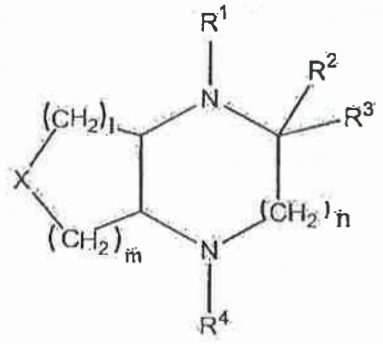
CLAIMS

1. A heterocyclic compound represented by the formula (1) or a salt thereof:



wherein m = 2, l = 1, and n =1; X $-CH_2-$;

R^1 represents hydrogen, a C1-C6 alkyl group, a hydroxy-C1-C6 alkyl group, a protecting group selected from substituted or unsubstituted C1-C6 alkanoyl, phthaloyl, C1-C6 alkoxycarbonyl, substituted or unsubstituted aralkyloxycarbonyl, 9-fluorenylmethyoxycarbonyl, nitrophenylsulfenyl, aralkyl and C1-C6 alkylsilyl groups, or a tri-C1-C6 alkylsilyloxy-C1-C6 alkyl group;

R^2 and R^3, which are the same or different, each independently represent hydrogen or a C1-C6 alkyl group; or R_2 and R_3 are bonded to form a cyclo-C3-C8 alkyl group; and

R^4 represents any of

(1) a phenyl group,

(2) an indolyl group,

(3) a benzothienyl group,

(4) a naphthyl group,

(5) a benzofuryl group,

(6) a quinolyl group,

(7) an isoquinolyl group,

(8) a pyridyl group,

(9) a thienyl group,

(10) a dihydrobenzoxazinyl group,

(11) a dihydrobenzodioxinyl group,

(12) a dihydroquinolyl group,

(13) a chromanyl group,

(14) a quinoxalinyl group,

(15) a dihydroindenyl group,

(16) a dihydrobenzofuryl group,

(17) a benzodioxolyl group,

(18) an indazolyl group,

(19) a benzothiazolyl group,

(20) an indolinyl group,

(21) a thienopyridyl group,

(22) a tetrahydrobenzazepinyl group,

(23) a tetrahydrobenzodiazepinyl group,

(24) a dihydrobenzodioxepinyl group,

(25) a fluorenyl group,

(26) a pyridazinyl group,

(27) a tetrahydroquinolyl group,

(28) a carbazolyl group,

(29) a phenanthryl group,

(30) a dihydroacenaphthylenyl group,

(31) a pyrrolopyridyl group,

(32) an anthryl group,

(33) a benzodioxinyl group,

(34) a pyrrolidinyl group,

(35) a pyrazolyl group,

(36) an oxadiazolyl group,

(37) a pyrimidinyl group,

(38) a tetrahydronaphthyl group,

(39) a dihydroquinazolinyl group,

(40) a benzoxazolyl group,

(41) a thiazolyl group,

(42) a quinazolinyl group,

(43) a phthalazinyl group,

(44) a pyrazinyl group, and

(45) a chromenyl group, wherein

these aromatic or heterocyclic groups may have one or more substituent(s) selected from

(1-1) a halogen atom,

(1-2) a C1-C6 alkyl group,

(1-3) a C1-C6 alkanoyl group,

(1-4) a halogen-substituted C1-C6 alkyl group,

(1-5) a halogen-substituted C1-C6 alkoxy group,

(1-6) a cyano group,

(1-7) a C1-C6 alkoxy group,

(1-8) a C1-C6 alkylthio group,

(1-9) an imidazolyl group,

(1-10) a tri-C1-C6 alkylsilyl group,

(1-11) an oxadiazolyl group which may have a C1-C6 alkyl group(s),

(1-12) a pyrrolidinyl group which may have an oxo group(s),

(1-13) a phenyl group which may have a C1-C6 alkoxy group(s),

(1-14) a C1-C6 alkylamino-C1-C6 alkyl group,

(1-15) an oxo group,

(1-16) a pyrazolyl group which may have a C1-C6 alkyl group(s),

(1-17) a thienyl group,

(1-18) a furyl group,

(1-19) a thiazolyl group which may have a C1-C6 alkyl group(s),

(1-20) a C1-C6 alkylamino group,

(1-21) a pyrimidyl group which may have a C1-C6 alkyl group(s),

(1-22) a phenyl-C2-C6 alkenyl group,

(1-23) a phenoxy group which may have a halogen atom(s),

(1-24) a phenoxy-C1-C6 alkyl group,

(1-25) a pyrrolidinyl-C1-C6 alkoxy group,

(1-26) a C1-C6 alkylsulfamoyl group,

(1-27) a pyridazinyloxy group which may have a C1-C6 alkyl group(s),

(1-28) a phenyl-C1-C6 alkyl group,

(1-29) a C1-C6 alkylamino-C1-C6 alkoxy group,

(1-30) an imidazolyl-C1-C6 alkyl group,

(1-31) a phenyl-C1-C6 alkoxy group,

(1-32) a hydroxy group,

(1-33) a C1-C6 alkoxycarbonyl group,

(1-34) a hydroxy-C1-C6 alkyl group,

(1-35) an oxazolyl group,

(1-36) a piperidyl group,

(1-37) a pyrrolyl group,

(1-38) a morpholinyl-C1-C6 alkyl group,

(1-39) a piperazinyl-C1-C6 alkyl group which may have a C1-C6 alkyl group(s),

(1-40) a piperidyl-C1-C6 alkyl group,

(1-41) a pyrrolidinyl-C1-C6 alkyl group,

(1-42) a morpholinyl group, and

(1-43) a piperazinyl group which may have a C1-C6 alkyl group(s).

2. The compound represented by the formula (1) or a pharmaceutically acceptable salt thereof according to claim 1, wherein

R^4 represents any of

(1) a phenyl group,

(2) an indolyl group,

(3) a benzothienyl group,

(4) a naphthyl group,

(5) a benzofuryl group,

(6) a quinolyl group,

(7) an isoquinolyl group,

(8) a pyridyl group,

(9) a thienyl group,

(10) a dihydrobenzoxazinyl group,

(11) a dihydrobenzodioxinyl group,

(12) a dihydroquinolyl group,

(13) a chromanyl group,

(14) a quinoxalinyl group,

(15) a dihydroindenyl group,

(16) a dihydrobenzofuryl group,
(17) a benzodioxolyl group,
(18) an indazolyl group,
(19) a benzothiazolyl group,
(20) an indolinyl group,
(21) a thienopyridyl group,
(22) a tetrahydrobenzazepinyl group,
(23) a tetrahydrobenzodiazepinyl group,
(24) a dihydrobenzodioxepinyl group,
(25) a fluorenyl group,
(26) a pyridazinyl group,
(27) a tetrahydroquinolyl group,
(28) a carbazolyl group,
(29) a phenanthryl group,
(30) a dihydroacenaphthylenyl group,
(31) a pyrrolopyridyl group,
(32) an anthryl group,
(33) a benzodioxinyl group,
(34) a pyrrolidinyl group,
(35) a pyrazolyl group,
(36) an oxadiazolyl group,
(37) a pyrimidinyl group,
(38) a tetrahydronaphthyl group,
(39) a dihydroquinazolinyl group,
(40) a benzoxazolyl group,
(41) a thiazolyl group,
(42) a quinazolinyl group,
(43) a phthalazinyl group,
(44) a pyrazinyl group, and
(45) a chromenyl group, wherein
these aromatic or heterocyclic groups may have 1 to 4 substituent(s) selected from
(1-1) a halogen atom,

(1-2) a C1-C6 alkyl group,

(1-3) a C1-C6 alkanoyl group,

(1-4) a halogen-substituted C1-C6 alkyl group,

(1-5) a halogen-substituted C1-C6 alkoxy group,

(1-6) a cyano group,

(1-7) a C1-C6 alkoxy group,

(1-8) a C1-C6 alkylthio group,

(1-9) an imidazolyl group,

(1-10) a tri-C1-C6 alkylsilyl group,

(1-11) an oxadiazolyl group which may have 1 C1-C6 alkyl group,

(1-12) a pyrrolidinyl group which may have 1 oxo group,

(1-13) a phenyl group which may have 1 C1-C6 alkoxy group,

(1-14) a C1-C6 alkylamino-C1-C6 alkyl group,

(1-15) an oxo group,

(1-16) a pyrazolyl group which may have 1 C1-C6 alkyl group,

(1-17) a thienyl group,

(1-18) a furyl group,

(1-19) a thiazolyl group which may have 1 C1-C6 alkyl group,

(1-20) a C1-C6 alkylamino group,

(1-21) a pyrimidyl group which may have 1 C1-C6 alkyl group,

(1-22) a phenyl-C2-C6 alkenyl group,

(1-23) a phenoxy group which may have 1 halogen atom,

(1-24) a phenoxy-C1-C6 alkyl group,

(1-25) a pyrrolidinyl-C1-C6 alkoxy group,

(1-26) a C1-C6 alkylsulfamoyl group,

(1-27) a pyridazinyloxy group which may have 1 C1-C6 alkyl group,

(1-28) a phenyl-C1-C6 alkyl group,

(1-29) a C1-C6 alkylamino-C1-C6 alkoxy group,

(1-30) an imidazolyl-C1-C6 alkyl group,

(1-31) a phenyl-C1-C6 alkoxy group,

(1-32) a hydroxy group,

(1-33) a C1-C6 alkoxycarbonyl group,

(1-34) a hydroxy-C1-C6 alkyl group,

(1-35) an oxazolyl group,

(1-36) a piperidyl group,

(1-37) a pyrrolyl group,

(1-38) a morpholinyl-C1-C6 alkyl group,

(1-39) a piperazinyl-C1-C6 alkyl group which may have 1 C1-C6 alkyl group,

(1-40) a piperidyl-C1-C6 alkyl group,

(1-41) a pyrrolidinyl-C1-C6 alkyl group,

(1-42) a morpholinyl group, and

(1-43) a piperazinyl group which may have 1 C1-C6 alkyl group.

3. The compound represented by the formula (1) or a pharmaceutically acceptable salt thereof according to claim 2, wherein

R^1 represents hydrogen, a C1-C6 alkyl group, a hydroxy-C1-C6 alkyl group, a benzyl group, or a tri-C1-C6 alkylsilyloxy-C1-C6 alkyl group; and

R^4 represents any of

(1) a phenyl group,

(2) an indolyl group,

(4) a naphthyl group,

(5) a benzofuryl group, and

(31) a pyrrolopyridyl group, wherein

these aromatic or heterocyclic groups may have 1 to 4 substituent(s) selected from

(1-1) a halogen atom,

(1-2) a C1-C6 alkyl group,

(1-3) a C1-C6 alkanoyl group,

(1-4) a halogen-substituted C1-C6 alkyl group,

(1-5) a halogen-substituted C1-C6 alkoxy group,

(1-6) a cyano group,

(1-7) a C1-C6 alkoxy group,

(1-8) a C1-C6 alkylthio group,

(1-9) an imidazolyl group,

(1-10) a tri-C1-C6 alkylsilyl group,

(1-11) an oxadiazolyl group which may have 1 C1-C6 alkyl group,

(1-12) a pyrrolidinyl group which may have 1 oxo group,

(1-13) a phenyl group which may have 1 C1-C6 alkoxy group,

(1-14) a C1-C6 alkylamino-C1-C6 alkyl group,

(1-15) an oxo group,

(1-16) a pyrazolyl group which may have 1 C1-C6 alkyl group,

(1-17) a thienyl group,

(1-18) a furyl group,

(1-19) a thiazolyl group which may have 1 C1-C6 alkyl group,

(1-20) a C1-C6 alkylamino group,

(1-21) a pyrimidyl group which may have 1 C1-C6 alkyl group,

(1-22) a phenyl-C2-C6 alkenyl group,

(1-23) a phenoxy group which may have 1 halogen atom,

(1-24) a phenoxy-C1-C6 alkyl group,

(1-25) a pyrrolidinyl-C1-C6 alkoxy group,

(1-26) a C1-C6 alkylsulfamoyl group,

(1-27) a pyridazinyloxy group which may have 1 C1-C6 alkyl group,

(1-28) a phenyl-C1-C6 alkyl group,

(1-29) a C1-C6 alkylamino-C1-C6 alkoxy group,

(1-30) an imidazolyl-C1-C6 alkyl group,

(1-31) a phenyl-C1-C6 alkoxy group,

(1-32) a hydroxy group,

(1-34) a hydroxy-C1-C6 alkyl group,

(1-35) an oxazolyl group,

(1-36) a piperidyl group,

(1-37) a pyrrolyl group,

(1-38) a morpholinyl-C1-C6 alkyl group,

(1-39) a piperazinyl-C1-C6 alkyl group which may have a C1-C6 alkyl group(s),

(1-40) a piperidyl-C1-C6 alkyl group,

(1-41) a pyrrolidinyl-C1-C6 alkyl group,

(1-42) a morpholinyl group, and

(1-43) a piperazinyl group which may have 1 C1-C6 alkyl group.

4. The compound represented by the formula (1) or a pharmaceutically acceptable salt thereof according to claim 3, wherein

R^1 represents hydrogen;

R^2 and R^3, which are the same or different, each independently represent a C1-C6 alkyl group; or

R^2 and R^3 are bonded to form a cyclo-C3-C8 alkyl group; and

R^4 represents any of

(1) a phenyl group,

(2) an indolyl group,

(4) a naphthyl group,

(5) a benzofuryl group, and

(31) a pyrrolopyridyl group, wherein

these aromatic or heterocyclic groups may have 1 to 2 substituent(s) selected from

(1-1) a halogen atom,

(1-2) a C1-C6 alkyl group,

(1-5) a halogen-substituted C1-C6 alkoxy group,

(1-6) a cyano group, and

(1-7) a C1-C6 alkoxy group.

5. The heterocyclic compound represented by the general formula (1) or a salt thereof according to claim 4, which is selected from

(4a*S*,8a*R*)-1-(4-chlorophenyl)-3,3-dimethyldecahydroquinoxaline,

2-chloro-4-((4a*S*,8a*S*)-3,3-dimethyloctahydroquinoxalin-1(2*H*)-yl)benzonitrile,

(4a*S*,8a*R*)-1-(3-chloro-4-fluorophenyl)-3,3-dimethyldecahydroquinoxaline,

(4a*S*,8a*R*)-1-(7-fluorobenzofuran-4-yl)-3,3-dimethyldecahydroquinoxaline,

5-((4a*R*,8a*S*)-3,3-dimethyloctahydroquinoxalin-1(2*H*)-yl)-1-methyl-1*H*-indole-2-carbonitrile,

(4a'*R*,8a'*S*)-4'-(7-methoxybenzofuran-4-yl)octahydro-1'*H*-spiro[cyclobutane-1,2'-quinoxaline],

(4a*S*,8a*R*)-1-(6,7-difluorobenzofuran-4-yl)-3,3-dimethyldecahydroquinoxaline,

5-((4a*S*,8a*S*)-3,3-dimethyloctahydroquinoxalin-1(2*H*)-yl)-1*H*-indole-2-carbonitrile,

6-((4a*S*,8a*S*)-3,3-dimethyloctahydroquinoxalin-1(2*H*)-yl)-2-naphthonitrile,

(4a*S*,8a*S*)-3,3-dimethyl-1-(1*H*-pyrrolo[2,3-*b*]pyridin-4-yl)decahydroquinoxaline,

(4a*S*,8a*S*)-1-(4-(difluoromethoxy)-3-fluorophenyl)-3,3-dimethyldecahydroquinoxaline,

(4aS,8aS)- 1-(4-difluoromethoxy)phenyl-3,3-dimethyldecahydroquinoxaline and (4aR,8aR)- 1-(4-difluoromethoxy)-3-fluorophenyl-3,3-dimethyldecahydroquinoxaline.

6. A pharmaceutical composition comprising the compound represented by the formula (1) or a pharmaceutically acceptable salt thereof according to claim 1 as an active ingredient and a pharmaceutically acceptable carrier.

7. The compound of formula (1) or a pharmaceutically acceptable salt thereof as defined in claim 1, for use in the treatment of disorders caused by reduced neurotransmission of serotonin, norepinephrine or dopamine, wherein the disorder is selected from the group consisting of depression, depression status caused by adjustment disorder, anxiety caused by adjustment disorder, anxiety caused by various diseases, generalized anxiety disorder, phobia, obsessive-compulsive disorder, panic disorder, posttraumatic stress disorder, acute stress disorder, hypochondria, dissociative amnesia, avoidant personality disorder, body dysmorphic disorder, eating disorder, obesity, chemical dependence, pain, fibromyalgia, Alzheimer's disease, memory deficit, Parkinson's disease, restless leg syndrome, endocrine disorder, vasospasm, cerebellar ataxia, gastrointestinal disorder, negative syndrome of schizophrenia, premenstrual syndrome, stress urinary incontinence, Tourette's disorder, attention deficit hyperactivity disorder (ADHD), autism, Asperger syndrome, impulse control disorder, trichotillomania, kleptomania, gambling disorder, cluster headache, migraine, chronic paroxysmal hemicrania, chronic fatigue syndrome, precocious ejaculation, male impotence, narcolepsy, primary hypersomnia, cataplexy, sleep apnea syndrome and headache.

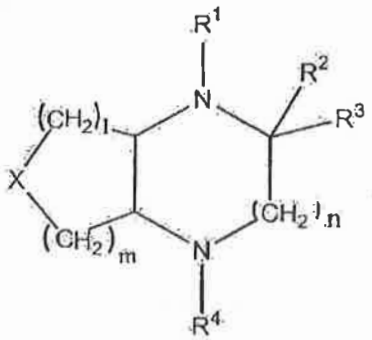
8. The compound for use according to claim 7, wherein the depression is selected from the group consisting of major depressive disorder; bipolar I disorder; bipolar II disorder; mixed state; dysthymic disorder; rapid cycler; atypical depression; seasonal affective disorder; postpartum depression; hypomelancholia; recurrent brief depressive disorder; refractory depression; chronic depression; double depression; alcohol-induced mood disorder; mixed anxiety-depressive disorder; depression caused by various physical diseases such as Cushing('s) syndrome, hypothyroidism, hyperparathyroidism, Addison's disease, amenorrhea-galactorrhea

syndrome, Parkinson's disease, Alzheimer's disease, cerebrovascular dementia, brain infarct, brain hemorrhage, subarachnoid hemorrhage, diabetes millitus, virus infection, multiple sclerosis, chronic fatigue syndrome, coronary artery disease, pain, cancer, etc.; presenile depression; senile depression; depression in children and adolescents; depression induced by drugs such as interferon, etc.

9. The compound for use according to claim 7, wherein the anxiety caused by various diseases is selected from the group consisting of anxiety caused by head injury, brain infection, inner ear impairment, cardiac failure, arrhythmia, hyperadrenalism, hyperthyroidism, asthma and chronic obstructive pulmonary disease.

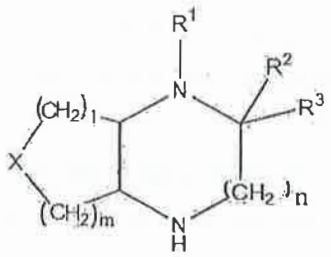
10. The compound for use according to claim 7, wherein the pain is selected from the group consisting of chronic pain, psychogenic pain, neuropathic pain, phantom limb pain, postherpetic neuralgia, traumatic cervical syndrome, spinal cord injury pain, trigeminal neuralgia, diabetic neuropathy.

11. A process for producing a compound of general formula (1):



or pharmaceutically acceptable salts thereof, wherein m, l, n, X, R^1, R^2, and R^3 are defined in the above in claim 1,

the process comprising reacting the compound represented by the general formula;



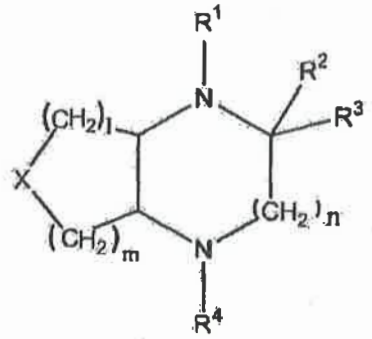
wherein m, l, n, X, R^1, R^2, and R^3 are defined in the above in claim 1 and the compound represented by the general formula;



wherein R^4 and X^1 are defined in the above in claim 1.

CLAIMS

1. A heterocyclic compound represented by the general formula (1) or a salt thereof:



wherein m, l, and n respectively represent an integer of 1 or 2; X represents -O- or -CH_2-;

R^1 represents hydrogen, a lower alkyl group, a hydroxy-lower alkyl group, a protecting group, or a tri-lower alkylsilyloxy-lower alkyl group;

R^2 and R^3, which are the same or different, each independently represent hydrogen or a lower alkyl group; or R_2 and R_3 are bonded to form a cyclo-C3-C8 alkyl group; and

R^4 represents an aromatic group or a heterocyclic group, wherein

the aromatic or heterocyclic group may have one or more arbitrary substituent(s).

2. The heterocyclic compound represented by the general formula (1) or a salt thereof according to claim 1, wherein

R^4 represents any of

(1) a phenyl group,

(2) an indolyl group,

(3) a benzothienyl group,

(4) a naphthyl group,

(5) a benzofuryl group,

(6) a quinolyl group,

(7) an isoquinolyl group,

(8) a pyridyl group,

(9) a thienyl group,

(10) a dihydrobenzoxazinyl group,

(11) a dihydrobenzodioxinyl group,

(12) a dihydroquinolyl group,

(13) a chromanyl group,

(14) a quinoxalinyl group,

(15) a dihydroindenyl group,

(16) a dihydrobenzofuryl group,

(17) a benzodioxolyl group,

(18) an indazolyl group,

(19) a benzothiazolyl group,

(20) an indolinyl group,

(21) a thienopyridyl group,

(22) a tetrahydrobenzazepinyl group,

(23) a tetrahydrobenzodiazepinyl group,

(24) a dihydrobenzodioxepinyl group,

(25) a fluorenyl group,

(26) a pyridazinyl group,

(27) a tetrahydroquinolyl group,

(28) a carbazolyl group,

(29) a phenanthryl group,

(30) a dihydroacenaphthylenyl group,

(31) a pyrrolopyridyl group,

(32) an anthryl group,

(33) a benzodioxinyl group,

(34) a pyrrolidinyl group,

(35) a pyrazolyl group,

(36) an oxadiazolyl group,

(37) a pyrimidinyl group,

(38) a tetrahydronaphthyl group,

(39) a dihydroquinazolinyl group,

(40) a benzoxazolyl group,

(41) a thiazolyl group,

(42) a quinazolinyl group,

(43) a phthalazinyl group,

(44) a pyrazinyl group, and

(45) a chromenyl group, wherein

these aromatic or heterocyclic groups may have one or more substituent(s) selected from

(1-1) a halogen atom,

(1-2) a lower alkyl group,

(1-3) a lower alkanoyl group,

(1-4) a halogen-substituted lower alkyl group,

(1-5) a halogen-substituted lower alkoxy group,

(1-6) a cyano group,

(1-7) a lower alkoxy group,

(1-8) a lower alkylthio group,

(1-9) an imidazolyl group,

(1-10) a tri-lower alkylsilyl group,

(1-11) an oxadiazolyl group which may have a lower alkyl group(s),

(1-12) a pyrrolidinyl group which may have an oxo group(s),

(1-13) a phenyl group which may have a lower alkoxy group(s),

(1-14) a lower alkylamino-lower alkyl group,

(1-15) an oxo group,

(1-16) a pyrazolyl group which may have a lower alkyl group(s),

(1-17) a thienyl group,

(1-18) a furyl group,

(1-19) a thiazolyl group which may have a lower alkyl group(s),

(1-20) a lower alkylamino group,

(1-21) a pyrimidyl group which may have a lower alkyl group(s),

(1-22) a phenyl-lower alkenyl group,

(1-23) a phenoxy group which may have a halogen atom(s),

(1-24) a phenoxy-lower alkyl group,

(1-25) a pyrrolidinyl-lower alkoxy group,

(1-26) a lower alkylsulfamoyl group,

(1-27) a pyridazinyloxy group which may have a lower alkyl group(s),

(1-28) a phenyl-lower alkyl group,

(1-29) a lower alkylamino-lower alkoxy group,

(1-30) an imidazolyl-lower alkyl group,

(1-31) a phenyl-lower alkoxy group,

(1-32) a hydroxy group,

(1-33) a lower alkoxycarbonyl group,

(1-34) a hydroxy-lower alkyl group,

(1-35) an oxazolyl group,

(1-36) a piperidyl group,

(1-37) a pyrrolyl group,

(1-38) a morpholinyl-lower alkyl group,

(1-39) a piperazinyl-lower alkyl group which may have a lower alkyl group(s),

(1-40) a piperidyl-lower alkyl group,

(1-41) a pyrrolidinyl-lower alkyl group,

(1-42) a morpholinyl group, and

(1-43) a piperazinyl group which may have a lower alkyl group(s).

3. The heterocyclic compound represented by the general formula (1) or a salt thereof according to claim 2, wherein

R^4 represents any of

(1) a phenyl group,

(2) an indolyl group,

(3) a benzothienyl group,

(4) a naphthyl group,

(5) a benzofuryl group,

(6) a quinolyl group,

(7) an isoquinolyl group,

(8) a pyridyl group,

(9) a thienyl group,

(10) a dihydrobenzoxazinyl group,

(11) a dihydrobenzodioxinyl group,

(12) a dihydroquinolyl group,

(13) a chromanyl group,

(14) a quinoxalinyl group,

(15) a dihydroindenyl group,

(16) a dihydrobenzofuryl group,

(17) a benzodioxolyl group,

(18) an indazolyl group,

(19) a benzothiazolyl group,

(20) an indolinyl group,

(21) a thienopyridyl group,

(22) a tetrahydrobenzazepinyl group,

(23) a tetrahydrobenzodiazepinyl group,

(24) a dihydrobenzodioxepinyl group,

(25) a fluorenyl group,

(26) a pyridazinyl group,

(27) a tetrahydroquinolyl group,

(28) a carbazolyl group,

(29) a phenanthryl group,

(30) a dihydroacenaphthylenyl group,

(31) a pyrrolopyridyl group,

(32) an anthryl group,

(33) a benzodioxinyl group,

(34) a pyrrolidinyl group,

(35) a pyrazolyl group,

(36) an oxadiazolyl group,

(37) a pyrimidinyl group,

(38) a tetrahydronaphthyl group,

(39) a dihydroquinazolinyl group,

(40) a benzoxazolyl group,

(41) a thiazolyl group,

(42) a quinazolinyl group,

(43) a phthalazinyl group,

(44) a pyrazinyl group, and

(45) a chromenyl group, wherein

these aromatic or heterocyclic groups may have 1 to 4 substituent(s) selected from

(1-1) a halogen atom,

(1-2) a lower alkyl group,

(1-3) a lower alkanoyl group,

(1-4) a halogen-substituted lower alkyl group,

(1-5) a halogen-substituted lower alkoxy group,

(1-6) a cyano group,

(1-7) a lower alkoxy group,

(1-8) a lower alkylthio group,

(1-9) an imidazolyl group,

(1-10) a tri-lower alkylsilyl group,

(1-11) an oxadiazolyl group which may have 1 lower alkyl group,

(1-12) a pyrrolidinyl group which may have 1 oxo group,

(1-13) a phenyl group which may have 1 lower alkoxy group,

(1-14) a lower alkylamino-lower alkyl group,

(1-15) an oxo group,

(1-16) a pyrazolyl group which may have 1 lower alkyl group,

(1-17) a thienyl group,

(1-18) a furyl group,

(1-19) a thiazolyl group which may have 1 lower alkyl group,

(1-20) a lower alkylamino group,

(1-21) a pyrimidyl group which may have 1 lower alkyl group,

(1-22) a phenyl-lower alkenyl group,

(1-23) a phenoxy group which may have 1 halogen atom,

(1-24) a phenoxy-lower alkyl group,

(1-25) a pyrrolidinyl-lower alkoxy group,

(1-26) a lower alkylsulfamoyl group,

(1-27) a pyridazinyloxy group which may have 1 lower alkyl group,

(1-28) a phenyl-lower alkyl group,

(1-29) a lower alkylamino-lower alkoxy group,

(1-30) an imidazolyl-lower alkyl group,

(1-31) a phenyl-lower alkoxy group,

(1-32) a hydroxy group,

(1-33) a lower alkoxycarbonyl group,

(1-34) a hydroxy-lower alkyl group,

(1-35) an oxazolyl group,

(1-36) a piperidyl group,

(1-37) a pyrrolyl group,

(1-38) a morpholinyl-lower alkyl group,

(1-39) a piperazinyl-lower alkyl group which may have 1 lower alkyl group,

(1-40) a piperidyl-lower alkyl group,

(1-41) a pyrrolidinyl-lower alkyl group,

(1-42) a morpholinyl group, and

(1-43) a piperazinyl group which may have 1 lower alkyl group.

4. The heterocyclic compound represented by the general formula (1) or a salt thereof according to claim 3, wherein

m represents 2; l and n respectively represent an integer of 1; X represents $-CH_2-$;

R^1 represents hydrogen, a lower alkyl group, a hydroxy-lower alkyl group, a benzyl group, or a tri-lower alkylsilyloxy-lower alkyl group; and

R^4 represents any of

(1) a phenyl group,

(2) an indolyl group,

(4) a naphthyl group,

(5) a benzofuryl group, and

(31) a pyrrolopyridyl group, wherein

these aromatic or heterocyclic groups may have 1 to 4 substituent(s) selected from

(1-1) a halogen atom,

(1-2) a lower alkyl group,

(1-3) a lower alkanoyl group,

(1-4) a halogen-substituted lower alkyl group,

(1-5) a halogen-substituted lower alkoxy group,

(1-6) a cyano group,

(1-7) a lower alkoxy group,

(1-8) a lower alkylthio group,

(1-9) an imidazolyl group,

(1-10) a tri-lower alkylsilyl group,

(1-11) an oxadiazolyl group which may have 1 lower alkyl group,

(1-12) a pyrrolidinyl group which may have 1 oxo group,

(1-13) a phenyl group which may have 1 lower alkoxy group,

(1-14) a lower alkylamino-lower alkyl group,

(1-15) an oxo group,

(1-16) a pyrazolyl group which may have 1 lower alkyl group,

(1-17) a thienyl group,

(1-18) a furyl group,

(1-19) a thiazolyl group which may have 1 lower alkyl group,

(1-20) a lower alkylamino group,

(1-21) a pyrimidyl group which may have 1 lower alkyl group,

(1-22) a phenyl-lower alkenyl group,

(1-23) a phenoxy group which may have 1 halogen atom,

(1-24) a phenoxy-lower alkyl group,

(1-25) a pyrrolidinyl-lower alkoxy group,

(1-26) a lower alkylsulfamoyl group,

(1-27) a pyridazinyloxy group which may have 1 lower alkyl group,

(1-28) a phenyl-lower alkyl group,

(1-29) a lower alkylamino-lower alkoxy group,

(1-30) an imidazolyl-lower alkyl group,

(1-31) a phenyl-lower alkoxy group,

(1-32) a hydroxy group,

(1-34) a hydroxy-lower alkyl group,

(1-35) an oxazolyl group,

(1-36) a piperidyl group,

(1-37) a pyrrolyl group,

(1-38) a morpholinyl-lower alkyl group,

(1-39) a piperazinyl-lower alkyl group which may have a lower alkyl group(s),

(1-40) a piperidyl-lower alkyl group,

(1-41) a pyrrolidinyl-lower alkyl group,

(1-42) a morpholinyl group, and

(1-43) a piperazinyl group which may have 1 lower alkyl group.

5. The heterocyclic compound represented by the general formula (1) or a salt thereof according to claim 4, wherein

R^1 represents hydrogen;

R^2 and R^3, which are the same or different, each independently represent a lower alkyl group; or

R^2 and R^3 are bonded to form a cyclo-C3-C8 alkyl group; and

R^4 represents any of

(1) a phenyl group,

(2) an indolyl group,

(4) a naphthyl group,

(5) a benzofuryl group, and

(31) a pyrrolopyridyl group, wherein

these aromatic or heterocyclic groups may have 1 to 2 substituent(s) selected from

(1-1) a halogen atom,

(1-2) a lower alkyl group,

(1-5) a halogen-substituted lower alkoxy group,

(1-6) a cyano group, and

(1-7) a lower alkoxy group.

6. The heterocyclic compound represented by the general formula (1) or a salt thereof according to claim 5, which is selected from
(4a*S*,8a*R*)-1-(4-chlorophenyl)-3,3-dimethyldecahydroquinoxaline,
2-chloro-4-((4a*S*,8a*S*)-3,3-dimethyloctahydroquinoxalin-1(2*H*)-yl)benzonitrile,
(4a*S*,8a*R*)-1-(3-chloro-4-fluorophenyl)-3,3-dimethyldecahydroquinoxaline,
(4a*S*,8a*R*)-1-(7-fluorobenzofuran-4-yl)-3,3-dimethyldecahydroquinoxaline,
5-((4a*R*,8a*S*)-3,3-dimethyloctahydroquinoxalin-1(2*H*)-yl)-1-methyl-1*H*-indole-2-carbonitrile,
(4a'*R*,8a'*S*)-4'-(7-methoxybenzofuran-4-yl)octahydro-1'*H*-spiro[cyclobutane-1,2'-quinoxaline],
(4a*S*,8a*R*)-1-(6,7-difluorobenzofuran-4-yl)-3,3-dimethyldecahydroquinoxaline,
5-((4a*S*,8a*S*)-3,3-dimethyloctahydroquinoxalin-1(2*H*)-yl)-1*H*-indole-2-carbonitrile,
(4a*S*,8a*R*)-1-(7-chloro-2,3-dihydro-1*H*-inden-4-yl)-3,3-dimethyldecahydroquinoxaline,
6-((4a*S*,8a*S*)-3,3-dimethyloctahydroquinoxalin-1(2*H*)-yl)-2-naphthonitrile,
(4a*S*,8a*S*)-3,3-dimethyl-1-(1*H*-pyrrolo[2,3-*b*]pyridin-4-yl)decahydroquinoxaline,
(4a*S*,8a*S*)-1-(4-(difluoromethoxy)-3-fluorophenyl)-3,3-dimethyldecahydroquinoxaline,
(4aS,8aS)-1-(4-(difluoromethoxy)phenyl)-3,3-dimethyldecahydroquinoxaline, and
(4aR,8aR)-1-(4-(difluoromethoxy)-3-fluorophenyl)-3,3-dimethyldecahydroquinoxaline.

7. A pharmaceutical composition comprising a heterocyclic compound represented by the general formula (1) or a salt thereof according to claim 1 as an active ingredient and a pharmaceutically acceptable carrier.

8. A prophylactic and/or therapeutic agent for disorders caused by reduced neurotransmission of serotonin, norepinephrine or dopamine, comprising as an active ingredient a heterocyclic compound of general formula (1) or a salt thereof according to claim 1.

9. A prophylactic and/or therapeutic agent according to claim 8, wherein the disorder is selected from the group consisting of depression, depression status caused by adjustment disorder, anxiety caused by adjustment disorder, anxiety caused by various diseases, generalized anxiety disorder, phobia, obsessive-compulsive disorder, panic disorder, posttraumatic stress disorder, acute stress disorder, hypochondria, dissociative amnesia, avoidant personality disorder, body dysmorphic disorder, eating disorder, obesity, chemical dependence, pain, fibromyalgia, Alzheimer's disease, memory deficit, Parkinson's disease, restless leg syndrome, endocrine disorder, vasospasm, cerebellar ataxia, gastrointestinal

disorder, negative syndrome of schizophrenia, premenstrual syndrome, stress urinary incontinence, Tourette's disorder, attention deficit hyperactivity disorder (ADHD), autism, Asperger syndrome, impulse control disorder, trichotillomania, kleptomania, gambling disorder, cluster headache, migraine,

chronic paroxysmal hemicrania, chronic fatigue syndrome, precocious ejaculation, male impotence, narcolepsy, primary hypersomnia, cataplexy, sleep apnea syndrome and headache.

10. A prophylactic and/or therapeutic agent according to claim 9, wherein the depression is selected from the group consisting of major depressive disorder; bipolar I disorder; bipolar II disorder; mixed state; dysthymic disorder; rapid cycler; atypical depression; seasonal affective disorder; postpartum depression; hypomelancholia; recurrent brief depressive disorder; refractory depression; chronic depression; double depression; alcohol-induced mood disorder; mixed anxiety-depressive disorder; depression caused by various physical diseases such as Cushing('s) syndrome, hypothyroidism, hyperparathyroidism, Addison's disease, amenorrhea-galactorrhea syndrome, Parkinson's disease, Alzheimer's disease, cerebrovascular dementia, brain infarct、brain hemorrhage、subarachnoid hemorrhage, diabetes millitus, virus infection, multiple sclerosis, chronic fatigue syndrome, coronary artery disease, pain, cancer, etc.; presenile depression; senile depression; depression in children and adolescents; depression induced by drugs such as interferon, etc.

11. A prophylactic and/or therapeutic agent according to claim 9, wherein the anxiety caused by various diseases is selected from the group consisting of anxiety caused by head injury, brain infection, inner ear impairment, cardiac failure, arrhythmia, hyperadrenalism, hyperthyroidism, asthma and chronic obstructive pulmonary disease.

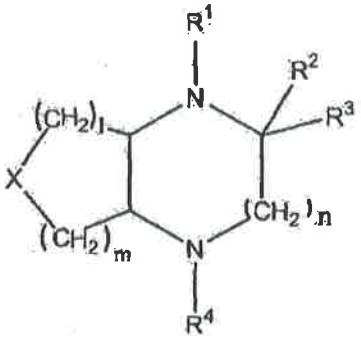
12. A prophylactic and/or therapeutic agent according to claim 9, wherein the pain is selected from the group consisting of chronic pain, psychogenic pain, neuropathic pain, phantom limb pain, postherpetic neuralgia, traumatic cervical syndrome, spinal cord injury pain, trigeminal neuralgia, diabetic neuropathy.

13. Use of a heterocyclic compound of the general formula (1) or a salt thereof according to any one of claims 1 to 6 as a drug.

14. Use of a heterocyclic compound of the general formula (1) or a salt thereof according to any one of claims 1 to 6 as a serotonine reuptake inhibitor and/or a norepinephrine reuptake inhibitor and/or a dopamine reuptake inhibitor.

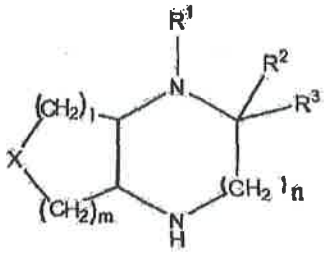
15. A method for treating and/or preventing disorders caused by reduced neurotransmission of serotonin, norephnephrine or dopamine, comprising administering a heterocyclic compound of general formula (1) or a salt thereof according to claims 1 to 6 to a human or an animal.

16. A process for producing a heterocyclic compound of general formula (1):



or salts thereof, wherein m, l and n respectively represent an integer of 1 or 2; X, R^1, R^2, and R^3 are defined in the above in claim 1,

the process comprising reacting the compound represented by the general formula;



wherein m, l and n respectively represent an integer of 1 or 2; X, R^1, R^2, and R^3 are defined in the above in claim 1 and the compound represented by the general formula;

R^4——X_1

wherein R^4 and X^1 are defined in the above in claim 1.