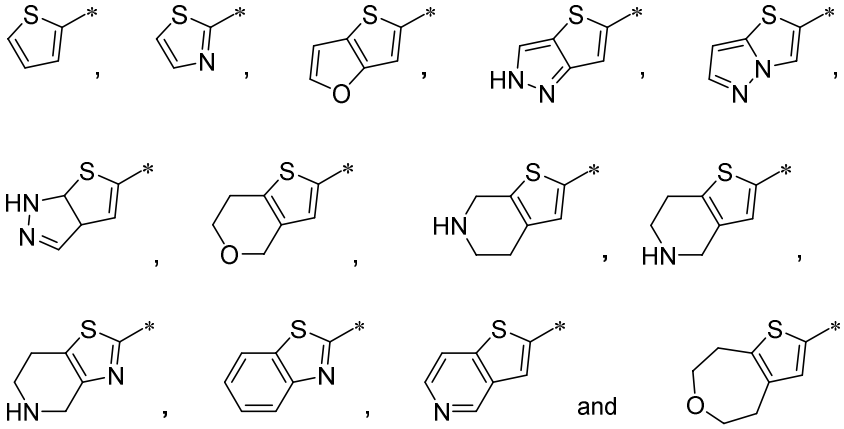


(I-1)

wherein R^{2-1} represents (1) a C1-6 alkyl group, (2) a C1-6 alkoxy group, (3) a C1-6 haloalkyl group, or (4) a C1-6 haloalkoxy group,

R^{4-1} represents (1) a halogen atom, (2) a C1-6 alkyl group, (3) a C1-6 alkoxy group, (4) a C1-6 haloalkyl group, (5) a C1-6 haloalkoxy group, (6) a cyclopropyl group, (7) a benzene ring, (8) a pyridine ring, (9) -$COOCH_3$, (10) -COOtBu, or (11) a cyano group, and

ring 1-1 has a ring structure selected from the group consisting of the following ring structures:



wherein the * mark represents a bonding position with a carbonyl group, and a hydrogen atom represented by NH may be replaced with R^{4-1}, and

other symbols represent the same meaning as the symbols described in claim 1.

[Claim 6]

The compound or the pharmaceutically acceptable salt thereof according to claim 1, wherein the compound represented by general formula (I) is a compound selected from the group consisting of:

(1) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](6,7-dihydro-4H-thieno[3,2-c]pyran-2-yl)methanone,

(2) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](5-methyl-2-thienyl)methanone,

(3) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](2-methyl-2H-thieno[3,2-c]pyrazol-5-yl)methanone,

(4) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](6-methylpyrazolo[5,1-b][1,3]thiazol-2-yl)methanone,

(5) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](2-cyclopropyl-2H-thieno[3,2-c]pyrazol-5-yl)methanone,

(6) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl][2-(difluoromethyl)-2H-thieno[3,2-c]pyrazol-5-yl]methanone,

(7) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](6-fluoro-1,3-benzothiazol-2-yl)methanone,

(8) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl][5-(difluoromethyl)-2-thienyl]methanone,

(9) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](thieno[3,2-c]pyridin-2-yl)methanone,

(10) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](thieno[3,2-b]furan-5-yl)methanone,

(11) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](1-methyl-1H-thieno[2,3-c]pyrazol-5-yl)methanone,

(12) 5-{[(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl]carbonyl}-2-methyl-3-thiophenecarbonitrile,

(13) 2-Methyl-2-propanyl 2-[(3aS,4R,6aR)-4-[(6-bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl]carbonyl}-6,7-dihydro[1,3]thiazolo[4,5-c]pyridine-5(4H)-carboxylate,

(14) Methyl 2-[(3aS,4R,6aR)-4-[(6-bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl]carbonyl}-6,7-dihydrothieno[3,2-c]pyridine-5(4H)-carboxylate,

(15) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](2-phenyl-2H-thieno[3,2-c]pyrazol-5-yl)methanone,

(16) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl][2-(3-pyridinyl)-2H-thieno[3,2-c]pyrazol-5-yl]methanone,

(17) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](4,5-dimethyl-1,3-thiazol-2-yl)methanone,

(18) Methyl 2-[(3aS,4R,6aR)-4-[(6-bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl]carbonyl}-4,7-dihydrothieno[2,3-c]pyridine-6(5H)-carboxylate,

(19) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](4,5,7,8-tetrahydrothieno[2,3-d]oxepin-2-yl)methanone,

(20) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl][5-(2-fluoroethoxy)-2-thienyl]methanone,

(21) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](4-fluoro-5-methyl-2-thienyl)methanone,

(22) [(3aS,4R,6aR)-4-[(6-Chloro-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](6,7-dihydro-4H-thieno[3,2-c]pyran-2-yl)methanone,

(23) [(3aS,4R,6aR)-4-{[6-Chloro-4-(trifluoromethyl)-3-pyridazinyl]oxy}hexahydrocyclopenta[c]pyrrol-2(1H)-yl](6,7-dihydro-4H-thieno[3,2-

c]pyran-2-yl)methanone,

(24) {4-[(5-Chloropyrido[2,3-d]pyridazin-8-yl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl}(6,7-dihydro-4H-thieno[3,2-c]pyran-2-yl)methanone,

(25) {4-[(4-Chlorothieno[2,3-d]pyridazin-7-yl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl}(6,7-dihydro-4H-thieno[3,2-c]pyran-2-yl)methanone,

(26) [(3aS,4R,6aR)-4-[(6-Chloro-5-methoxy-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](6,7-dihydro-4H-thieno[3,2-c]pyran-2-yl)methanone,

(27) [(3aS,4R,6aR)-4-[(6-Chloro-4-methoxy-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](6,7-dihydro-4H-thieno[3,2-c]pyran-2-yl)methanone,

(28) [(3aS,4R,6aR)-4-[(6-Chloro-3-pyridazinyl)oxy]hexahydrocyclopenta[c]pyrrol-2(1H)-yl](2-methyl-2H-thieno[3,2-c]pyrazol-5-yl)methanone,

(29) [(3aS,4S,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]tetrahydro-1H-spiro[cyclopenta[c]pyrrole-5,1'-cyclopropan]-2(3H)-yl](6,7-dihydro-4H-thieno[3,2-c]pyran-2-yl)methanone,

(30) [(3aS,4R,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]-3a-methylhexahydrocyclopenta[c]pyrrol-2(1H)-yl](6,7-dihydro-4H-thieno[3,2-c]pyran-2-yl)methanone,

(31) [(3aS,4S,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]-5,5-dimethylhexahydrocyclopenta[c]pyrrol-2(1H)-yl](6,7-dihydro-4H-thieno[3,2-c]pyran-2-yl)methanone,

(32) [(3aR,4R,6aS)-4-[(6-Bromo-3-pyridazinyl)oxy]-3a-hydroxyhexahydrocyclopenta[c]pyrrol-2(1H)-yl](6,7-dihydro-4H-thieno[3,2-c]pyran-2-yl)methanone,

(33) [(3aR,4R,6aS)-4-[(6-Bromo-3-pyridazinyl)oxy]-3a-methoxyhexahydrocyclopenta[c]pyrrol-2(1H)-yl](6,7-dihydro-4H-thieno[3,2-c]pyran-2-yl)methanone, and

(34) [(3aS,4S,5S,6aR)-4-[(6-Bromo-3-pyridazinyl)oxy]-5-fluorohexahydrocyclopenta[c]pyrrol-2(1H)-yl](6,7-dihydro-4H-thieno[3,2-c]pyran-2-yl)methanone.

[Claim 7]

A pharmaceutical composition comprising the compound or the pharmaceutically acceptable salt thereof according to any one of claims 1 to 6 as an active ingredient, and a

pharmaceutically acceptable carrier.

[Claim 8]

The pharmaceutical composition according to claim 7, which is an ABHD6 inhibitor.

[Claim 9]

Use of the compound or the pharmaceutically acceptable salt thereof according to any one of claims 1 to 6, or the pharmaceutical composition according to claim 7 or 8, in the manufacture of a medicament for preventing and/or treating a disease associated with ABHD6.

[Claim 10]

The use according to claim 9, wherein the disease associated with ABHD6 is pain, a neurological disease, an inflammatory disease, an autoimmune disease, a metabolic disease, or a malignant tumor.

[Claim 11]

The use according to claim 9, wherein the disease associated with ABHD6 is pain, and the pain is pain associated with osteoarthritis, cancer pain, pain associated with chemotherapy, chronic low back pain, low back pain associated with osteoporosis, fracture pain, pain associated with rheumatoid arthritis, neuropathic pain, post-herpetic pain, pain associated with diabetic neuropathy, pain associated with fibromyalgia, pain associated with pancreatitis, pain associated with interstitial cystitis or bladder pain syndrome, pain associated with endometriosis, pain associated with irritable bowel syndrome, migraine, or pain associated with pulpitis.

[Claim 12]

The use according to claim 9, wherein the disease associated with ABHD6 is the neurological disease, and the neurological disease is tremor, dyskinesia, dystonia, spasticity, compressive and obsessive behavior, depression, anxiety disorder, panic disorder, acute stress disorder, post-traumatic stress disorder, obsessive-compulsive disorder, agoraphobia, social phobia, mood disorder, epilepsy, traumatic brain injury, spinal cord injury, multiple sclerosis, encephalomyelitis, Parkinson's disease, Huntington's disease, Alzheimer's disease, or sleep disorder.

[Claim 13]

The use according to any one of claims 9 to 12, wherein the medicament is to be administered in combination with one or more selected from the group consisting of acetaminophen, non-steroidal anti-inflammatory drugs, opioid drugs, antidepressant drugs,

antiepileptic drugs, N-methyl-D-aspartate antagonists, muscle relaxants, antiarrhythmic drugs, steroid drugs, and bisphosphonate drugs.

[Claim 14]

The compound or the pharmaceutically acceptable salt thereof according to any one of claims 1 to 6, or the pharmaceutical composition according to claim 7 or 8, for use in therapy.