from the group consisting of alkyl, alkenyl, alkynyl, halogen, cyano, oxo, $-NO_2$, $-OR^{1b}$, $-OC(O)R^{1b}$, $-OC(O)N(R^b)(R^{3b})$, $-SR^{1b}$, $-S(O)_2R^{2b}$, $-S(O)_2N(R^b)(R^{3b})$, $-C(O)R^{1b}$, $-C(O)OR^{1b}$, $-C(O)N(R^b)(R^{3b})$, $-N(R^b)(R^{3b})$, $-N(R^a)C(O)R^{1b}$, $-N(R^a)C(O)O(R^{1b})$, $-N(R^a)C(O)N(R^b)(R^{3b})$, $-(CR^{4b}R^{5b})_m-NO_2$, $-(CR^{4b}R^{5b})_m-OR^{1b}$, $-(CR^{4b}R^{5b})_m-OC(O)R^{1b}$, $-(CR^{4b}R^{5b})_m-OC(O)N(R^b)(R^{3b})$, $-(CR^{4b}R^{5b})_m-SR^{1b}$, $-(CR^{4b}R^{5b})_m-S(O)_2R^{2b}$, $-(CR^{4b}R^{5b})_m-S(O)_2N(R^b)(R^{3b})$, $-(CR^{4b}R^{5b})_m-C(O)R^{1b}$, $-(CR^{4b}R^{5b})_m-C(O)OR^{1b}$, $-(CR^{4b}R^{5b})_m-C(O)N(R^b)(R^{3b})$, $-(CR^{4b}R^{5b})_m-N(R^b)(R^{3b})$, $-(CR^{4b}R^{5b})_m-N(R^a)C(O)R^{1b}$, $-(CR^{4b}R^{5b})_m-N(R^a)C(O)O(R^{1b})$, $-(CR^{4b}R^{5b})_m-N(R^a)C(O)N(R^b)(R^{3b})$, cyanoalkyl, and haloalkyl;

wherein

alkyl is a straight or branched, saturated hydrocarbon chain containing from 1 to 10 carbon atoms;

haloalkyl is an alkyl in which one, two, three, four, five or six hydrogen atoms are replaced by halogen;

alkenyl is a straight or branched hydrocarbon chain containing from 2 to 10 carbons and containing at least one carbon-carbon double bond;

alkynyl is a straight or branched chain hydrocarbon group containing from 2 to 10 carbon atoms and containing at least one carbon-carbon triple bond;

aryl is phenyl, naphthyl, a phenyl fused to a monocyclic cycloalkyl, or a phenyl fused to a monocyclic cycloalkenyl;

arylalkyl is an aryl group appended to the parent molecular moiety through an alkylene group;

alkylene is a divalent group derived from a straight or branched chain hydrocarbon of from 1 to 10 carbon atoms;

heteroaryl is a monocyclic heteroaryl, a bicyclic heteroaryl or a tricyclic heteroaryl, wherein the monocyclic heteroaryl is a five-membered ring containing two double bonds or is a six-membered ring containing three double bonds and one, two, three or four nitrogen atoms, wherein the bicyclic heteroaryl consists of a monocyclic heteroaryl fused to a phenyl, or a monocyclic heteroaryl fused to a monocyclic cycloalkyl, or a monocyclic heteroaryl fused to a monocyclic cycloalkenyl, or a monocyclic heteroaryl fused to a monocyclic heteroaryl, or a monocyclic heteroaryl fused to a monocyclic heterocycle, and wherein the tricyclic heteroaryl consists of a bicyclic heteroaryl fused to a phenyl, or a bicyclic heteroaryl fused to a monocyclic cycloalkyl, or a bicyclic heteroaryl fused to a monocyclic cycloalkenyl, or a bicyclic heteroaryl fused to a monocyclic heteroaryl, or a bicyclic heteroaryl fused to a monocyclic heterocycle;

heteroarylalkyl is a heteroaryl group appended to the parent molecular moiety through an alkylene group;

monocyclic cycloalkenyl contains from 3 to 10 carbons and contains at least one carbon-carbon double bond;

cycloalkyl is a monocyclic, a bicyclic, or a tricyclic cycloalkyl; wherein the monocyclic cycloalkyl is a carbocyclic ring system containing three to eight carbon atoms, zero heteroatoms and zero double bonds, and the bicyclic cycloalkyl is a monocyclic cycloalkyl fused to a monocyclic cycloalkyl ring, or a bridged monocyclic ring system in which two non-adjacent carbon atoms of the monocyclic ring are linked by an alkylene bridge containing one, two, three, or four carbon atoms; and

heterocycle is a monocyclic heterocycle, a bicyclic heterocycle, or a tricyclic heterocycle, wherein the monocyclic heterocycle is a three-, four-, five-, six-, seven-, or eight-membered ring containing at least one heteroatom independently selected from the group consisting of O, N, and S, the three- or four-membered ring containing zero or one double bond, and one heteroatom selected from the group consisting of O, N, and S, the five-membered ring containing zero or one double bond and one, two or three heteroatoms selected from the group consisting of O, N and S, the six-membered ring containing zero, one or two double bonds and one, two, or three heteroatoms selected from the group consisting of O, N, and S, and the seven- and eight-membered rings containing zero, one, two, or three double bonds and one, two, or three heteroatoms selected from the group consisting of O, N, and S, and wherein the bicyclic heterocycle is a monocyclic heterocycle fused to a phenyl group, or a monocyclic heterocycle fused to a monocyclic cycloalkyl, or a monocyclic heterocycle fused to a monocyclic cycloalkenyl, or a monocyclic heterocycle fused to a monocyclic heterocycle, or a bridged monocyclic heterocycle ring system in which two non-adjacent atoms of the ring are linked by an alkylene bridge of 1, 2, 3, or 4 carbon atoms, or an alkenylene bridge of two, three, or four carbon atoms;

or a pharmaceutically acceptable salt~~, amide, ester or prodrug~~ thereof.

2. The compound of claim 1, wherein R is Ar^1.

3. The compound of claim 2, wherein X is CH_2, and Ar^1 is a bicyclic or tricyclic heteroaryl optionally oxidized on an oxidizable nitrogen or sulfur and either unsubstituted or substituted with 1, 2, or 3 substituents selected from halogen or alkyl.

4. The compound of claim 1, wherein R is Ar^2-Ar^3 or –C(O)-Ar^2-Ar^3.

5. The compound of claim 4, wherein

X is CH_2;

Ar^2 is heteroaryl selected from oxadiazolyl, pyridazinyl, pyrazolyl, pyridinyl, thiadiazolyl or 1,3-thiazolyl;

Ar^3 is phenyl or heteroaryl, wherein the phenyl or heteroaryl is unsubstituted or substituted with 1, 2, 3, or 4 substituents selected from alkyl, halogen, cyano, -OR^{1a}, -O-$(CR^{4a}R^{5a})_p$-O-, -C(O)R^{1a}, -N(R^b)(R^{3a}), -N(R^a)C(O)R^{1a}, or haloalkyl; wherein

R^{1a} and R^{3a}, at each occurrence, are each independently alkyl or haloalkyl;

R^{4a} and R^{5a}, at each occurrence, are each independently hydrogen or alkyl; and

R^b, at each occurrence, are each independently hydrogen, alkyl, or haloalkyl.

6. The compound of claim 1, wherein R is -C(O)Ar^3 or -C(O)OAr^3.

7. The compound of claim 6, wherein

4-[5-(2-ethoxyphenyl)pyridin-3-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-[5-(1,4-diazatricyclo[4.3.1.1^{3,8}]undec-4-yl)pyridin-3-yl]benzonitrile;

3-[5-(1,4-diazatricyclo[4.3.1.1^{3,8}]undec-4-yl)pyridin-3-yl]benzonitrile;

4-{5-[3-(trifluoromethyl)phenyl]pyridin-3-yl}-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-[5-(1,3-benzodioxol-5-yl)pyridin-3-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-(2'-methoxy-3,3'-bipyridin-5-yl)-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

N-{3-[5-(1,4-diazatricyclo[4.3.1.1^{3,8}]undec-4-yl)pyridin-3-yl]phenyl}acetamide;

4-[5-(3,5-difluorophenyl)pyridin-3-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-(6'-methoxy-3,3'-bipyridin-5-yl)-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-[5-(2-methoxy-5-methylphenyl)pyridin-3-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-[5-(4-methoxy-3-methylphenyl)pyridin-3-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-[5-(3,4-difluorophenyl)pyridin-3-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

1-{5-[5-(1,4-diazatricyclo[4.3.1.1^{3,8}]undec-4-yl)pyridin-3-yl]thien-2-yl}ethanone;

4-(5-pyrimidin-5-ylpyridin-3-yl)-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

1-{2-[5-(1,4-diazatricyclo[4.3.1.1^{3,8}]undec-4-yl)pyridin-3-yl]phenyl}ethanone;

4-[5-(1*H*-indol-5-yl)pyridin-3-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-[5-(1*H*-indol-4-yl)pyridin-3-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-[5-(4-methoxyphenyl)-1,3-thiazol-2-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-[5-(4-methylphenyl)-1,3-thiazol-2-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-[5-(3-methylphenyl)-1,3-thiazol-2-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-[5-(3-fluorophenyl)-1,3-thiazol-2-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-[5-(2,5-dimethoxyphenyl)-1,3-thiazol-2-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-[5-(4-fluorophenyl)-1,3-thiazol-2-yl]-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-(6-chloro-1,3-benzothiazol-2-yl)-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

4-(6-chloro-1,3-benzoxazol-2-yl)-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane; and

4-(1,3-benzothiazol-2-yl)-1,4-diazatricyclo[4.3.1.1^{3,8}]undecane;

or a pharmaceutically acceptable salt~~, amide or prodrug~~ thereof.

17. Use of a compound of claim 16, or a pharmaceutically acceptable salt~~, amide or prodrug~~ thereof, in the manufacture of a medicament for treating or preventing conditions, disorders or deficits modulated by an α7 nicotinic acetylcholine receptor, an α4β2 nicotinic acetylcholine receptor or both α7 and α4β2 nicotinic acetylcholine receptor wherein the condition, disorder or deficit is selected from the group consisting of a memory disorder, cognitive disorder, neurodegeneration, and neurodevelopmental disorder.

18. Use of a compound of claim 16, or a pharmaceutically acceptable salt~~, amide or prodrug~~ thereof, in the manufacture of a medicament for treating a disorder selected from the group consisting of mild cognitive impairment, age-associated memory impairment (AAMI), senile dementia, AIDS dementia, Pick's disease, dementia associated with Lewy bodies, dementia associated with Down's syndrome, amyotrophic lateral sclerosis, Huntington's disease, smoking cessation, schizoaffective disorder, bipolar and manic disorders, diminished CNS function associated with traumatic brain injury, acute pain, acute pain, chronic pain, neuropathic pain, nociceptive pain, allodynia, inflammatory pain, inflammatory hyperalgesia, post herpetic neuralgia, neuropathies, neuralgia, diabetic neuropathy, HIV-related neuropathy, nerve injury, rheumatoid arthritic pain, osteoarthritic pain, burns, back pain, eye pain, visceral pain, cancer pain, dental pain, headache, migraine, carpal tunnel syndrome, fibromyalgia, neuritis, sciatica, pelvic hypersensitivity, pelvic pain, post operative pain, post stroke pain, and menstrual pain.

19. Use of a compound of claim 16, or a pharmaceutically acceptable salt~~, amide or prodrug~~ thereof, in the manufacture of a medicament for treating a disorder selected from the group consisting of attention deficit disorder, attention deficit hyperactivity disorder (ADHD), Alzheimer's disease (AD), Parkinson's disease, Tourette's syndrome, schizophrenia, and cognitive deficits associated with schizophrenia (CDS).

20. Use of a compound of claim 16, or a pharmaceutically acceptable salt~~, amide or prodrug~~ thereof, in the manufacture of a medicament and one or more atypical antipsychotics for treating a disorder selected from the group consisting of schizophrenia and cognitive deficits associated with schizophrenia (CDS), or combination thereof.

21. A pharmaceutical composition comprising a therapeutically effective amount of the compound of claim 16, or a pharmaceutically acceptable salt~~, amide or prodrug~~ thereof, in combination with one or more pharmaceutically acceptable carriers.

22. The pharmaceutical composition of claim 21 further comprising one or more atypical antipsychotics.