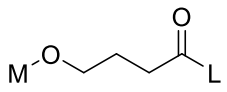
[0003] The present technology provides one or more compounds that deliver GHB to a human or animal subject. In some examples, these compounds have increased bioavailabilty or a longer duration of action, or both, when compared to sodium oxybate (NaGHB). In other examples, based on their improved bioavailablity, the compounds of the present technology can be administered to a human or animal subject at a lower molar dose that is therapeutically equivalent as compared to NaGHB. These GHB delivering compounds are prodrugs or precursors of gamma-hydroxybutyrate, salts of such compounds, and combinations thereof. In some examples, prodrugs of GHB, 2-hydroxytetrahydrofuran (2-OH-THF), and 1,4-butanediol (BD) of the current disclosure/presently described technology provide similar or improved oral bioavailability of GHB, similar or extended-release of GHB, and/or reduced or zero sodium content in comparison to NaGHB. When administered as intended, the compounds of the presently described and claimed technology provide therapeutic plasma concentrations of GHB in a human or animal subject.

[0004] In at least one example of the present technology, there is provided a compound having a structure as shown in Formula I:

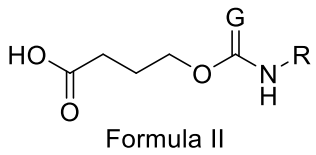


Formula I ,

[0005] or a pharmaceutically acceptable salt thereof; where L is selected from the group consisting of hydroxyl, gamma-hydroxybutyrate, gamma-aminobutyric acid, 1,4-butanediol, 2-hydroxytetrahydrofuran, phosphate, sulfate, sulfamate, alkenyl, alkenylaminocarbonyl, alkoxy, alkoxycarbonyl, alkyl, alkylamino, alkylaminocarbonyl, alkylammonium, alkylcarbonyl, alkylcarbonylamino, alkylcarbonyloxy, alkylsulfinyl, alkylsulfonyl, alkylthio, alkynyl, alkynylaminocarbonyl, amino acids, peptides, salts thereof, and combinations thereof; and where M is selected from the group consisting of hydrogen, gamma-hydroxybutyrate, gamma-aminobutyric acid, 1,4-butanediol, 2-hydroxytetrahydrofuran, sugar alcohol, ethylene glycol, glycerol, erythritol, threitol, arabitol, xylitol, ribitol, mannitol, sorbitol, galactitol, fucitol, iditol, inositol, volemitol, isomalt, lactitol, maltotriitol, maltotetraitol, polyglycitol, phosphate, sulfate, sulfamate, alkenyl, alkenylaminocarbonyl, alkoxy, alkoxycarbonyl, alkyl, alkylamino,

alkylaminocarbonyl, alkylammonium, alkylcarbonyl, alkylcarbonylamino, alkylcarbonyloxy, alkylsulfinyl, alkylsulfonyl, alkylthio, alkynyl, alkynylaminocarbonyl, amine, amino, aminocarbonyl, ammonium, aryl, substituted aryl, arylalkenyl, arylalkoxy, arylalkyl, arylalkynyl, arylamino, arylaminocarbonyl, arylammonium, arylazo, arylcarbonyl, arylcarbonylamino, arylcarbonyloxy, arylcycloalkyl, aryloxy, aryloxyalkyl, arylsulfinyl, arylsulfinylalkyl, arylsulfonyl, arylsulfonylamino, arylthio, arylthioalkyl, cyano, cycloalkenyl, cycloalkenylalkyl, carboxyl, cycloalkyl, cycloalkylalkyl, cycloalkylamino, cycloalkyloxy, cycloalkynyl, cycloheteroalkyl, cycloheteroalkylalkyl, halo, haloalkoxy, haloalkyl, heteroaryl, heteroarylalkenyl, heteroarylalkyl, heteroarylamino, heteroarylcarbonyl, heteroarylcarbonylamino, heteroaryloxo, heteroaryloxy, heteroarylsulfinyl, heteroarylsulfonyl, heteroarylthio, nitro, polycycloalkenyl, polycycloalkenylalkyl, polycycloalkyl, polycycloalkylalkyl, polyethylene glycol, thiol, amino acids, peptides, salts thereof, and combinations thereof.

[0006] Another example of the present technology includes a compound having a structure as shown in Formula II:



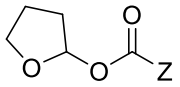
Formula II

[0007] or a pharmaceutically acceptable salt thereof; wherein G is S or O, and R is selected from the group consisting of 

, hydrogen, alkenyl, alkenylaminocarbonyl, alkoxy, alkoxycarbonyl, alkyl, alkylamino, alkylaminocarbonyl, alkylammonium, alkylcarbonyl, alkylcarbonylamino, alkylcarbonyloxy, alkylsulfinyl, alkylsulfonyl, alkylthio, alkynyl, alkynylaminocarbonyl, amine, amino, aminocarbonyl, ammonium, aryl, substituted aryl, arylalkenyl, arylalkoxy, arylalkyl, arylalkynyl, arylamino, arylaminocarbonyl, arylammonium, arylazo, arylcarbonyl, arylcarbonylamino, arylcarbonyloxy, arylcycloalkyl, aryloxy, aryloxyalkyl, arylsulfinyl, arylsulfinylalkyl, arylsulfonyl, arylsulfonylamino, arylthio, arylthioalkyl, cyano,

cycloalkenyl, cycloalkenylalkyl, carboxyl, cycloalkyl, cycloalkylalkyl, cycloalkylamino, cycloalkyloxy, cycloalkynyl, cycloheteroalkyl, cycloheteroalkylalkyl, halo, haloalkoxy, haloalkyl, heteroaryl, heteroarylalkenyl, heteroarylalkyl, heteroarylamino, heteroarylcarbonyl, heteroarylcarbonylamino, heteroaryloxo, heteroaryloxy, heteroarylsulfinyl, heteroarylsulfonyl, heteroarylthio, hydroxy, nitro, polycycloalkenyl, polycycloalkenylalkyl, polycycloalkyl, polycycloalkylalkyl, polyethylene glycol, thiol, amino acids, peptides, salts thereof, and combinations thereof; and where R^1 is an amino acid or a peptide (e.g., a dipeptide or a tripeptide).

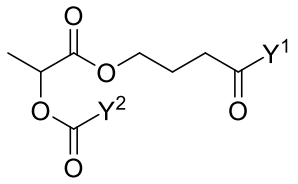
[0008] Another example of the present technology includes a compound having a structure of Formula III:



Formula III

[0009] or a pharmaceutically acceptable salt thereof; wherein Z is selected from the group consisting of gamma-hydroxybutyrate, gamma-aminobutyric acid, 1,4-butanediol, 2-hydroxytetrahydrofuran, alkenyl, alkenylaminocarbonyl, alkoxy, alkoxycarbonyl, alkyl, alkylamino, alkylaminocarbonyl, alkylammonium, alkylcarbonyl, alkylcarbonylamino, alkylcarbonyloxy, alkylsulfinyl, alkylsulfonyl, alkylthio, alkynyl, alkynylaminocarbonyl, amine, amino, aminocarbonyl, ammonium, aryl, substituted aryl, arylalkenyl, arylalkoxy, arylalkyl, arylalkynyl, arylamino, arylaminocarbonyl, arylammonium, arylazo, arylcarbonyl, arylcarbonylamino, arylcarbonyloxy, arylcycloalkyl, aryloxy, aryloxyalkyl, arylsulfinyl, arylsulfinylalkyl, arylsulfonyl, arylsulfonylamino, arylthio, arylthioalkyl, cyano, cycloalkenyl, cycloalkenylalkyl, carboxyl, cycloalkyl, cycloalkylalkyl, cycloalkylamino, cycloalkyloxy, cycloalkynyl, cycloheteroalkyl, cycloheteroalkylalkyl, dicarboxylic acid, halo, haloalkoxy, haloalkyl, heteroaryl, heteroarylalkenyl, heteroarylalkyl, heteroarylamino, heteroarylcarbonyl, heteroarylcarbonylamino, heteroaryloxo, heteroaryloxy, heteroarylsulfinyl, heteroarylsulfonyl, heteroarylthio, hydroxy, nitro, polycycloalkenyl, polycycloalkenylalkyl, polycycloalkyl, polycycloalkylalkyl, polyethylene glycol, thiol, amino acids, peptides, salts thereof, and combinations thereof.

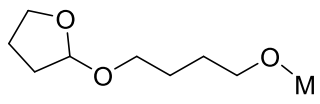
[0010] Another example of the present technology includes a compound having a structure of Formula IV:



Formula IV

[0011] wherein Y^1 and Y^2 are independently selected from the group consisting of hydroxyl, gamma-hydroxybutyrate, gamma-aminobutyric acid, 1,4-butanediol, 2-hydroxytetrahydrofuran, alkenyl, alkenylaminocarbonyl, alkoxy, alkoxycarbonyl, alkyl, alkylamino, alkylaminocarbonyl, alkylammonium, alkylcarbonyl, alkylcarbonylamino, alkylcarbonyloxy, alkylsulfinyl, alkylsulfonyl, alkylthio, alkynyl, alkynylaminocarbonyl, amine, amino, aminocarbonyl, ammonium, aryl, substituted aryl, arylalkenyl, arylalkoxy, arylalkyl, arylalkynyl, arylamino, arylaminocarbonyl, arylammonium, arylazo, arylcarbonyl, arylcarbonylamino, arylcarbonyloxy, arylcycloalkyl, aryloxy, aryloxyalkyl, arylsulfinyl, arylsulfinylalkyl, arylsulfonyl, arylsulfonylamino, arylthio, arylthioalkyl, cyano, cycloalkenyl, cycloalkenylalkyl, carboxyl, cycloalkyl, cycloalkylalkyl, cycloalkylamino, cycloalkyloxy, cycloalkynyl, cycloheteroalkyl, cycloheteroalkylalkyl, halo, haloalkoxy, haloalkyl, heteroaryl, heteroarylalkenyl, heteroarylalkyl, heteroarylamino, heteroarylcarbonyl, heteroarylcarbonylamino, heteroaryloxo, heteroaryloxy, heteroarylsulfinyl, heteroarylsulfonyl, heteroarylthio, nitro, polycycloalkenyl, polycycloalkenylalkyl, polycycloalkyl, polycycloalkylalkyl, polyethylene glycol, thiol, amino acids, peptides, salts thereof, and combinations thereof.

[0012] An aspect of the present technology includes a compound having a structure of Formula V:

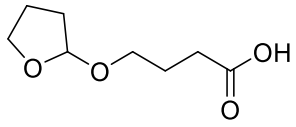


Formula V

[0013] or a pharmaceutically acceptable salt thereof; where M is selected from the group consisting of hydrogen, 1,4-butanediol, 2-hydroxytetrahydrofuran, gamma-hydroxybutyrate, sugar alcohol, ethylene glycol, glycerol, erythritol, threitol, arabitol, xylitol, ribitol, mannitol, sorbitol, galactitol, fucitol, iditol, inositol, volemitol, isomalt, lactitol, maltotriitol, maltotetraitol, polyglycitol, gamma-aminobutyric acid, phosphate, sulfate, sulfamate, alkenyl, alkenylaminocarbonyl, alkoxy, alkoxycarbonyl, alkyl, alkylamino, alkylaminocarbonyl, alkylammonium, alkylcarbonyl, alkylcarbonylamino, alkylcarbonyloxy, alkylsulfinyl, alkylsulfonyl, alkylthio, alkynyl, alkynylaminocarbonyl, amine, amino, aminocarbonyl, ammonium, aryl, substituted aryl, arylalkenyl, arylalkoxy, arylalkyl, arylalkynyl, arylamino, arylaminocarbonyl, arylammonium, arylazo, arylcarbonyl, arylcarbonylamino, arylcarbonyloxy, arylcycloalkyl, aryloxy, aryloxyalkyl, arylsulfinyl, arylsulfinylalkyl, arylsulfonyl, arylsulfonylamino, arylthio, arylthioalkyl, cyano, cycloalkenyl, cycloalkenylalkyl, carboxyl, cycloalkyl, cycloalkylalkyl, cycloalkylamino, cycloalkyloxy, cycloalkynyl, cycloheteroalkyl, cycloheteroalkylalkyl, halo, haloalkoxy, haloalkyl, heteroaryl, heteroarylalkenyl, heteroarylalkyl, heteroarylamino, heteroarylcarbonyl, heteroarylcarbonylamino, heteroaryloxo, heteroaryloxy, heteroarylsulfinyl, heteroarylsulfonyl, heteroarylthio, nitro, polycycloalkenyl, polycycloalkenylalkyl, polycycloalkyl, polycycloalkylalkyl, polyethylene glycol, thiol, amino acids, peptides, salts thereof, and combinations thereof.

[0014] In some examples of the presently described technology, the amino acids in Formulas I-V are selected from the group containing alanine, arginine, asparagine, aspartic acid, cysteine, glutamine, glutamic acid, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tryptophan, tyrosine, valine, and/or salts thereof. In some examples, the peptide can be a dipeptide or a tripeptide.

[0015] In some examples, at least one compound of the presently described technology having the structure of Formula I is selected from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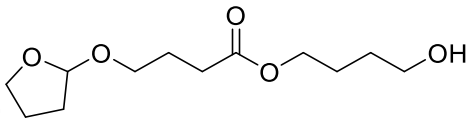
or 
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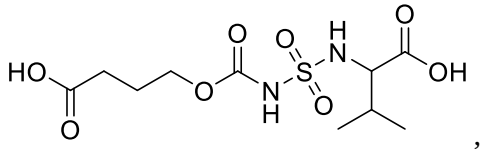
[0016] In some examples, at least one compound of the presently described technology having the structure of Formula II is selected from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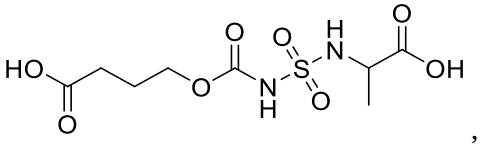
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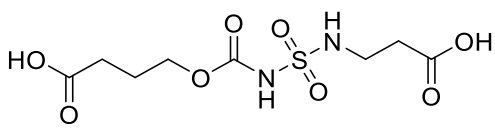
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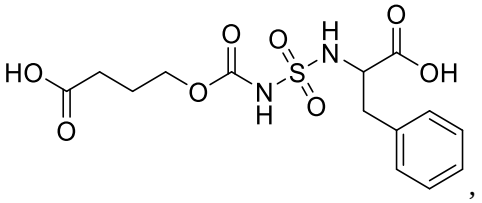
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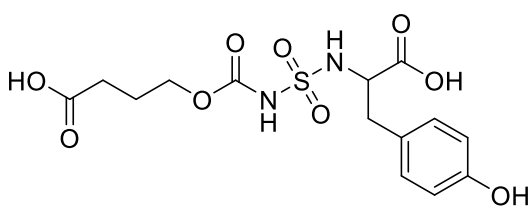
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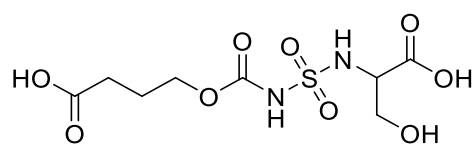
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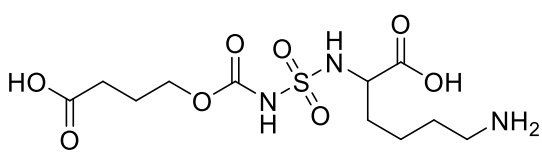
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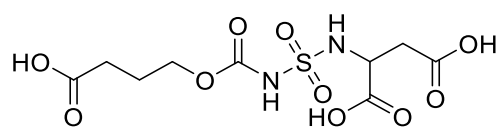
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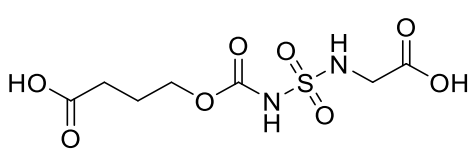
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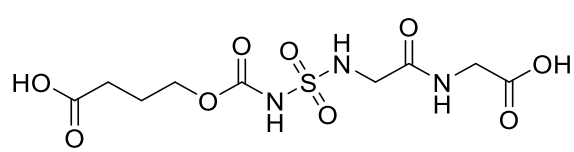
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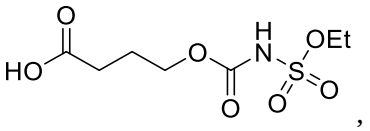
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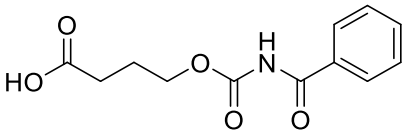
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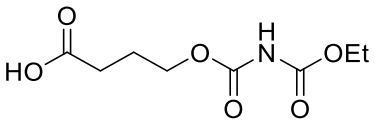
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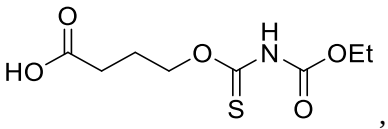
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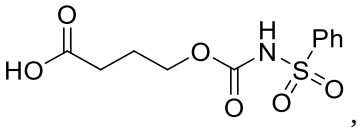
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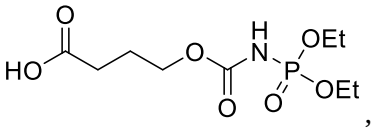
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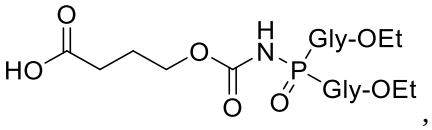
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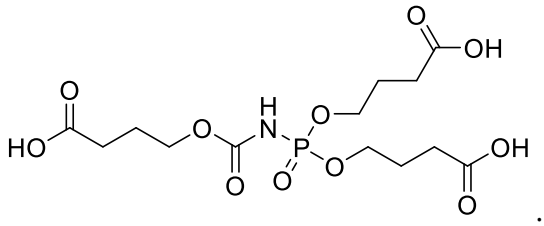
or 
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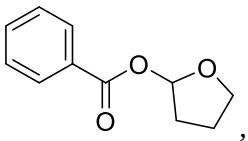
[0017] In some further examples, one or more compounds of the presently described technology having the structure of Formula III are selected from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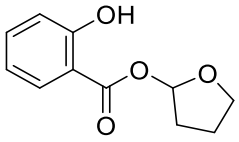
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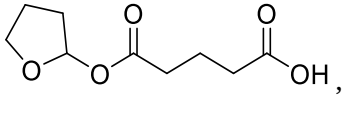
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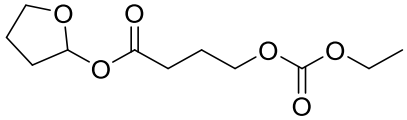
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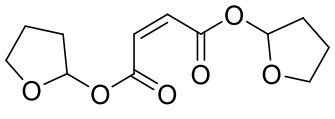
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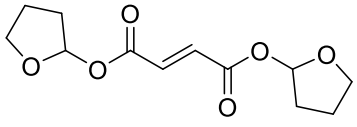
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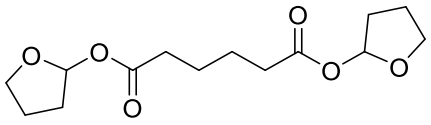
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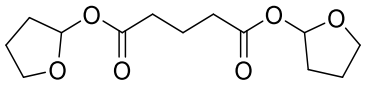
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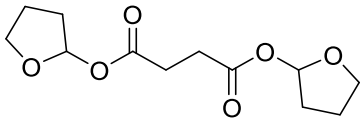
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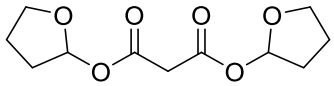
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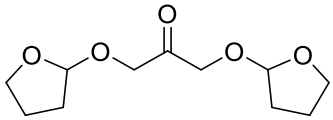
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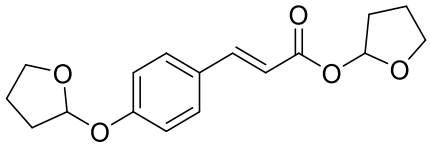
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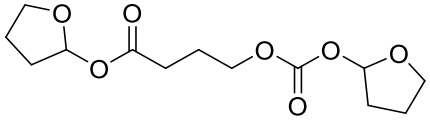
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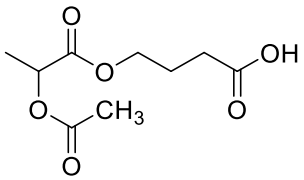
[0018] In some still further examples, at least one compound of the presently described technology having the structure of Formula IV is selected from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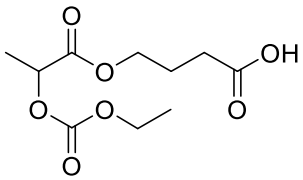
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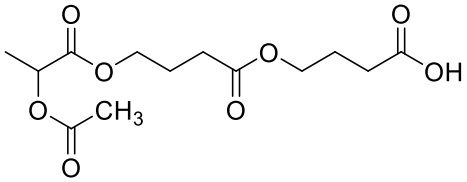
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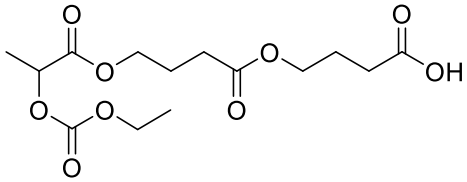
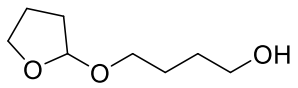

or .

[0019] In some further examples, one or more compounds of the presently described technology having the structure of Formula V are selected from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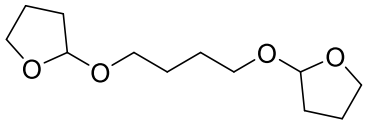
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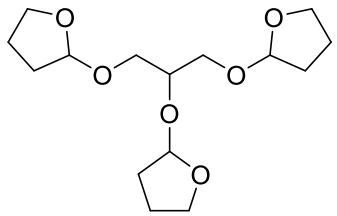
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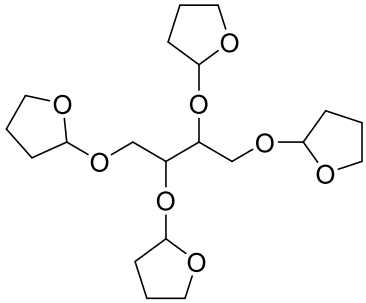
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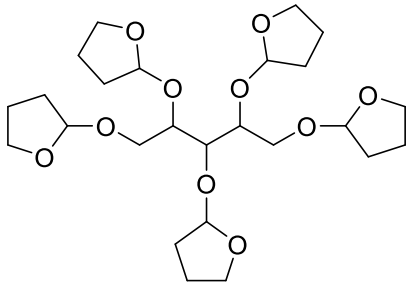
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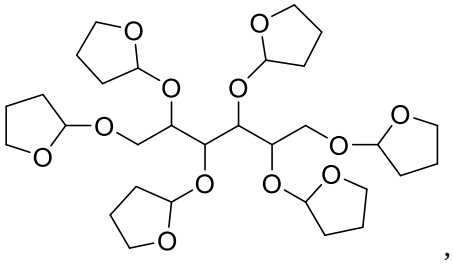
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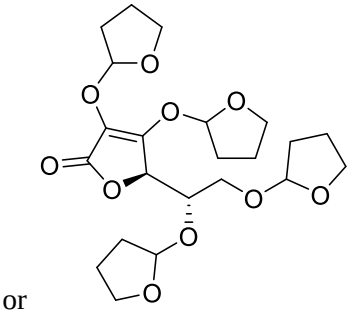

or .

[0020] Another example of the present technology includes at least one composition comprising at least one of the disclosed GHB delivering compounds or compositions, or a pharmaceutically acceptable salt of the compound(s) or composition. It should be appreciated by those skilled in the art that in a further example of the present technology, compositions comprising unmodified GHB/NaGHB in combination with one or more of the presently described and claimed GHB delivering compounds are also envisaged.

[0020a] In another aspect, the present disclosure refers to a composition comprising the compound as defined above, or a pharmaceutically acceptable salt of the compound, wherein the pharmaceutically acceptable salt is selected from the group consisting of an acetate, L-aspartate, besylate, bicarbonate, carbonate, D-camsylate, L-camsylate, citrate, edisylate, formate, fumarate, gluconate, hydrobromide/bromide, hydrochloride/chloride, D-lactate, L-lactate, D,L-lactate, D,L-malate, L-malate, mesylate, pamoate, phosphate, succinate, sulfate, bisulfate, D-tartrate, L-tartrate, D,L-tartrate, meso-tartrate, benzoate, gluceptate, D-glucuronate, hybenzate, isethionate, malonate, methylsulfate, 2-napsylate, nicotinate, nitrate, orotate, stearate, tosylate, thiocyanate, acefyllinate, aceturate, aminosalicylate, ascorbate, borate, butyrate, camphorate, camphocarbonate, decanoate, hexanoate, cholate, cypionate, dichloroacetate, edentate, ethyl sulfate, furate, fusidate, galactarate, galacturonate, gallate, gentisate, glutamate, glutarate, glycerophosphate, heptanoate, hydroxybenzoate, hippurate, phenylpropionate, iodide, xinafoate, lactobionate, laurate, maleate, mandelate, methanesulfonate, myristate, napadisilate, oleate, oxalate, palmitate, picrate, pivalate, propionate, pyrophosphate, salicylate, salicylsulfate, sulfosalicylate, tannate, terephthalate, thiosalicylate, tribrophenate, valerate, valproate, adipate, 4-acetamidobenzoate, camsylate, octanoate, estolate, esylate, glycolate, thiocyanate, undecylenate, sodium, potassium, calcium, magnesium, zinc, aluminum, lithium, cholinate, lysinium, ammonium, troethamine, and a mixture thereof.

[0020b] In another aspect, there is provided the use of a composition comprising the composition as defined above in the manufacture of a medicament for preventing or treating a sleep disorder or sleep syndrome.

[0021] In a further example of the present technology, there is provided at least one method of preventing or treating a sleep disorder in a subject in need thereof, comprising administering to the subject a composition comprising any one of the disclosed GHB delivering compounds or a pharmaceutically acceptable salt of the compound thereof. In some examples, the sleep disorder is a symptom of a degenerative neurological disease or disorder and/or is a side effect of treating a degenerative neurological disease or disorder with medication or a therapeutic compound. In a further example, the degenerative neurological

disease or disorder is selected from the group containing Parkinson's disease, primary parkinsonism, paralysis agitans, and/or idiopathic parkinsonism.

[0022] In some examples of at least one method of the present technology, the composition further comprises amantadine, aplindore, apomorphine, benztropine, bromocriptine, carbidopa, entacapone, fenoldopam, istradefylline, levodopa (L-dopa), opicapone, pramipexole, rasagiline, ropinirole, rotigotine, safinamide, tolcapone, trihexyphenidyl, amphetamine, armodafinil, caffeine, mazindol, methylphenidate, modafinil, pitolisant, reboxetine, samelisant, serdexmethylphenidate, and solriamfetol, or combinations thereof.

[0023] In another example, the sleep disorder is excessive daytime sleepiness associated with central hypersomnolence disorders, obstructive sleep apnea, or shift work disorder. In a further example, the central hypersomnolence disorder is selected from the group containing narcolepsy type 1 (with cataplexy), narcolepsy type 2, idiopathic hypersomnia, Kleine-Levin syndrome, hypersomnia due to a medical condition, hypersomnia due to a medication or substance, hypersomnia associated with a psychiatric condition, and/or insufficient sleep syndrome.

[0024] In some examples, the one or more compositions of the present technology further comprise one or more excipients, wherein the excipients are selected from the group containing anti-adherents, binders, coatings, disintegrants, fillers, flavors, dyes, colors, glidants, lubricants, preservatives, sorbents, sweeteners, derivatives thereof, and/or combinations thereof.

[0025] In some examples, the compositions of the present technology have a dosing regimen that is one time a day. In other examples, the compositions of the present technology have a dosing regimen that is about two times a day.

[0026] In some examples, the compositions of the present technology are orally administered to a human or an animal subject.

[0026a] In another aspect, the present disclosure refers to a kit comprising a therapeutically effective amount of a compound as defined above or pharmaceutically acceptable salt thereof, wherein the compound is in a unit dosage form, and wherein further the unit dosage form is selected from the group consisting of a sublingual, a gummy, a chewable tablet, a rapidly dissolving tablet, a tablet, a capsule, a caplet, a troche, a lozenge, an oral powder, a solution, a liquid, a thin strip, an oral thin film (OTF), an oral strip, a syrup, a suspension, a slurry, a sachet, a buccal tablet, and a suppository, and instructions for use thereof.

[0027] Another example of the present technology is at least one kit comprising a therapeutically effective amount of any one of the disclosed GHB delivering compounds or a pharmaceutically acceptable salt thereof, wherein the compound is in a unit dosage form, and instructions for the use thereof.

[0028] In some examples, the unit dosage form is selected from the group containing a sublingual, a gummy, a chewable tablet, a rapidly dissolving tablet, a tablet, a capsule, a caplet, a troche, a lozenge, an oral powder, a solution, a liquid, a thin strip, an oral thin film (OTF), an oral strip, a syrup, a suspension, a slurry, a sachet, a buccal tablet, and/or a suppository. In further examples, the unit dosage form is selected from the group of transdermal patch, nasal spray, intramascular injection, depot injection, subcutaneous injection, and/or intravenous injection. In one example, the unit dosage forms can be packaged as a blisterpack or simular unit dosage delivery packaging or system.

[0029] In another example, the one or more kits of the present technology further comprise an additional therapeutic compound. In some examples, the additional therapeutic compound is selected from the group containing amantadine, aplindore, apomorphine, benztropine, bromocriptine, carbidopa, entacapone, fenoldopam, istradefylline, levodopa (L-dopa), opicapone, pramipexole, rasagiline, ropinirole, rotigotine, safinamide, tolcapone, trihexyphenidyl, amphetamine, armodafinil, caffeine, mazindol, methylphenidate, modafinil, pitolisant, reboxetine, samelisant, serdexmethylphenidate, and/or solriamfetol, and combinations thereof. In a further example, the additional therapeutic compound is in a unit dosage form. In yet a further example,

the unit dosage form is a sublingual, a gummy, a chewable tablet, a rapidly dissolving tablet, a tablet, a capsule, a caplet, a troche, a lozenge, an oral powder, a solution, a liquid, a thin strip, an oral thin film (OTF), an oral strip, a syrup, a suspension, a slurry, a sachet, a buccal tablet, and/or a suppository.

[0030] In some examples, the GHB delivering compound(s) is in a liquid dosage form, and the additional therapeutic compound is in an oral powder form or sachet form. In other examples, the

GHB delievering compound(s) and the additional therapeutic compound(s) can be in different combinatorial dosage forms including but not limited to capsule and thin film, or liquid and tablet.

[0031] In further examples, the additional therapeutic compound is added to the liquid dosage form of the GHB delivering compound prior to administration.

[0032] In some examples, the kit comprises instructions for use. In futher examples, the instructions for use include instructions for administration of at least one of the GHB delivering compounds, administration of at least one of the additional therapeutic compounds, and/or salt thereof or combinations thereof.

[0032a] In another aspect, the present disclosure refers to an oral formulation comprising a therapeutically effective dose of compound as defined above or a pharmaceutically acceptable salt thereof.

[0033] Another example of the present technology is an oral formulation comprising a therapeutically effective dose (e.g., for the treatment of a sleep disorder) of any one of the disclosed GHB delivering compounds or a pharmaceutically acceptable salt thereof.

[0034] In some examples, the oral formulation further comprises one or more excipients, wherein the excipients are anti-adherents, binders, coatings, disintegrants, fillers, flavors, dyes, colors, glidants, lubricants, preservatives, sorbents, sweeteners, derivatives thereof, and/or combinations thereof. In another example, the therapeutically effective dose is in a unit dosage form. In a further example, the unit dosage form is a sublingual, a gummy, a chewable tablet, a rapidly dissolving tablet, a tablet, a capsule, a caplet, a troche, a lozenge, an oral powder, a solution, a liquid, a thin strip, an oral thin film (OTF), an oral strip, a syrup, a suspension, a slurry, and/or a buccal tablet.

[0035] In some examples, the oral formulation(s) has a dosing regimen that is about two times per day. In some examples, the oral formulation(s) has a dosing regimen that is about one time a day. In another example, the oral formulation(s) is orally administered to a human or an animal subject.

[0035a] In another aspect, there is provided the use of the oral formulation as defined above in the manufacture of a medicament, wherein the oral formulation has a dosing regiment that is about one to two times a day.

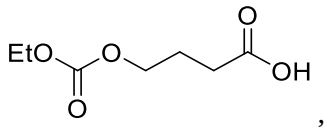
[0035b] In another aspect, there is provided the use of the oral formulation as defined above in the manufacture of a medicament, wherein the oral formulation has a dosing regiment that is about one time a day, where the oral formulation is to be administered orally to a human or an animal subject.

[0036] In some examples, the pharmaceutically acceptable salt is an acetate, L-aspartate, besylate, bicarbonate, carbonate, D-camsylate, L-camsylate, citrate, edisylate, formate, fumarate, gluconate, hydrobromide/bromide, hydrochloride/chloride, D-lactate, L-lactate, D,L-lactate, D,L-malate, L-malate, mesylate, pamoate, phosphate, succinate, sulfate, bisulfate, D-tartrate, L-tartrate, D,L-tartrate, meso-tartrate, benzoate, gluceptate, D-glucuronate, hybenzate, isethionate, malonate, methylsulfate, 2-napsylate, nicotinate, nitrate, orotate, stearate, tosylate, thiocyanate, acefyllinate,

aceturate, aminosalicylate, ascorbate, borate, butyrate, camphorate, camphocarbonate, decanoate, hexanoate, cholate, cypionate, dichloroacetate, edentate, ethyl sulfate, furate, fusidate, galactarate, galacturonate, gallate, gentisate, glutamate, glutarate, glycerophosphate, heptanoate, hydroxybenzoate, hippurate, phenylpropionate, iodide, xinafoate, lactobionate, laurate, maleate, mandelate, methanesulfonate, myristate, napadisilate, oleate, oxalate, palmitate, picrate, pivalate, propionate, pyrophosphate, salicylate, salicylsulfate, sulfosalicylate, tannate, terephthalate, thiosalicylate, tribrophenate, valerate, valproate, adipate, 4-acetamidobenzoate, camsylate, octanoate, estolate, esylate, glycolate, thiocyanate, undecylenate, sodium, potassium, calcium, magnesium, zinc, aluminum, lithium, cholinate, lysinium, ammonium, troethamine, and/or a mixture thereof.

[0037] In other examples of the present technology, the pharmaceutically acceptable salt may be amphetaminium or serdexmethylphenidate.

[0038] Another example of the present technology is at least one method of preventing or treating a sleep disorder in a subject in need thereof, comprising administering to the subject a composition comprising a GHB delivering compound or a pharmaceutically acceptable salt of the compound from:



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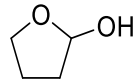

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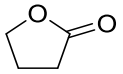

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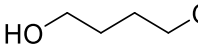

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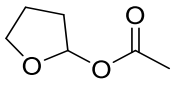
or 

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[0039] In some examples of the method, the sleep disorder is a symptom of a degenerative neurological disease or disorder and/or is a side effect of treating a degenerative neurological

disease or disorder with medication or a therapeutic compound. In another example, the degenerative neurological disease or disorder is Parkinson's disease, primary parkinsonism, paralysis agitans, and idiopathic parkinsonism.

[0040] In another example of the method, the composition further comprises amantadine, aplindore, apomorphine, benztropine, bromocriptine, carbidopa, entacapone, fenoldopam, istradefylline, levodopa (L-dopa), opicapone, pramipexole, rasagiline, ropinirole, rotigotine, safinamide, tolcapone, trihexyphenidyl, amphetamine, armodafinil, caffeine, mazindol, methylphenidate, modafinil, pitolisant, reboxetine, samelisant, serdexmethylphenidate, and solriamfetol, or combinations thereof.

[0041] In another example, the sleep disorder is excessive daytime sleepiness associated with central hypersomnolence disorders, obstructive sleep apnea, or shift work disorder. In another example, the central hypersomnolence disorder is narcolepsy type-1 (with cataplexy), narcolepsy type 2, idiopathic hypersomnia, Kleine-Levin syndrome, hypersomnia due to a medical condition, hypersomnia due to a medication or substance, hypersomnia associated with a psychiatric condition, insufficient sleep syndrome, and/or combinations thereof.

[0042] In some examples of the method, the composition further comprises one or more excipients, wherein the excipients are anti-adherents, binders, coatings, disintegrants, fillers, flavors, dyes, colors, glidants, lubricants, preservatives, sorbents, sweeteners, derivatives thereof, and/or combinations thereof. In another example, the composition has a dosing regimen that is about two times a day. In another example, the composition has a dosing regimen that is one time a day. In some examples, the composition is orally administered to a human or an animal subject.

[0043] Another example of the present technology is a kit comprising a therapeutically effective amount of any one of the disclosed compositions, wherein the composition is in a unit dosage form. In an example, the unit dosage form is a sublingual, a gummy, a chewable tablet, a rapidly dissolving tablet, a tablet, a capsule, a caplet, a troche, a lozenge, an oral powder, a solution, a liquid, a thin strip, an oral thin film (OTF), an oral strip, a syrup, a suspension, a sachet, a slurry, a buccal tablet, and/or a suppository. In one example, the unit dosage forms can be packaged as a blisterpack or simular unit dosage delivery packaging or system.

[0044] In another example, the kit further comprises an additional therapeutic compound. In a further example, the additional therapeutic compound is amantadine, aplindore, apomorphine, benztropine, bromocriptine, carbidopa, entacapone, fenoldopam, istradefylline, levodopa (L-dopa), opicapone, pramipexole, rasagiline, ropinirole, rotigotine, safinamide, tolcapone, trihexyphenidyl, amphetamine, armodafinil, caffeine, mazindol, methylphenidate, modafinil, pitolisant, reboxetine, samelisant, serdexmethylphenidate, and/or solriamfetol, and combinations thereof. In yet a further example, the additional therapeutic compound is in a unit dosage form.

[0045] In another example, the unit dosage form is a sublingual, a gummy, a chewable tablet, a rapidly dissolving tablet, a tablet, a capsule, a caplet, a troche, a lozenge, an oral powder, a solution, a liquid, a thin strip, an oral thin film (OTF), an oral strip, a syrup, a suspension, a sachet, a slurry, a buccal tablet, and/or a suppository.

[0046] In another example, the pharmaceutically acceptable salt is an acetate, L-aspartate, besylate, bicarbonate, carbonate, D-camsylate, L-camsylate, citrate, edisylate, formate, fumarate, gluconate, hydrobromide/bromide, hydrochloride/chloride, D-lactate, L-lactate, D,L-lactate, D,L-malate, L-malate, mesylate, pamoate, phosphate, succinate, sulfate, bisulfate, D-tartrate, L-tartrate, D,L-tartrate, meso-tartrate, benzoate, gluceptate, D-glucuronate, hybenzate, isethionate, malonate, methylsulfate, 2-napsylate, nicotinate, nitrate, orotate, stearate, tosylate, thiocyanate, acefyllinate, aceturate, aminosalicylate, ascorbate, borate, butyrate, camphorate, camphocarbonate, decanoate, hexanoate, cholate, cypionate, dichloroacetate, edentate, ethyl sulfate, furate, fusidate, galactarate, galacturonate, gallate, gentisate, glutamate, glutarate, glycerophosphate, heptanoate, hydroxybenzoate, hippurate, phenylpropionate, iodide, xinafoate, lactobionate, laurate, maleate, mandelate, methanesulfonate, myristate, napadisilate, oleate, oxalate, palmitate, picrate, pivalate, propionate, pyrophosphate, salicylate, salicylsulfate, sulfosalicylate, tannate, terephthalate, thiosalicylate, tribrophenate, valerate, valproate, adipate, 4-acetamidobenzoate, camsylate, octanoate, estolate, esylate, glycolate, thiocyanate, undecylenate, sodium, potassium, calcium, magnesium, zinc, aluminum, lithium, cholinate, lysinium, ammonium, troethamine, and/or a mixture thereof.

[0047] In other examples, the pharmaceutically acceptable salt may be amphetaminium or serdexmethylphenidate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0048] Various aspects of the present disclosure will now be described, by way of example only, with reference to the attached Figures, wherein:

[0049] FIG. 1 depicts the metabolic pathways of 2-hydroxytetrahydrofuran and 1,4-butanediol to gamma-hydroxybutyrate.

[0050] FIG. 2 shows the pharmacokinetic profile of NaGHB vs 3CPr O-(ethoxycarbonyl)-GHB (4a) after oral administration in rats (all doses were the molar equivalent of 70 mg/kg NaGHB).

[0051] FIG. 3 shows the pharmacokinetic profile of NaGHB vs 3CPr O-(ethoxycarbonyl)-GHB (4a) after oral administration in rats (all doses were the molar equivalent of 100 mg/kg NaGHB).

[0052] FIG. 4 shows the pharmacokinetic profile of NaGHB vs 3CPr sulfamate (33) after oral administration in rats (all doses were the molar equivalent of 100 mg/kg NaGHB).

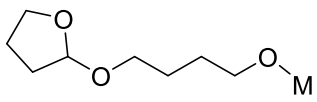
[0053] FIG. 5 shows the pharmacokinetic profile of NaGHB vs (2-THF) salicylate (34b) after oral administration in rats (all doses were the molar equivalent of 100 mg/kg NaGHB).

[0054] FIG. 6 shows the pharmacokinetic profile of NaGHB vs O-(2-THF)-glutaric acid (35) and *bis*(2-THF) malonate (41c) after oral administration in rats (all doses were the molar equivalent of 100 mg/kg NaGHB).

[0055] FIG. 7 shows the pharmacokinetic profile of NaGHB vs O-(2-THF) O-(ethoxycarbonyl)-GHB (38) and *bis*(2-THF) maleate (39) after oral administration in rats (all doses were the molar equivalent of 100 mg/kg NaGHB).

CLAIMS

1. A compound having a structure of Formula V:



Formula V

or a pharmaceutically acceptable salt thereof;

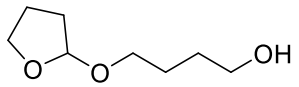
where M is selected from the group consisting of hydrogen, 1,4-butanediol, 2-hydroxytetrahydrofuran, gamma-hydroxybutyrate, sugar alcohol, ethylene glycol, glycerol, erythritol, threitol, arabitol, xylitol, ribitol, mannitol, sorbitol, galactitol, fucitol, iditol, inositol, volemitol, isomalt, lactitol, maltotriitol, maltotetraitol, polyglycitol , gamma-aminobutyric acid, phosphate, sulfate, sulfamate, alkenyl, alkenylaminocarbonyl, alkoxy, alkoxycarbonyl, alkyl, alkylamino, alkylaminocarbonyl, alkylammonium, alkylcarbonyl, alkylcarbonylamino, alkylcarbonyloxy, alkylsulfinyl, alkylsulfonyl, alkylthio, alkynyl, alkynylaminocarbonyl, amine, amino, aminocarbonyl, ammonium, aryl, substituted aryl, arylalkenyl, arylalkoxy, arylalkyl, arylalkynyl, arylamino, arylaminocarbonyl, arylammonium, arylazo, arylcarbonyl, arylcarbonylamino, arylcarbonyloxy, arylcycloalkyl, aryloxy, aryloxyalkyl, arylsulfinyl, arylsulfinylalkyl, arylsulfonyl, arylsulfonylamino, arylthio, arylthioalkyl, cyano, cycloalkenyl, cycloalkenylalkyl, carboxyl, cycloalkyl, cycloalkylalkyl, cycloalkylamino, cycloalkyloxy, cycloalkynyl, cycloheteroalkyl, cycloheteroalkylalkyl, halo, haloalkoxy, haloalkyl, heteroaryl, heteroarylalkenyl, heteroarylalkyl, heteroarylamino, heteroarylcarbonyl, heteroarylcarbonylamino, heteroaryloxo, heteroaryloxy, heteroarylsulfinyl, heteroarylsulfonyl,

heteroarylthio, nitro, polycycloalkenyl, polycycloalkenylalkyl, polycycloalkyl, polycycloalkylalkyl, polyethylene glycol, thiol, amino acids, peptides, salts thereof, and combinations thereof.

2. The compound of Claim 1, wherein the amino acids are selected from the group consisting of alanine, arginine, asparagine, aspartic acid, cysteine, glutamine, glutamic acid, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tryptophan, tyrosine, valine, and salts thereof.

3. The compound of Claim 1 or 2, wherein the peptide is a dipeptide or a tripeptide.

4. The compound of claim 1, wherein the compound is selected from the group consisting of



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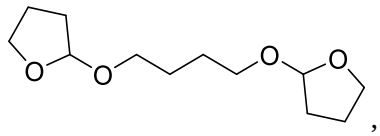

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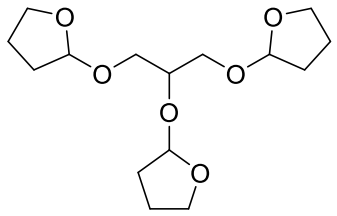

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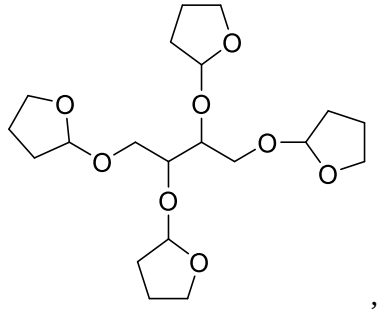

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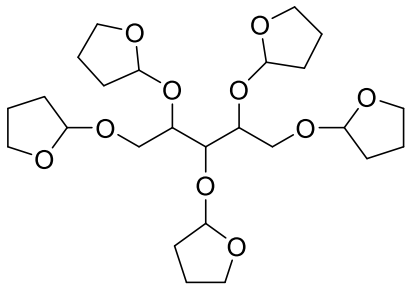
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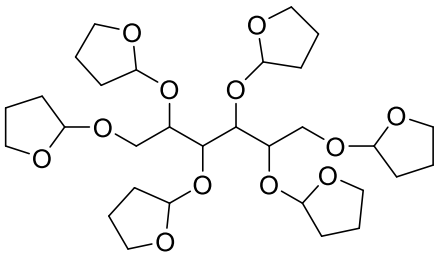
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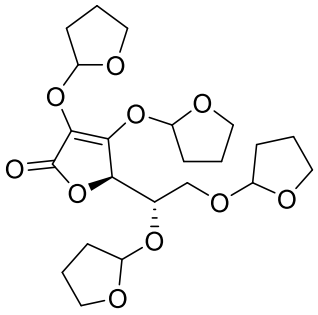
or .

5. A composition comprising the compound of Claims 1-4, or a pharmaceutically acceptable salt of the compound, wherein the pharmaceutically acceptable salt is selected from the group consisting of an acetate, L-aspartate, besylate, bicarbonate, carbonate, D-camsylate, L-camsylate, citrate, edisylate, formate, fumarate, gluconate, hydrobromide/bromide, hydrochloride/chloride, D-lactate, L-lactate, D,L-lactate, D,L-malate, L-malate, mesylate, pamoate, phosphate, succinate, sulfate, bisulfate, D-tartrate, L-tartrate, D,L-tartrate, meso-tartrate, benzoate, gluceptate, D-glucuronate, hybenzate, isethionate, malonate, methylsulfate, 2-napsylate, nicotinate, nitrate, orotate, stearate, tosylate, thiocyanate, acefyllinate, aceturate, aminosalicylate, ascorbate, borate, butyrate, camphorate, camphocarbonate, decanoate, hexanoate, cholate, cypionate, dichloroacetate, edentate, ethyl sulfate, furate, fusidate, galactarate, galacturonate, gallate, gentisate, glutamate, glutarate, glycerophosphate, heptanoate, hydroxybenzoate,

hippurate, phenylpropionate, iodide, xinafoate, lactobionate, laurate, maleate, mandelate, methanesulfonate, myristate, napadisilate, oleate, oxalate, palmitate, picrate, pivalate, propionate, pyrophosphate, salicylate, salicylsulfate, sulfosalicylate, tannate, terephthalate, thiosalicylate, tribrophenate, valerate, valproate, adipate, 4-acetamidobenzoate, camsylate, octanoate, estolate, esylate, glycolate, thiocyanate, undecylenate, sodium, potassium, calcium, magnesium, zinc, aluminum, lithium, cholinate, lysinium, ammonium, troethamine, and a mixture thereof.

6. Use of a composition comprising the composition of claim 5 in the mantufacture of a medicament for preventing or treating a sleep disorder or sleep syndrome.

7. The use of claim 6, wherein the sleep disorder is a symptom of a degenerative neurological disease or disorder and/or is a side effect of treating a degenerative neurological disease or disorder with medication or a therapeutic compound, wherein the degenerative neurological disease or disorder is selected from the group consisting of Parkinson’s disease, primary parkinsonism, paralysis agitans, and idiopathic parkinsonism.

8. The use of any one of claims 6 to 7, wherein the composition further comprises amantadine, aplindore, apomorphine, benztropine, bromocriptine, carbidopa, entacapone, fenoldopam, istradefylline, levodopa (L-dopa), opicapone, pramipexole, rasagiline, ropinirole, rotigotine, safinamide, tolcapone, trihexyphenidyl, amphetamine, armodafinil, caffeine, mazindol, methylphenidate, modafinil, pitolisant, reboxetine, samelisant, serdexmethylphenidate, solriamfetol, or combinations thereof.

9. The use of any one of claims 6 to 8, wherein the sleep disorder is excessive daytime sleepiness associated with central hypersomnolence disorders, obstructive sleep apnea, or shift

work disorder, wherein the central hypersomnolence disorder is selected from the group consisting of narcolepsy type-1 (with cataplexy), narcolepsy type 2, idiopathic hypersomnia, Kleine-Levin syndrome, hypersomnia due to a medical condition, hypersomnia due to a medication or substance, hypersomnia associated with a psychiatric condition, and insufficient sleep syndrome.

10. The composition of claim 5 or the use of any one of claims 6-9, wherein the composition further comprises one or more excipients, wherein the excipients are selected from the group consisting of anti-adherents, binders, coatings, disintegrants, fillers, flavors, dyes, colors, glidants, lubricants, preservatives, sorbents, sweeteners, derivatives thereof, and combinations thereof.

11. The composition of claim 5 or the use of any one of claims 6 to 10, composition has a dosing regimen that is about one to two times a day.

12. The composition of claim 5 or the use of any one of claims 6 to 11, wherein the composition has a dosing regimen that is about one time a day, wherein the composition is orally administered to a human or an animal subject.

13. A kit comprising a therapeutically effective amount of a compound of any one of claims 1 to 4 or pharmaceutically acceptable salt thereof, wherein the compound is in a unit dosage form, and wherein further the unit dosage form is selected from the group consisting of a sublingual, a gummy, a chewable tablet, a rapidly dissolving tablet, a tablet, a capsule, a caplet, a troche, a lozenge, an oral powder, a solution, a liquid, a thin strip, an oral thin film (OTF), an oral strip, a syrup, a suspension, a slurry, a sachet, a buccal tablet, and a suppository, and instructions for use thereof.

14. The kit of claim 13, wherein the kit further comprises an additional therapeutic compound, wherein the additional therapeutic compound is selected from the group consisting of amantadine, aplindore, apomorphine, benztropine, bromocriptine, carbidopa, entacapone, fenoldopam, istradefylline, levodopa (L-dopa), opicapone, pramipexole, rasagiline, ropinirole, rotigotine, safinamide, tolcapone, trihexyphenidyl, amphetamine, armodafinil, caffeine, mazindol, methylphenidate, modafinil, pitolisant, reboxetine, samelisant, serdexmethylphenidate, solriamfetol, and combinations thereof.

15. The kit of claim 14, wherein the additional therapeutic compound is in a unit dosage form, wherein the unit dosage form is selected from the group consisting of a sublingual, a gummy, a chewable tablet, a rapidly dissolving tablet, a tablet, a capsule, a caplet, a troche, a lozenge, an oral powder, a solution, a liquid, a thin strip, an oral thin film (OTF), an oral strip, a syrup, a suspension, a slurry, a sachet, a buccal tablet, and a suppository.

16. The kit of claim 15, wherein the compound of any one of claims 1 to 4 is in a liquid dosage form and the additional therapeutic compound is in an oral powder form or sachet form.

17. The kit of claim 16, wherein the additional therapeutic compound is added to the liquid dosage form of the compound prior to administration.

18. An oral formulation comprising a therapeutically effective dose of compound of any one of claims 1 to 4 or a pharmaceutically acceptable salt thereof.

19. The oral formulation of claim 18, wherein the oral formulation further comprises one or more excipients, wherein the excipients are selected from the group consisting of anti-

adherents, binders, coatings, disintegrants, fillers, flavors, dyes, colors, glidants, lubricants, preservatives, sorbents, sweeteners, derivatives thereof, and combinations thereof.

20. The oral formulation of claim 18 or claim 19, wherein the therapeutically effective dose is in a unit dosage form, wherein the unit dosage form is selected from the group consisting of a sublingual, a gummy, a chewable tablet, a rapidly dissolving tablet, a tablet, a capsule, a caplet, a troche, a lozenge, an oral powder, a solution, a liquid, a thin strip, an oral thin film (OTF), an oral strip, a syrup, a suspension, a slurry, a sachet, and a buccal tablet.

21. The oral formulation of any one of claims 18-20, wherein the oral formulation has a dosing regimen that is about one to two times a day.

22. The oral formulation of any one of claims 18 to 21, wherein the oral formulation has a dosing regimen that is about one time a day, wherein the oral formulation is to be administered orally to a human or an animal subject.

23. Use of the oral formulation of any one of claims 18-20 in the manufacture of a medicament, wherein the oral formulation has a dosing regiment that is about one to two times a day.

24. Use of the oral formulation of any one of claims 18-20 in the manufacture of a medicament, wherein the oral formulation has a dosing regiment that is about one time a day, where the oral formulation is to be administered orally to a human or an animal subject.