

pulse width, 0.033Hz) with a concentric bipolar electrode to evoke field excitatory post synaptic potentials (fEPSPs) recorded from the stratum radiatum of the CA1 region. Experiments were performed to examine the effect of compound compared to 1 μ M carbachol (CCh), on the amplitude of fEPSPs in the CA1 region of rat hippocampal slices. 1 μ M CCh was initially applied until steady-state, followed by wash, before performing a five point cumulative concentration-response to compound. Each compound was tested on 6 slices and results averaged. Drug preparation, compound was dissolved in 100% DMSO at a stock concentration of 30 mM, and diluted according to requirements, carbamoylcholine chloride (CCh) was purchased from Sigma (Cat#C4382) and dissolved at a stock concentration of 1 mM in ddH₂O.

Table 4	
Ex.No.	Cell Firing EC50 (mM)
6	4.10E-06 $\pm$ 0.2
27	1.21E-06 $\pm$ 0.08
40	9.40E-06 $\pm$ 0.09
65	2.05E-06 $\pm$ 0.06

EXAMPLE F

PHARMACEUTICAL FORMULATIONS

(i) Tablet Formulation

A tablet composition containing a compound of the formula (1) is prepared by mixing 50 mg of the compound with 197 mg of lactose (BP) as diluent, and 3 mg magnesium stearate as a lubricant and compressing to form a tablet in known manner.

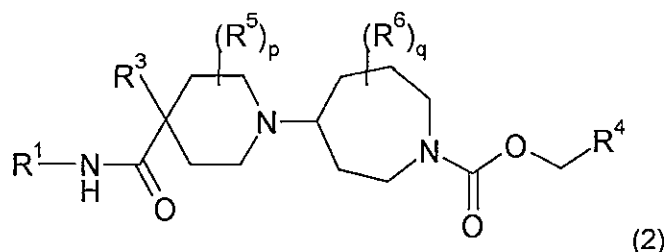
(ii) Capsule Formulation

A capsule formulation is prepared by mixing 100 mg of a compound of the formula (1) with 100 mg lactose and optionally 1% by weight of magnesium stearate and filling the resulting mixture into standard opaque hard gelatin capsules.

Equivalents

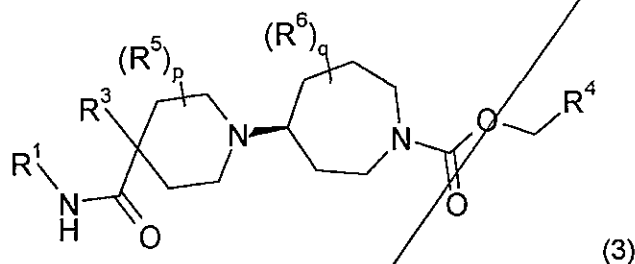
The foregoing examples are presented for the purpose of illustrating the invention and should not be construed as imposing any limitation on the scope of the invention. It will readily be apparent that numerous modifications and alterations may be made to the specific embodiments of the invention described above and illustrated in the examples without departing from the principles underlying the invention. All such modifications and alterations are intended to be embraced by this application.

10. A compound according to claim 1 having the formula (2):



wherein R^1 , R^3 , R^4 , R^5 , R^6 , p and q are as defined in any one of claims 1 to 9.

11. A compound according to claim 1 having the formula (3):



wherein R^1 , R^3 , R^4 , R^5 , R^6 , p and q are as defined in any one of claims 1 to 9.

12. A compound according to claim 10 or 11 wherein p is 0, q is 0 and R^3 is H.

13. A compound according to any one of claims 10 to 12 wherein R^1 is selected from 2-methylpropyl, *tert*-butyl, 2-methylbutyl, 2,2-dimethylpropyl, 2-methylbut-2-yl, cyclobutylmethyl, cyclopropylmethyl, cyclopentylmethyl, isopropyl, 1-methylcyclohexyl, 1-methylcyclopentylmethyl, 2-cyclopropylpropyl, 1-methylcyclobutyl, cyclopentyl, 2,3-dimethylbutan-2-yl, 1-ethylcyclobutylmethyl, 1-methylcyclopentyl, 2-cyclopropylpropan-2-yl, cyclobutyl, 1-methylcyclobutylmethyl, 1-(trifluoromethyl)cyclobutyl, 1-ethylcyclobutyl, $(^2H_3)$ methyl $(^2H_6)$ propyl and 2-methylpentan-2-yl.

14. A compound according to claim 1 wherein the compound is selected from compounds numbered 1-82 as shown in table 1.

15. A compound according to claim 1 which is selected from:

ethyl 4-(4-((2-methylpropyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
ethyl (4*S*)-4-[4-((2-methylpropyl)methylcarbamoyl)piperidin-1-yl]azepane-1-carboxylate;

ethyl (4*R*)-4-[4-((2-methylpropyl)methylcarbamoyl)piperidin-1-yl]azepane-1-carboxylate;

ethyl 4-(4-((1-methylcyclobutyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

5 ethyl (4*S*)-4-[4-[(1-methylcyclobutyl)carbamoyl]-1-piperidyl]azepane-1-carboxylate;
and salts thereof.

16. A compound according to any one of claims 1 to 15 for use in medicine.

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17. A pharmaceutical composition comprising a compound as defined in any one of claims 1 to 15 and a pharmaceutically acceptable excipient.

18. A compound according to any one of claims 1 to 15 having muscarinic M1
15 receptor agonist activity.

19. An invention as defined in any one of Embodiments 1.1 to 1.70, 2.1 to 2.26, 3.1 and 4.1 to 4.3 herein.

20 20. A compound according to claims 1 to 15 for use in the treatment of a cognitive disorder or psychotic disorder or for the treatment or lessening the severity of acute, chronic, neuropathic, or inflammatory pain.

pulse width, 0.033Hz) with a concentric bipolar electrode to evoke field excitatory post synaptic potentials (fEPSPs) recorded from the stratum radiatum of the CA1 region. Experiments were performed to examine the effect of compound compared to 1 μ M carbachol (CCh), on the amplitude of fEPSPs in the CA1 region of rat hippocampal slices. 1 μ M CCh was initially applied until steady-state, followed by wash, before performing a five point cumulative concentration-response to compound. Each compound was tested on 6 slices and results averaged. Drug preparation; compound was dissolved in 100% DMSO at a stock concentration of 30 mM, and diluted according to requirements, carbamoylcholine chloride (CCh) was purchased from Sigma (Cat#C4382) and dissolved at a stock concentration of 1 mM in ddH₂O.

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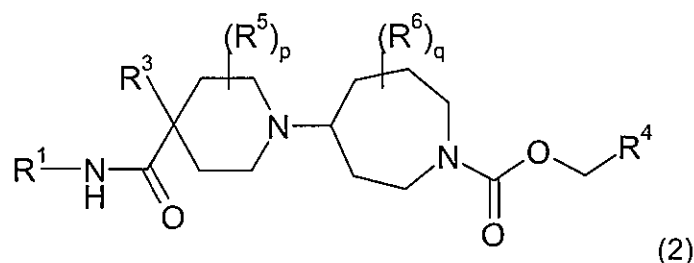
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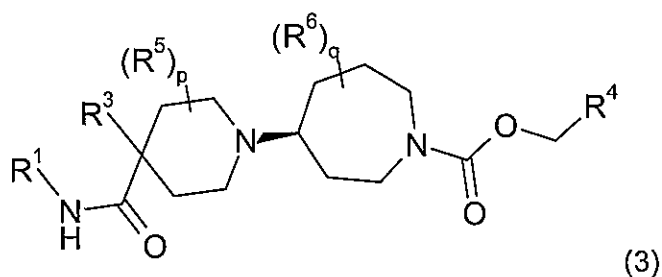
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10. A compound according to claim 1 having the formula (2):



wherein R¹, R³, R⁴, R⁵, R⁶, p and q are as defined in any one of claims 1 to 9.

11. A compound according to claim 1 having the formula (3):



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12. A compound according to claim 10 or 11 wherein p is 0, q is 0 and R³ is H.

13. A compound according to any one of claims 10 to 12 wherein R¹ is selected from 2-methylpropyl, *tert*-butyl, 2-methylbutyl, 2,2-dimethylpropyl, 2-methylbut-2-yl, cyclobutylmethyl, cyclopropylmethyl, cyclopentylmethyl, isopropyl, 1-methylcyclohexyl, 1-methylcyclopentylmethyl, 2-cyclopropylpropyl, 1-methylcyclobutyl, cyclopentyl, 2,3-dimethylbutan-2-yl, 1-ethylcyclobutylmethyl, 1-methylcyclopentyl, 2-cyclopropylpropan-2-yl, cyclobutyl, 1-methylcyclobutylmethyl, 1-(trifluoromethyl)cyclobutyl, 1-ethylcyclobutyl, (²H₃)methyl(²H₆)propyl and 2-methylpentan-2-yl.

14. A compound according to claim 1 wherein the compound is selected from the group consisting of ethyl 4-(2-methylpropyl)carbamoyl-1,4'-bipiperidine-1'-carboxylate;

ethyl 4-((3,3-difluoropyrrolidin-1-yl)carbamoyl)-1,4'-bipiperidine-1'-carboxylate;

ethyl 4-(2,3-dimethylbutan-2-yl)carbamoyl-1,4'-bipiperidine-1'-carboxylate;

ethyl 4-(1,1-dimethylpropyl)carbamoyl-1,4'-bipiperidine-1'-carboxylate;

- ethyl 4-(1-methylcyclobutyl)carbamoyl)-1,4'-bipiperidine-1'-carboxylate;
 ethyl 4-(4-((2-methylpropyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-((1,1-dimethylethyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-((2-methylbutyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 5 ethyl 4-(4-((2,2-dimethylpropyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-((1,1-dimethylpropyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-((cyclobutylmethyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-((diethyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-((ethyl(propan-2-yl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 10 ethyl 4-(4-((3-methoxy-2-methylpropyl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate;
 ethyl 4-(4-((cyclopropylmethyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-((cyclopentylmethyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-((1-methylcyclohexyl)carbamoyl)piperidin-1-yl)azepane-1-
 15 carboxylate;
 ethyl 4-(4-((1-methylcyclopentyl)methyl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate;
 ethyl 4-(4-((2,2,2-trifluoroethyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-((3,3,3-trifluoro-2-methoxypropyl)carbamoyl)piperidin-1-yl)azepane-
 20 1-carboxylate;
 ethyl 4-(4-((tetrahydrofuran-3-ylmethyl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate;
 ethyl 4-(4-((methoxy(methyl))carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-((propan-2-yloxy))carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 25 ethyl 4-(4-((2-methylallyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-(butylcarbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-((cyclopropylmethyl)(ethyl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate;
 ethyl 4-(4-((1-methylcyclobutyl)carbamoyl)piperidin-1-yl)azepane-1-
 30 carboxylate;
 ethyl 4-(4-((1-cyclopropylpropan-2-yl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate;
 ethyl 4-(4-(cyclopent-3-en-1-ylcarbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-(cyclopentylcarbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 35 ethyl 4-(4-((2,3-dimethylbutan-2-yl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate;

- 4-(4-(allylcarbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-(2-methylpiperidine-1-carbonyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-(diisopropylcarbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-((2-methylbut-3-yn-2-yl)carbamoyl)piperidin-1-yl)azepane-1-
 5 carboxylate;
 ethyl 4-(4-(methyl(prop-2-yn-1-yl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate;
 ethyl 4-(4-(((1-ethylcyclobutyl)methyl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate;
 10 ethyl 4-(4-((1,1,1-trifluoro-2-methylpropan-2-yl))carbamoyl)piperidin-1-
 yl)azepane-1-carboxylate;
 ethyl 4-(4-((2-cyclopropylpropyl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate;
 ethyl 4-(4-fluoro-4-((2-methylpropyl)carbamoyl)piperidin-1-yl)azepane-1-
 15 carboxylate;
 ethyl 4-(4-fluoro-4-((1,1-dimethylpropyl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate;
 ethyl 4-(4-fluoro-4-((cyclobutylmethyl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate;
 20 ethyl 4-(4-fluoro-4-((tert-butyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;
 ethyl 4-(4-fluoro-4-((2,3-dimethylbutan-2-yl)carbamoyl)piperidin-1-yl)azepane-
 1-carboxylate;
 ethyl 4-(4-fluoro-4-((1-cyclopropylpropan-2-yl)carbamoyl)piperidin-1-
 yl)azepane-1-carboxylate;
 25 ethyl 4-(4-fluoro-4-((2,2-dimethylpropyl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate
 ethyl 4-(4-fluoro-4-((1-methylcyclopropyl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate
 ethyl 4-(4-fluoro-4-((1-methylcyclopentyl)carbamoyl)piperidin-1-yl)azepane-1-
 30 carboxylate
 ethyl 4-(4-fluoro-4-(((1-ethylcyclobutyl)methyl)carbamoyl)piperidin-1-
 yl)azepane-1-carboxylate
 ethyl 4-(4-fluoro-4-((1-methylcyclobutyl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate
 35 ethyl 4-(4-fluoro-4-((cyclopentyl)carbamoyl)piperidin-1-yl)azepane-1-
 carboxylate;

ethyl 4-(4-fluoro-4-((cyclopropylmethyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

ethyl 4-(4-fluoro-4-((cyclopentylmethyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

5 ethyl 4-(4-fluoro-4-((2-cyclopropylpropan-2-yl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

ethyl 4-(4-fluoro-4-((cyclobutyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

ethyl 4-(4-methyl-4-((2-methylpropyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

10 prop-2-yn-1-yl-4-(4-((2-methylpropyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

but-2-yn-1-yl-4-(4-((2-methylpropyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

15 2-fluoroethyl-4-(4-((2-methylpropyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

2-methoxyethyl-4-(4-((2-methylpropyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

2-propyl-4-(4-((2-methylpropyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

20 2,2,2-trifluoroethyl-4-(4-((2-methylpropyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

ethyl (4S)-4-[4-((2-methylpropyl)methylcarbamoyl)piperidin-1-yl]azepane-1-carboxylate;

ethyl (4R)-4-[4-((2-methylpropyl)methylcarbamoyl)piperidin-1-yl]azepane-1-carboxylate;

25 ethyl (4S)-4-{4-[(1-methylcyclobutyl)carbamoyl]piperidin-1-yl}azepane-1-carboxylate;

ethyl (4R)-4-{4-[(1-methylcyclobutyl)carbamoyl]piperidin-1-yl}azepane-1-carboxylate;

ethyl (4S)-4-[4-(tert-butylcarbamoyl)piperidin-1-yl]azepane-1-carboxylate;

30 ethyl (4R)-4-[4-(tert-butylcarbamoyl)piperidin-1-yl]azepane-1-carboxylate;

ethyl 4-(4-[[1-(1-methylcyclobutyl)methyl]carbamoyl]piperidin-1-yl)azepane-1-carboxylate;

ethyl 4-(4-[[1-(trifluoromethyl)cyclobutyl]carbamoyl]piperidin-1-yl)azepane-1-carboxylate;

35 ethyl 4-{4-[(2-methylcyclopentyl)carbamoyl]piperidin-1-yl}azepane-1-carboxylate;

ethyl 4-{4-[(3-methylidenecyclobutyl)carbamoyl]piperidin-1-yl}azepane-1-carboxylate;

ethyl 4-{4-[(3-methylcyclobutyl)carbamoyl]piperidin-1-yl}azepane-1-carboxylate;

ethyl 4-{4-[(1-ethylcyclobutyl)carbamoyl]piperidin-1-yl}azepane-1-carboxylate;

5 ethyl 4-(4-{[2-(2H3)methyl(2H6)propyl]carbamoyl}piperidin-1-yl)azepane-1-carboxylate;

ethyl 4-{4-[(1-fluoro-2-methylpropan-2-yl)carbamoyl]piperidin-1-yl}azepane-1-carboxylate;

10 ethyl 4-{4-[(2-methylpentan-2-yl)carbamoyl]piperidin-1-yl}azepane-1-carboxylate;

ethyl 4-{4-methyl-4-[(1-methylcyclobutyl)carbamoyl]piperidin-1-yl}azepane-1-carboxylate;

ethyl 4-{4-methoxy-4-[(1-methylcyclobutyl)carbamoyl]piperidin-1-yl}azepane-1-carboxylate;

15 but-2-yn-1-yl 4-{4-methoxy-4-[(1-methylcyclobutyl)carbamoyl]piperidin-1-yl}azepane-1-carboxylate;

ethyl 4-(4-methoxy-4-[[1-methylcyclobutyl)methyl]carbamoyl]piperidin-1-yl}azepane-1-carboxylate;

20 ethyl 4-{4-cyano-4-[(1-methylcyclobutyl)carbamoyl]piperidin-1-yl}azepane-1-carboxylate; and salts thereof.

15. A compound according to claim 1 which is selected from:

ethyl 4-(4-((2-methylpropyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

25 ethyl (4S)-4-[4-((2-methylpropyl)methylcarbamoyl)piperidin-1-yl]azepane-1-carboxylate;

ethyl (4R)-4-[4-((2-methylpropyl)methylcarbamoyl)piperidin-1-yl]azepane-1-carboxylate;

ethyl 4-(4-((1-methylcyclobutyl)carbamoyl)piperidin-1-yl)azepane-1-carboxylate;

30 ethyl (4S)-4-[4-[(1-methylcyclobutyl)carbamoyl]-1-piperidyl]azepane-1-carboxylate;

and salts thereof.

16. A compound according to any one of claims 1 to 15 for use in medicine.

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17. A pharmaceutical composition comprising a compound as defined in any one of claims 1 to 15 and a pharmaceutically acceptable excipient.

5 18. A compound according to claims 1 to 15 for use in the treatment of a cognitive disorder or psychotic disorder or for the treatment or lessening the severity of acute, chronic, neuropathic, or inflammatory pain.