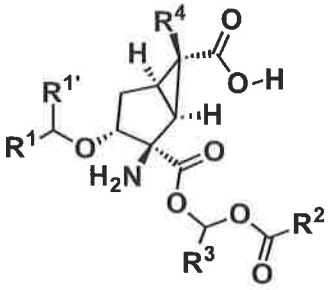
Claims

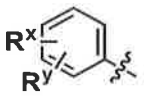
[Claim 1] A compound represented by formula (I-A):



(I-A)

wherein

R^1 represents a C_{1-6} alkyl group, a heteroaryl group optionally substituted by one halogen atom, or the following formula (IIIA):



(IIIA)

where R^x represents a hydrogen atom, a halogen atom, a C_{1-6} alkyl group, or a C_{1-6} alkoxy group, wherein the C_{1-6} alkyl group and the C_{1-6} alkoxy group are each optionally substituted by one to three halogen atoms, and

R^y represents a hydrogen atom, a fluorine atom, a C_{1-6} alkyl group, or a C_{1-6} alkoxy group, wherein the C_{1-6} alkyl group and the C_{1-6} alkoxy group are each optionally substituted by one to three halogen atoms,

$R^{1'}$ represents a hydrogen atom or a C_{1-6} alkyl group,

or R^1 and $R^{1'}$ optionally form a C_{3-8} cycloalkane together with the carbon atom adjacent thereto,

R^2 represents a C_{3-6} alkyl group, a C_{3-8} cycloalkyl group optionally substituted by one to three C_{1-6} alkyl groups, a C_{3-8}

cycloalkoxy group optionally substituted by one to three C_{1-6} alkyl groups and optionally having a C_{1-5} alkylene group crosslinking two different carbon atoms in the ring, an adamantyl group optionally substituted by one to three C_{1-6} alkyl groups, or a phenyl group,

R^3 represents a hydrogen atom or a C_{1-6} alkyl group, and

R^4 represents a hydrogen atom or a fluorine atom,

or a pharmaceutically acceptable salt thereof.

[Claim 2] The compound according to claim 1, wherein R^4 is a fluorine atom, or a pharmaceutically acceptable salt thereof.

[Claim 3] The compound according to claim 2, wherein R^2 is a C_{3-6} alkyl group, a C_{3-8} cycloalkyl group optionally substituted by one to three C_{1-6} alkyl groups, a C_{3-8} cycloalkoxy group optionally substituted by one to three C_{1-6} alkyl groups and optionally having a C_{1-5} alkylene group crosslinking two different carbon atoms in the ring, an adamantyl group optionally substituted by one to three C_{1-6} alkyl groups, or a phenyl group, or a pharmaceutically acceptable salt thereof.

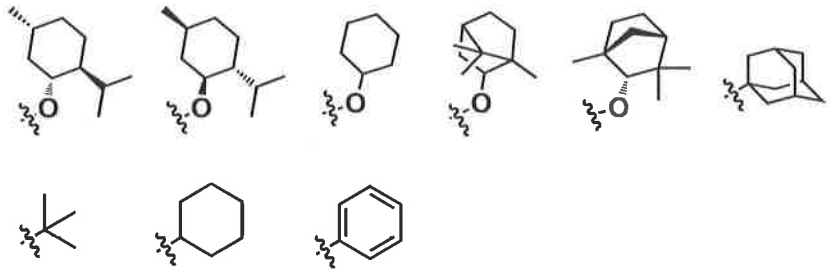
[Claim 4] The compound according to claim 2 or 3, wherein

R^1 is an ethyl group, a 4-fluorophenyl group, a 3,4-difluorophenyl group, a 4-fluoro-3-methoxyphenyl group, a 4-(trifluoromethyl)phenyl group, a 3-fluorophenyl group, a 4-methylphenyl group, a 6-chloropyridin-2-yl group, a 6-chloropyridin-3-yl group, a 5-chloropyridin-2-yl group or a 2-methylpropyl group,

$R^{1'}$ represents a hydrogen atom or a methyl group,

or R^1 and $R^{1'}$ optionally form a cyclopentane together with the carbon atom adjacent thereto,

R^2 represents any structure of the following formula group (IIIB):



(IIIB)

and

R^3 is a hydrogen atom or a C_{1-6} alkyl group, or a pharmaceutically acceptable salt thereof.

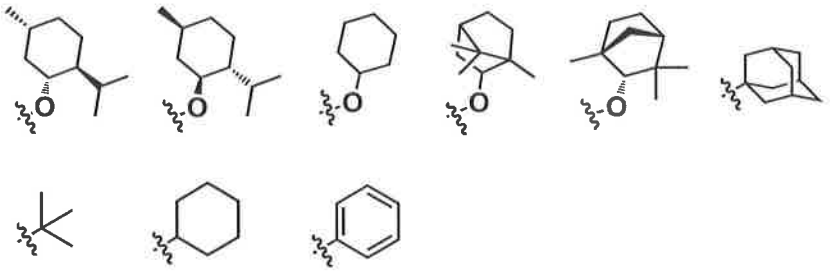
[Claim 5] The compound according to claim 1, wherein R^4 is a hydrogen atom, or a pharmaceutically acceptable salt thereof.

[Claim 6] The compound according to claim 5, wherein R^1 is an ethyl group, a 4-fluorophenyl group, a 3,4-difluorophenyl group, a 4-fluoro-3-methoxyphenyl group, a 4-(trifluoromethyl)phenyl group, a 3-fluorophenyl group, a 4-methylphenyl group, a 6-chloropyridin-2-yl group, a 6-chloropyridin-3-yl group, a 5-chloropyridin-2-yl group or a 2-methylpropyl,

$R^{1'}$ represents a hydrogen atom or a methyl group,

or R^1 and $R^{1'}$ optionally form a cyclopentane together with the carbon atom adjacent thereto,

R^2 represents any structure of the following formula group (IIIB):



(IIIB)

and

R^3 is a hydrogen atom or a C_{1-6} alkyl group, or a pharmaceutically acceptable salt thereof.

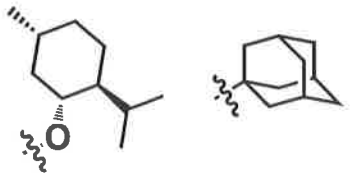
[Claim 7] The compound according to claim 5 or 6, wherein R^1 is a 4-fluorophenyl group or a 3,4-difluorophenyl group, or a pharmaceutically acceptable salt thereof.

[Claim 8] The compound according to any one of claims 5 to 7, wherein

R^1 is a 4-fluorophenyl group,

$R^{1'}$ is a hydrogen atom, and

R^2 represents any structure of the following formula group (IIIb):

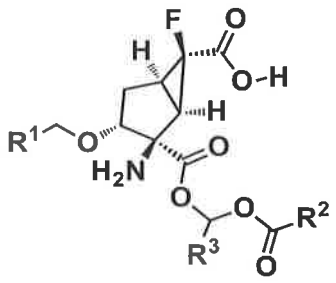


(IIIb)

or a pharmaceutically acceptable salt thereof.

[Claim 9] The compound according to any one of claims 5 to 8, wherein R^3 is a methyl group, or a pharmaceutically acceptable salt thereof.

[Claim 10] A compound represented by formula (I):

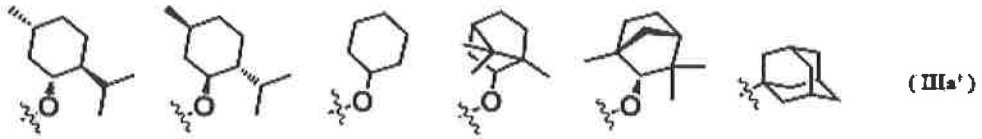


(I)

wherein

R^1 represents an ethyl group, a 4-fluorophenyl group or a 3,4-difluorophenyl group,

R^2 represents any structure of the following formula group (IIIa'):



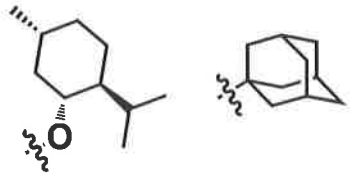
(IIIa')

and

R^3 represents a hydrogen atom or a C_{1-6} alkyl group,

or a pharmaceutically acceptable salt thereof.

[Claim 11] The compound according to claim 10, wherein R^2 represents any structure of the following formula group (IIIb):



(IIIb)

or a pharmaceutically acceptable salt thereof.

[Claim 12] The compound according to claim 10 or 11, wherein R^3 is a methyl group, or a pharmaceutically acceptable salt thereof.

[Claim 13] The compound according to claim 1, wherein the compound is any of the following compounds:

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(4-fluorophenyl)methoxy]-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(4-fluorophenyl)methoxy]-2-({[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]methoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-[(3,4-difluorophenyl)methoxy]-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-[(3,4-difluorophenyl)methoxy]-6-fluoro-2-({[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]methoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-2-({(1R)-1-[({[(1R,2S,5R)-5-methyl-2-(propan-2-yl)cyclohexyl]oxy}carbonyl)oxy]ethoxy}carbonyl)-3-propoxybicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-2-({1-[({[(1S,2R,5S)-5-methyl-2-(propan-2-yl)cyclohexyl]oxy}carbonyl)oxy]ethoxy}carbonyl)-3-propoxybicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(4-fluorophenyl)methoxy]-2-({1-[({[(1S,2R,4S)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-yl]oxy}carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-propoxy-2-({1-[({[(1S,2R,4S)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-yl]oxy}carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(4-fluorophenyl)methoxy]-2-({1-[({[(1R,2S,4R)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-yl]oxy}carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)-3-{[4-(trifluoromethyl)phenyl]methoxy}bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(3-fluorophenyl)methoxy]-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-[(6-chloropyridin-2-yl)methoxy]-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(1R)-1-(4-fluoro-3-methoxyphenyl)ethoxy]-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-[(5-chloropyridin-2-yl)methoxy]-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-[(6-chloropyridin-3-yl)methoxy]-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(4-methylphenyl)methoxy]-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-(3-methylbutoxy)-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-(cyclopentyloxy)-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(3-fluorophenyl)methoxy]-2-({(1R)-1-[({[(1R,2S,5R)-5-methyl-2-(propan-2-yl)cyclohexyl]oxy}carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-[(6-chloropyridin-2-yl)methoxy]-6-fluoro-2-({(1R)-1-[({[(1R,2S,5R)-5-methyl-2-(propan-2-yl)cyclohexyl]oxy}carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-2-({[(2,2-dimethylpropanoyl)oxy]methoxy}carbonyl)-6-fluoro-3-[(4-fluorophenyl)methoxy]bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-2-{[(benzoyloxy)methoxy]carbonyl}-6-

fluoro-3-[(4-fluorophenyl)methoxy]bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-2-({[(cyclohexanecarbonyl)oxy]methoxy}carbonyl)-6-fluoro-3-[(4-fluorophenyl)methoxy]bicyclo[3.1.0]hexane-6-carboxylic acid,

and

(1S,2R,3R,5R,6S)-2-amino-3-[(4-fluorophenyl)methoxy]-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

or a pharmaceutically acceptable salt thereof.

[Claim 14] The compound according to claim 1, wherein the compound is any of the following compounds:

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(4-fluorophenyl)methoxy]-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(4-fluorophenyl)methoxy]-2-({[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]methoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-[(3,4-difluorophenyl)methoxy]-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-[(3,4-difluorophenyl)methoxy]-6-fluoro-2-({[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]methoxy}carbonyl)bicyclo[3.1.0]hexane-6-

carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-2-({(1R)-1-[({[(1R,2S,5R)-5-methyl-2-(propan-2-yl)cyclohexyl]oxy}carbonyl)oxy]ethoxy}carbonyl)-3-propoxybicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.$1^{3,7}$]decane-1-carbonyl)oxy]ethoxy}carbonyl)-3-{[4-(trifluoromethyl)phenyl]methoxy}bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(3-fluorophenyl)methoxy]-2-({(1S)-1-[(tricyclo[3.3.1.$1^{3,7}$]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-[(6-chloropyridin-2-yl)methoxy]-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.$1^{3,7}$]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(1R)-1-(4-fluoro-3-methoxyphenyl)ethoxy]-2-({(1S)-1-[(tricyclo[3.3.1.$1^{3,7}$]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-[(5-chloropyridin-2-yl)methoxy]-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.$1^{3,7}$]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-[(6-chloropyridin-3-yl)methoxy]-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.$1^{3,7}$]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic

acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(4-methylphenyl)methoxy]-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-(3-methylbutoxy)-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

(1R,2R,3R,5R,6R)-2-amino-3-(cyclopentyloxy)-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

and

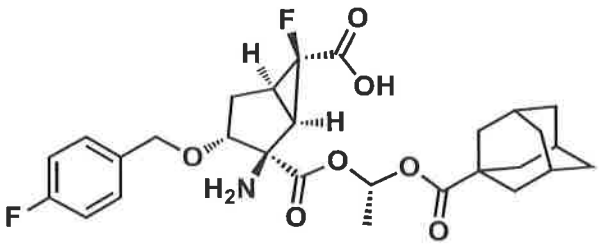
(1S,2R,3R,5R,6S)-2-amino-3-[(4-fluorophenyl)methoxy]-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

or a pharmaceutically acceptable salt thereof.

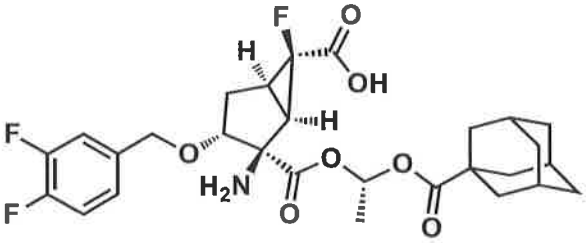
[Claim 15] The compound according to any one of claims 1 to 4 or 10 to 12, wherein the compound is the following compound:

(1R,2R,3R,5R,6R)-2-amino-6-fluoro-3-[(4-fluorophenyl)methoxy]-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,

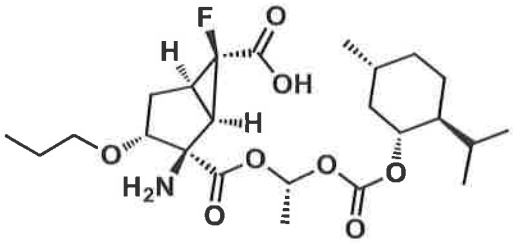
or a pharmaceutically acceptable salt thereof.



[Claim 16] The compound according to any one of claims 1 to 4 or 10 to 12, wherein the compound is the following compound:
(1R,2R,3R,5R,6R)-2-amino-3-[(3,4-difluorophenyl)methoxy]-6-fluoro-2-({(1S)-1-[(tricyclo[3.3.1.1^{3,7}]decane-1-carbonyl)oxy]ethoxy}carbonyl)bicyclo[3.1.0]hexane-6-carboxylic acid,
or a pharmaceutically acceptable salt thereof.



[Claim 17] The compound according to any one of claims 1 to 4 or 10 to 12, wherein the compound is the following compound:
(1R,2R,3R,5R,6R)-2-amino-6-fluoro-2-({(1R)-1-[({[(1R,2S,5R)-5-methyl-2-(propan-2-yl)cyclohexyl]oxy}carbonyl)oxy]ethoxy}carbonyl)-3-propoxybicyclo[3.1.0]hexane-6-carboxylic acid,
or a pharmaceutically acceptable salt thereof.



[Claim 18] A drug comprising the compound according to any one of claims 1 to 17 or a pharmaceutically acceptable salt thereof and a pharmaceutically acceptable carrier, excipient or diluent.

[Claim 19] An agent for prevention or treatment of a condition selected from the group consisting of mood disorders, anxiety disorder, cognitive disorders, developmental disorders, Alzheimer's disease, Parkinson's disease, sleep disorders, Huntington's chorea, eating disorders, drug dependence, epilepsy, brain infarction, cerebral ischemia, cerebral edema, head trauma, inflammation and immune-related diseases, comprising the compound according to any one of claims 1 to 17 or a pharmaceutically acceptable salt thereof.

[Claim 20] The agent according to claim 19, wherein the condition is a mood disorder selected from depression and bipolar disorder.