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(54) **COMPOSITIONS AND METHODS FOR ENHANCING NEUROREGENERATION AND COGNITION BY COMBINING MUSHROOM EXTRACTS CONTAINING ACTIVE INGREDIENTS PSILOCIN OR PSILOCYBIN WITH ERINACINES OR HERICENONES ENHANCED WITH NIACIN**

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(57) **ABSTRACT**

Methods and compositions are disclosed for enhancing neurogenesis, resolving neuropathy and improving neurological health and functioning using fungal extracts and their active ingredients, including species of mushrooms and mycelia containing psilocybin and psilocin, combined with erinacines and hericenones or fungal extracts containing those active ingredients, with the addition of nicotinic acid. The compositions may optionally be combined with nervine plants.

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ENHANCED WITH NIACIN**

CROSS-REFERENCE TO RELATED
APPLICATIONS

[0001] This application claim the benefit under 35 USC 119(e) of U.S. provisional patent application Ser. No. 62/365,982, filed Jul. 23, 2016, currently co-pending, which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to neuroregenerative compositions based upon constituents isolated from or contained within mushroom fruitbodies or mycelia, or the corresponding synthetic molecules, combined with niacin.

BRIEF SUMMARY OF THE INVENTION

[0003] The current invention describes novel contributions to the field of medicinal mushroom research, particularly discoveries pertaining to neuroregeneration.

[0004] The tragedy of aging is the loss of accumulated knowledge due to neuropathy, especially related to dementia, Alzheimer's, and other neurological disorders. The cause of these disorders is a matter of dispute, ranging from free radical damage to exposure to toxins to inability of neurons to regenerate in the numbers and quality necessary for healthy mental functioning. In addressing a disease complex with multifactorial causes, offering a combination of elements which can synergistically repair and improve neurological function is an important step in helping cognitive and motor skills, in particular, as humans age and/or when exposed to neurotoxins, stress or head trauma. Not only are benefits realized from multiple active principle ingredients activating neurogenesis, but the compositions and methods below may additionally help mitigate and/or reverse ocular and cochlear nerve degeneration.

[0005] A composition including psilocybin (4-phosphoryloxy-N,N-dimethyltryptamine) or psilocin (4-hydroxy-N,N-dimethyltryptamine) in pure form or extracts from *Psilocybe* and psilocybin containing mushrooms combined with erinacines or hericenones, or extracts from *Herichium* mushroom species, and niacin (nicotinic acid or 3-pyridinecarboxylic acid, also known as vitamin B3), uniquely aids in repairing and improving neurologic functioning and signaling. (Schartner et al. (2017) reported substantial increased global neural signal diversity in a psilocybin-human clinical study (Nature Scientific Reports, 7:46421).) Additionally, niacin is known to be a neural anti-inflammatory, and, in itself, has been implicated in improving neural functioning. As niacin activates nerve endings, the inventor suggests that the addition of niacin contributes an added benefit by enhancing the neurogenic effects of psilocybin, psilocin, erinacines and hericenones by helping these nootropics cross the blood brain barrier, and migrate throughout the nervous systems, and to its end points. Moreover, niacin is a vasodilator improving blood flow in the brain by relaxing con-

stricted blood vessels. This unique combination not only rebuilds myelin upon the axons, it also activates new astrocyte/astroglial cells and neuronal nodes of crossings such as the synaptic regions, particularly in the hippocampus. Other medicinal mushroom species also can be added, particularly species of *Antrodia*, *Beauveria*, *Copelandia*, *Cordyceps*, *Ganoderma*, *Grifola*, *Inonotus*, *Isaria*, *Panaeolus*, *Phellinus*, and other medicinal mushrooms and their mycelia whose unique neurogenerative properties may add benefits to this basic formulation. An excellent summary of the prior art related to the use of mushrooms as 'brain foods' can be found in Phan et al. (2017), "Edible and Medicinal Mushrooms: Emerging Brain Food for the Mitigation of Neurodegenerative Diseases," *Journal of Medicinal Foods* 20(1): 1-10. Lion's Mane (*Herichium erinaceus*), Bear's Head (*H. coralloides*), or Comb Tooth (*H. ramosum*) mushrooms and mycelium have also been well studied and reported to regenerate myelin on the axons of nerves. Two particular families of compounds are most noteworthy—erinacines and hericenones. Erinacines, including known erinacines A-K, P and Q, are cyanthane terpenes isolated from the mycelia of *Herichium erinaceus* that promote NGF (nerve growth factor) synthesis. Hericenones, including known hericenones C-H, are cyanthane terpenes located in both the mycelia and fruiting body of *Herichium erinaceus* that promote NGF synthesis. Friedman et al. (2015) summarizes these activities in "Chemistry, Nutrition, and Health-Promoting Properties of *Herichium erinaceus* (Lion's Mane) Mushroom Fruiting Bodies and Mycelia and Their Bioactive Compounds," *Journal of Agricultural and Food Chemistry* 63: 7108-7123.

[0006] Although Phan et al. describes many species with potential neurogenerative properties, the psilocybin or psilocybian species (i.e. "psilocybin-containing", from the use of "psilocybinne" as described by the French mycologist, Roger Heim, with R. Gordon Wasson, in 1957 in *Les champignons hallucinogènes du Mexique*. Paris: Museum de histoire naturelle; 1958, pp. 268-71) are not mentioned, either alone or in combinations with the edible and medicinal mushroom species described by Phan. A good summary of the role of psilocybin in humans can be found in Passie et al. (2002), "The Pharmacology of Psilocybin," *Addiction Biology* 7: 357-364. That psilocybin has neurogenerative properties was elucidated by Catlow et al. (2013), "Effects of psilocybin on hippocampal neurogenesis and extinction of trace fear conditioning," *Experimental Brain Research* 228: 481-491.

[0007] The present nootropic invention can benefit those suffering from age or trauma related neuropathologies including but not limited to tinnitus, dementia, Alzheimer's, Parkinson's, Parkinsonism's, Multiple Sclerosis, atherosclerosis, trauma from accidents, exposure to neurotoxins (sarin, organophosphates and other toxic compounds), heavy metals, prions, amyloid plaque formation, demyelination, nerve signaling, neurotoxic viruses, stress and numerous other agents causing neuropathies. Psilocybian mushrooms, their enzymes and their indole alkaloids may counteract and reduce the toxicity of methyl phosphonates—the core structure of Sarin, a potent neurotoxin, used in nerve gases. Moreover, the use of psilocin and psilocybin in the compositions described here may help block the neurotoxicity effects of chemical nerve toxins and lead to protecting and healing military and civilians exposed to sarin and other neurotoxic agents. The use of fungal extracts also potentially

enables neurogenesis by removing agents harmful to neurological health, including but not limited to parasites such as nematodes, protozoa, pathogenic bacteria, including *Borrelia* species and other spirochetes, and other infectious organisms or viruses. The benefits of this invention to the nervous system is hard to overstate. Additional benefits are conferred not only to humans challenged with diseases or neurotoxins, but also in healthy humans, including but not limited to increased cognitive function in students, scientists, computer coders, hackers, Big Data specialists, mathematicians, astronomers, strategic planners (i.e. such as in the U.S. Defense Department), gamers, linguists, writers, futurists, Mensa members, athletes, soldiers, religious leaders, politicians, business leaders or anyone benefitting from increased memory, intelligence, imagination, cognition, clairvoyance, motor skills, spatial navigation, athleticism, ability to more quickly respond to and process stimuli, balance, neuroplasticity, state of mind, longevity and mental health. Various benefits are also expected in vertebrate animals including mammals, carnivores, omnivores, herbivores, pets including cats and dogs and companion animals, farm and produce animals, laboratory animals, zoo animals, reptiles, fish and birds. The compounds of the present invention may also be useful for bees, including those suffering from pesticides, viruses or at risk from Colony Collapse Disorder, and various other invertebrates.

DETAILED DESCRIPTION OF THE INVENTION

[0008] Niacin (nicotinic acid) has long been reported to counteract the effects of psilocybin and LSD, helping those experiencing adverse reactions or ‘bad trips’ to return to a non-psychoactive state of mind, by reversing the excitement of nerve receptors. Therefore, the prior art teaches away from using niacin to excite nerve endings using psilocybin or psilocin. Hence, counter-intuitively, this invention uniquely combines niacin with psilocin/psilocybin and erinacines/hericenones for neurological restructuring and improved neurological health. By adding niacin into a psilocybin-centered neuroregenerative nootropic nutraceutical, vitamin complex or medicine in sufficient quantities to cause extreme discomfort for those who might try to abuse a therapeutic combination containing psilocin or psilocybin, this invention provides improved methods and compositions to prevent potential abuse by those wishing to get ‘high.’ Analogous to effects of Antabuse (disulfiram), which induces an unpleasant experience for those abusing alcohol, the addition of sufficient quantities of niacin, which likewise causes extreme discomfort, with psilocybin/psilocin will help prevent the abuse of the described neurogenic formulas.

[0009] As little as 10-35 mg per day of niacin causes flushing redness on the skin, itchiness, burning and unpleasant tingling. Higher doses can lead to liver damage. 500 mg. per day is considered the top tier for safe use unless prescribed by a physician who closely monitors the patient for adverse effects. Some cholesterol-lowering products contain up to 500 milligrams of niacin and these levels can interfere with the metabolism of other medicines. 3,000 milligrams per day is clearly toxic. Upon hydrolysis, a drug called Picamilon produces GABA and niacin, allowing the inhibitory neurotransmitter GABA to pass through the blood-brain barrier. The addition of niacin to GABA to form nicotinyl- γ -aminobutyric acid or N-nicotinoyl-GABA also aids the passage of GABA across the blood-brain barrier.

The stacking of niacin, psilocybin (or psilocin), GABA, erinacines and hericenones is an additional embodiment of this invention. Further embodiments include the addition of vanillic acid, trans-ferulic acid, trans-cinnamic acid, or other antiviral, anti-inflammatory polyphenols to reverse neuropathies, especially in those harmed by viruses such as, but not limited to, herpes simplex viruses (HSV), human papilloma viruses (HPV), polio, pox and other neurotoxic and inflammatory viruses.

[0010] Moreover by using psilocin or psilocybin at levels equivalent to what is colloquially known as ‘microdoses,’ i.e. <1 mg per day for a 70 kg Individual, compounding effects can be realized over time. Such low doses have no noticeable consciousness altering effects on the person ingesting, and moreover, it is well know that tolerance to any perceived effects in altering one’s consciousness is achieved very quickly from daily dosing of even higher levels, such as 10 mg of psilocin or psilocybin per day for a 70 kg person. Johns Hopkins researchers found the ‘sweet spot’ for full-blown therapeutic doses to be around 35 mg of psilocybin/psilocin for a 70 kg person. (Note that psilocybin is dephosphorylated into psilocin, which passes through the blood-brain barrier.)

[0011] The term “effective amount” or “therapeutic amount” refers to an amount sufficient to have neurogenerative activity. This amount may vary to some degree depending on the mode of administration, but will be in the same general range. The exact effective amount necessary could vary from subject to subject, depending on the compound, preventative treatment or condition being treated, the mode of administration, etc. The appropriate effective amount may be determined by one of ordinary skill in the art using only routine experimentation or prior knowledge in the art in view of the present disclosure. Note that effective ranges/dosages are not expected to be precisely the same for all compounds. Dosages may be optimized with each compound when the pharmacokinetics are studied to see how each compound is metabolized, which may alter the dose ranges. Nevertheless, given these factors, this neuro-enhancing invention is best managed in consultation with a skilled medical professional.

[0012] A suggested formula containing optional nerve plants that serves the purpose of neurological benefit but below any noticeable level of intoxication could be a 550 mg delivery dose via an ingestible capsule or by any means known to the art of drug delivery:

Neurogenesis Formula 1

Psilocin or psilocybin	1 mg
Erinacines or hericenones	50 mg
Niacin per day	200 mg
Extract of <i>Hericium erinaceus</i> , <i>H. corralloides</i> , <i>H. abietis</i>	199 mg
mycelium and/or fruitbodies of medicinal mushrooms	
Extracts of plants with neurogenic properties*	100 mg

Plant extracts with known neuroregenerative properties include, but are not limited to: *Bacopa* species (*Bacopa monnieri*), Gotu kola (*Centella asiatica*), and *Ginkgo* (*Ginkgo biloba*). Additional plants with anti-inflammatory properties include but are not limited to: Ginger (*Zingiber officinale*), Holy Basil (*Ocimum sanctum*), Hu Zhang (*Polygonum cuspidatum*), Oregano (*Origanum vulgare*, *Origanum onites*), Rosemary (*Rosmarinus officinalis*, *Ros-*

marinus eriocalyx, species in the genus *Rosmarinus*), Turmeric (*Curcuma longa*), Green Tea (*Camellia sinensis*), lavender (*Lavandula spica* and related species in the genus *Lavandula*), skullcap (*Scutellaria lateriflora*) and oat straw (*Avena sativa*, *Avena byzantina*). Moreover, *Salvia divinorum*, aka Diviner's Sage, ayahuasca, a concoction made from *Banisteriopsis caapi* and *Psychotria* species, and plants containing ibogaine (*Tabernanthe iboga*, *Voacanga africana* and *Tabernaemontana undulate*), peyote (*Lophophora williamsii*), the seeds of morning glory (*Ipomoea tricolor* and related species) and Hawaiian baby woodrose (*Argyrea nervosa*), and *Cannabis* (*Cannabis sativa*, *C. indica* and *C. ruderalis*), can be incorporated as well. Any nervine agents from natural products may also be incorporated, including, for example, cordycepin (or *Cordyceps* extracts containing such) or amyloban (found in Lion's mane).

[0013] Depending on individual factors such as variations in metabolism, neurotransmitters and preventative treatment or condition, such a regimen of 500-1000 mg. of intake once to three times daily may produce measurable effects in one year, or the regimen may extend for up to a year or more before noticeable neurological benefits are evident. Since psilocybin converts to psilocin and is typically not detectable in the urine in 24 hours, the long term use of this nootropic formulation sustains psilocin as a serotonin agonist, while not activating dopamine receptors.

[0014] In another embodiment, the composition comprises one or more of ethyl 7-chloro-2-oxo-4-phenyl-2H-chromen-3-carboxylate, vanillic acid, chrysin, quercetin hydrate, rutin hydrate, syringic acid, trans-cinnamic acid, trans-ferulic acid, salts thereof, esters thereof, or combinations thereof, and thereby has an antiviral effect against a pathogenic virus comprising one or more of herpes Varicella zoster virus, Epstein-Barr virus, herpes simplex I and II viruses, human papillomaviruses (HPV), poliovirus, or viruses which contribute to neuropathies.

[0015] As ranges of these active ingredients can vary, the inventor anticipates the ranges giving benefits will include:

Neurogenesis Formula 2 (based on a 70 kg, 154 lb person)	
Psilocin or psilocybin	0.1 mg to 0.6 mg
Erinacines or hericenones	1 mg to 20 mg
Niacin per day	1 to 50 mg
Neurogenesis Formula 3	
Psilocin or psilocybin	0.6 mg to 0.9 mg
Erinacines or hericenones	20 mg to 50 mg
Niacin per day	50 mg to 100 mg
Neurogenesis Formula 4	
Psilocin	0.9 mg to 10 mg
Erinacines or hericenones	50 mg to 200 mg
Niacin per day	100 mg to 200 mg
Neurogenesis Formula 5	
Psilocin or psilocybin	0.1 mg to 10 mg
Erinacines or hericenones	1 mg to 200 mg
Niacin per day	1 mg to 200 mg
Neurogenesis Formula 6	
Psilocin or psilocybin	1 mg to 10 mg
Erinacines or hericenones	50 mg to 200 mg
Niacin per day	101 mg to 200 mg

-continued

Neurogenesis Formula 7	
Psilocybin mushroom @ 1% psilocin or psilocybin	0.1 g to 1 g
Lion's mane mushroom @ 1% erinacines or hericenones	50 mg to 200 mg
Niacin per day	101 mg to 200 mg

[0016] Compounds naturally produced by the mycelium of psilocybian mushrooms and their mycelium includes baecocystin, norbaecocystin, N,N-dimethyltryptamine, 5-hydroxytryptamine (serotonin), 5-hydroxytryptophan, psilocybin and psilocin. These compounds, their precursors and immediate derivatives are candidates for neurogenesis. Synthetic or natural prodrugs, congeners and analogs of psilocybin, psilocin, baecocystin and norbaecocystin may offer similar benefits. Congeners are chemical substances related to each other by origin, structure, or function. Analogs (or analogues or structural analogs) are compounds having a structure similar to another, but differing from it in respect of a certain substituent in which one or more atoms or functional groups which are replaced with other atoms or groups or substituents. Psilocybin and psilocin prodrugs and analogs that may similarly prove useful include those where the hydroxyl group is modified or the methyl groups of the terminal amine nitrogen have been modified. Example hydroxyl group substituents include alkyl and aryl ethers and esters, for example methoxy and ethoxy ethers and acetyl esters, halogens including fluoro-, chloro- and bromo-substituents, and thio groups such as methylthio or benzo-thio. Example nitrogen group substituents include one or both methyl groups substituted with ethyl, propyl, isopropyl, butyl, isobutyl, secbutyl, tertbutyl, amyl or allyl groups and the N-trimethyl analogs. The corresponding phosphate esters, namely psilocybin and baecocystin analogs, may also prove useful, as may analogs where one or more hydrogen atom is replaced by fluorine, chlorine or bromine. Also preferred, where possible, are the salts of the tryptamine compounds, for example hydrochloride, fumarate, maleate, picrate, oxalate, tartrate and sulfate salts, which are typically more stable. Also preferred are the zwitterionic forms, particularly of the phosphate esters and quaternary ammonium compounds. Preferred analogs include: 4-acetoxy-N, N-dimethyltryptamine (4-AcO-DMT or O-Acetylpsilocin) the acetylated form of the psilocin (4-OH-DMT). It is a possible prodrug of psilocin (as are other 4-alkyl-esters), more stable than psilocin, and has a longer shelf life; 4-acetoxy-N-methyl-N-ethyltryptamine (4-AcO-MET), a psilocin analog substituted at R4 of its indole heterocycle with an acetoxy (AcO or CH₃COO—) functional group which also contains a methyl group and an ethyl chain bound to the terminal amine nitrogen of its tryptamine backbone. 4-AcO-MET is an acetate ester analog of 4-OH-MET and a N-substituted ethyl homolog of 4-AcO-DMT; 4-acetoxy-N, N-diethyltryptamine (4-AcO-DET); 4-acetoxy-N-methyl-N-propyltryptamine (4-AcO-MPT); 4-acetoxy-N-methyl-N-isopropyltryptamine (4-AcO-MIPT); 4-acetoxy-N,N-dipropyltryptamine (4-AcO-DPT) and 4-acetoxy-N,N-diisopropyltryptamine (4-AcO-DIPT); 4-hydroxy-N-methyl-N-ethyltryptamine (4-OH-MET, metocin or methylcybin), a 4-hydroxy N-substituted structural analog of psilocin and the with a methyl and an ethyl group bound to the terminal amine nitrogen of the tryptamine structure; 4-hydroxy-N-methyl-N-propyltryptamine (4-OH-MPT); 4-hydroxy-N-methyl-N-isopropyltryptamine (4-OH-MIPT);

4-hydroxy-N,N-diethyltryptamine (4-OH-DET); 4-hydroxy-N,N-dipropyltryptamine (4-OH-DPT); 4-hydroxy-N,N-diisopropyltryptamine (4-OH-DIPT); and 4-hydroxy-N,N-diallyltryptamine (4-OH-DALT); analogs where the 4-OH group has been removed, such as N,N-dimethyltryptamine (DMT), N-methyl-N-ethyltryptamine (MET), N-methyl-N-propyltryptamine (MPT), N,N-diethyltryptamine (DET), N,N-dipropyltryptamine (DPT), N,N-diisopropyltryptamine (DIPT), N-methyl-N-isopropyltryptamine (MIPT), a-methyl-tryptamine (AMT), N-ethyl-N-isopropyltryptamine (EIPT), N-methyl-N-butyl-tryptamine (MBT) or analogs substituted at other positions such as N,N-dimethyl-5-hydroxytryptamine (5-OH-DMT or bufotenine), 5-methoxy-a-methyltryptamine (5-MeO-aMT), 5-methoxy-N,N-dimethyltryptamine (5-MeO-DMT), 5-methoxy-N,N-diethyltryptamine (5-MeO-DET), 5-methoxy-N,N-dipropyltryptamine (5-MeO-DPT), 5-methoxy-N,N-diisopropyltryptamine (5-MeO-DIPT), 5-methoxy-N-ethyl-N-isopropyltryptamine (5-MeO-EIPT), 2,α-dimethyltryptamine (2,α-DMT), α,N-dimethyltryptamine (α,N-DMT), α-ethyltryptamine (α-ET), 2-methyl-N,N-dimethyltryptamine (2-Me-DMT), 2-methyl-N,N-diethyltryptamine (2-Me-DET), 1-methylpsilocin and ibogaine (a complex tryptamine). In general, equimolar amounts of an analog may be used in place of psilocybin and/or psilocin in the formulas above, or amounts producing equivalent functional effects may be utilized. See *TiHKAL: The Continuation* by Alexander Shulgin and Ann Shulgin (1997, Transform Press) for an in-depth discussion of both “legal” analogs and “chemical” analogs, and synthesis and effects of various psilocybin and psilocin analogs.

[0017] Additional pharmaceutical excipients useful for the compositions as described herein include, for example, the following: Acidifying agents (acetic acid, glacial acetic acid, citric acid, fumaric acid, hydrochloric acid, diluted hydrochloric acid, malic acid, nitric acid, phosphoric acid, diluted phosphoric acid, sulfuric acid, tartaric acid); Alkalinizing agents (ammonia solution, ammonium carbonate, diethanolamine, diisopropanolamine, potassium hydroxide, sodium bicarbonate, sodium borate, sodium carbonate, sodium hydroxide, trolamine); Antifoaming agents (dimethicone, simethicone); Antimicrobial preservatives (benzalkonium chloride, benzalkonium chloride solution, benzethonium chloride, benzoic acid, benzyl alcohol, butylparaben, cetylpyridinium chloride, chlorobutanol, chlorocresol, cresol, dehydroacetic acid, ethylparaben, methylparaben, methylparaben sodium, phenol, phenylethyl alcohol, phenylmercuric acetate, phenylmercuric nitrate, potassium benzoate, potassium sorbate, propylparaben, propylparaben sodium, sodium benzoate, sodium dehydroacetate, sodium propionate, sorbic acid, thimerosal, thymol); Antioxidants (ascorbic acid, ascorbyl palmitate, butylated hydroxyanisole, butylated hydroxytoluene, hypophosphorous acid, monothioglycerol, propyl gallate, sodium formaldehyde sulfoxylate, sodium metabisulfite, sodium thiosulfate, sulfur dioxide, tocopherol, tocopherols excipient); Buffering agents (acetic acid, ammonium carbonate, ammonium phosphate, boric acid, citric acid, lactic acid, phosphoric acid, potassium citrate, potassium metaphosphate, potassium phosphate monobasic, sodium acetate, sodium citrate, sodium lactate solution, dibasic sodium phosphate, monobasic sodium phosphate); Chelating agents (edetate disodium, ethylenediaminetetraacetic acid and salts, edetic acid); Coating agents (sodium carboxymethylcellulose, cel-

lulose acetate, cellulose acetate phthalate, ethylcellulose, gelatin, pharmaceutical glaze, hydroxypropyl cellulose, hydroxypropyl methylcellulose, hydroxypropyl methylcellulose phthalate, methacrylic acid copolymer, methylcellulose, polyvinyl acetate phthalate, shellac, sucrose, titanium dioxide, carnauba wax, microcrystalline wax, zein); Colorants (caramel, red, yellow, black or blends, ferric oxide); Complexing agents (ethylenediaminetetraacetic acid and salts (EDTA), edetic acid, gentisic acid ethanolamide, oxyquinoline sulfate); Desiccants (calcium chloride, calcium sulfate, silicon dioxide); Emulsifying and/or solubilizing agents (acacia, cholesterol, diethanolamine (adjunct), glyceryl monostearate, lanolin alcohols, mono- and di-glycerides, monoethanolamine (adjunct), lecithin, oleic acid (adjunct), oleyl alcohol (stabilizer), poloxamer, polyoxyethylene 50 stearate, polyoxyl 35 castor oil, polyoxyl 40 hydrogenated castor oil, polyoxyl 10 oleyl ether, polyoxyl 20 cetostearyl ether, polyoxyl 40 stearate, polysorbate 20, polysorbate 40, polysorbate 60, polysorbate 80, diacetate, monostearate, sodium lauryl sulfate, sodium stearate, sorbitan monolaurate, sorbitan monooleate, sorbitan monopalmitate, sorbitan monostearate, stearic acid, trolamine, emulsifying wax); Filtering aids (powdered cellulose, purified siliceous earth); Flavors and perfumes (anethole, benzaldehyde, ethyl vanillin, menthol, methyl salicylate, monosodium glutamate, orange flower oil, peppermint, peppermint oil, peppermint spirit, rose oil, stronger rose water, thymol, tolu balsam tincture, vanilla, vanilla tincture, vanillin); Humectants (glycerol, hexylene glycol, sorbitol); Plasticizers (e.g., castor oil, diacetylated monoglycerides, diethyl phthalate, glycerol, mono- and di-acetylated monoglycerides, propylene glycol, triacetin, triethyl citrate); Polymers (e.g., cellulose acetate, alkyl celluloses, hydroxyalkyl, acrylic polymers and copolymers); Solvents (acetone, alcohol, diluted alcohol, amylene hydrate, benzyl benzoate, butyl alcohol, carbon tetrachloride, chloroform, corn oil, cottonseed oil, ethyl acetate, glycerol, hexylene glycol, isopropyl alcohol, methyl alcohol, methylene chloride, methyl isobutyl ketone, mineral oil, peanut oil, propylene carbonate, sesame oil, water for injection, sterile water for injection, sterile water for irrigation, purified water); Sorbents (powdered cellulose, charcoal, purified siliceous earth); Carbon dioxide sorbents (barium hydroxide lime, soda lime); Stiffening agents (hydrogenated castor oil, cetostearyl alcohol, cetyl alcohol, cetyl esters wax, hard fat, paraffin, polyethylene excipient, stearyl alcohol, emulsifying wax, white wax, yellow wax); Suspending and/or viscosity-increasing agents (acacia, agar, alginic acid, aluminum monostearate, bentonite, purified bentonite, magma bentonite, carbomer, carboxymethylcellulose calcium, carboxymethylcellulose sodium, carboxymethylcellulose sodium 12, carrageenan, microcrystalline and carboxymethylcellulose sodium cellulose, dextrin, gelatin, guar gum, hydroxyethyl cellulose, hydroxypropyl cellulose, hydroxypropyl methylcellulose, magnesium aluminum silicate, methylcellulose, pectin, polyethylene oxide, polyvinyl alcohol, povidone, alginate, silicon dioxide, colloidal silicon dioxide, sodium alginate, tragacanth, xanthan gum); Sweetening agents (aspartame, dextrates, dextrose, excipient dextrose, fructose, mannitol, saccharin, calcium saccharin, sodium saccharin, sorbitol, solution sorbitol, sucrose, compressible sugar, confectioner’s sugar, syrup); Surfactants (simethicone); Tablet binders (acacia, alginic acid, sodium carboxymethylcellulose, microcrystalline cellulose, dextrin,

ethylcellulose, gelatin, liquid glucose, guar gum, hydroxypropyl methylcellulose, methylcellulose, polyethylene oxide, povidone, pregelatinized starch, syrup); Tablet and/or capsule diluents (calcium carbonate, dibasic calcium phosphate, tribasic calcium phosphate, calcium sulfate, microcrystalline cellulose, powdered cellulose, dextrates, dextrin, dextrose excipient, fructose, kaolin, lactose, mannitol, sorbitol, starch, pregelatinized starch, sucrose, compressible sugar, confectioner's sugar); Tablet disintegrants (alginic acid, microcrystalline cellulose, croscarmellose sodium, crospovidone, polacrillin potassium, sodium starch glycolate, starch, pregelatinized starch); Tablet and/or capsule lubricants (calcium stearate, glyceryl behenate, magnesium stearate, light mineral oil, sodium stearyl fumarate, stearic acid, purified stearic acid, talc, hydrogenated vegetable oil, zinc stearate); Thickening agents (gelatin having a Bloom strength of 50-100); Tonicity agent (dextrose, glycerol, mannitol, potassium chloride, sodium chloride); Vehicle: flavored and/or sweetened (aromatic elixir, compound benzaldehyde elixir, iso-alcoholic elixir, peppermint water, sorbitol solution, syrup, tolu balsam syrup); Vehicle: oleaginous (almond oil, corn oil, cottonseed oil, ethyl oleate, isopropyl myristate, isopropyl palmitate, mineral oil, light mineral oil, myristyl alcohol, octyl dodecanol, olive oil, peanut oil, persic oil, sesame oil, soybean oil, squalane); Vehicle: solid carrier (sugar spheres); Vehicle: sterile (Bacteriostatic water for injection, bacteriostatic sodium chloride injection); Viscosity-increasing (see suspending agent); Water repelling agents (cyclomethicone, dimethicone, simethicone); and/or solubilizing agent (benzalkonium chloride, benzethonium chloride, cetylpyridinium chloride, docusate sodium, nonoxynol 9, nonoxynol 10, octoxynol 9, poloxamer, polyoxyl 35 castor oil, polyoxyl 40, hydrogenated castor oil, polyoxyl 50 stearate, polyoxyl 10 oleyl ether, polyoxyl 20, cetostearyl ether, polyoxyl 40 stearate, polysorbate 20, polysorbate 40, polysorbate 60, polysorbate 80, sodium lauryl sulfate, sorbitan monolaurate, sorbitan monooleate, sorbitan monopalmitate, sorbitan monostearate, tyloxapol). This list is not meant to be exclusive, but instead merely representative of the classes of excipients and the particular excipients that may be used in oral dosage forms as described herein.

[0018] Another embodiment is methods for manufacturing a dosing form for treating, ameliorating, mitigating, alleviating, reducing and curing a nerve damage from neurotoxic virus infection comprising: formulating a composition into a dosage form comprising sprays, capsules, tablets, elixirs, emulsions, lozenges, suspensions, syrups, pills, lotions, epidermal patches, suppositories, inhalers, or injectables. Any methods known to the art for formulating extracts or active principal ingredients into lotions, soaps, etc. may be utilized.

[0019] Using blue light stimulation in the 280-400 nm wavelength range, precursor molecules to psilocybin and psilocin production can be elicited from the mycelium, primordia or fruitbodies of psilocybian or their close non-psilocybian relatives, to induce the formation of neurogenic compounds, including those that are not illegal, and therefore would not violate statutes in the United States or other countries. The goal here is to employ legal neurogenic precursor, congener or analog compounds related to psilocybin and psilocin.

[0020] Induction of bioactive compounds from mycelium through light stimulation is a method that can be used for discovering synergistic neurogenic compounds. Blue light activates shikimic acid production in mycelium, and anti-

oxidant polyphenols, while also stimulating tyrosinase leading to melanization while inhibiting laccase and other enzymatic pathways, simultaneously inducing the production of psilocin, psilocybin and other tryptamines from mycelium in psilocybin active mushrooms and their relatives. Modifying the wavelength (i.e. blue light for 12 hours, red light for 12 hours, per day) and frequency of light exposure, including "pulsing" of the light, can help articulate the expression of active neurogenic ingredients. The shikimic acid pathway gives rise to aromatic amino acids (phenylalanine, tyrosine and tryptophan), which are precursors for the formation of ergot alkaloids, lysergic acid, psilocybin and psilocin (Isaac, *Fungal-Plant Interactions*, Springer Netherlands, 1992). The inventor postulates that light stimulation evoking the transformation of ergosterol to vitamin D will also influence the pathways where light induces neurogenic compounds from mycelium. These pathways are interrelated and can be used for creating medically significant novel compositions whose synergy is useful for repairing the neuropathic damage by promoting neurogenesis and synaptic integrations. Exposure of mycelium to select wavelengths of light, especially blue and red spectra, may induce indole alkaloids related to psilocin analogues that have distinct antiviral and neuroprotective properties.

[0021] The biosynthesis of psilocybin from tryptophan involves enzymatic decarboxylation, methylation at the N⁹ position, 4-hydroxylation and O-phosphorylation. Light stimulation triggers the production of psilocybin and psilocin in the mycelium of, for instance *Psilocybe azurescens*, *Psilocybe cyanescens* and *Psilocybe cubensis*, possibly by stimulation of the enzymatic reactions. The "off/on" production of psilocybin, psilocin, baecocystin (the N-demethylated analog of psilocybin, 4-phosphoryloxy-N-methyl-tryptamine), norbaecocystin (the N-demethylated analog of psilocin, 4-phosphoryloxy-tryptamine) and other associated alkaloids from the mycelium caused by light exposure (particularly UV) are interrelated to the production of p-coumaric acid and the resultant metabolic expression of tyrosinase coding for melanin, especially prior to, during and after the time of primordia formation. The transition of the mycelium upon controlled light exposure, especially blue and UV light in the 280-420 nanometers ranges, affords the development of a customized suite of active ingredients, from which an extract be created or combined with active pharmacological molecules for a net benefit for the patient that consumes this unique combination.

[0022] Compositions and methods utilizing combinations of psilocin or psilocybin, and their immediate precursors, derived from mycelium that is exposed to light, particularly in the blue spectrum, additionally combined with erinacines or hericenones, with or without the addition of niacin, can result in medically significant, deliverable formulations for human consumption supporting neurogenesis.

[0023] This inventor reported *Psilocybe azurescens* to be the most potent psilocybian mushrooms in the world. (Stamets, P., *Psilocybin Mushrooms of the World*, 1996, Ten Speed Press.) A common side effect of taking this psychoactive mushroom species is loss of coordination and in some occasions, temporary paralysis. This mushroom contains ingredients related to psilocybin that may swamp receptor fields to cause these conditions. In medicine, the difference between a toxin and a medicine is often the dose. As such, this inventor suggests that other potent neurologically active ingredients are within *Psilocybe azurescens* (and to a lesser

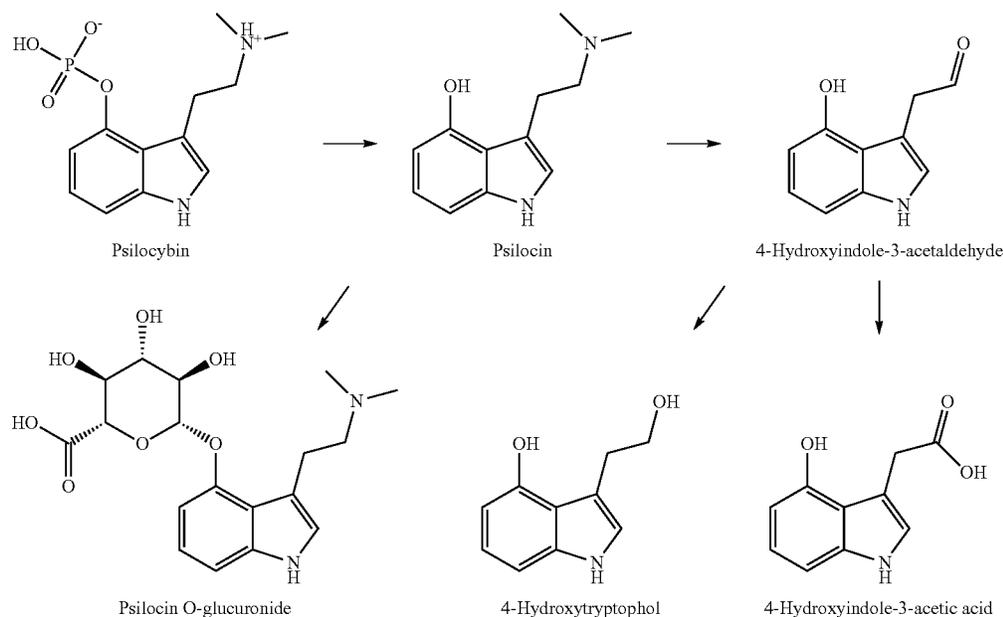
degree, *Psilocybe cyanescens* and *Psilocybe subaeruginosa*), which are likely useful for neurogenesis when presented or isolated at proper dosages.

[0024] Exposing mycelium grown on rice to blue and ultraviolet light in the 280-420 nanometer wavelengths, for a short window of time, lasting for a short duration of only 1-5 days, can help create and potentiate the neuroregenerative agents described herein. The intensity of light can range from 50-1,000 lux. By incubating the sterilized rice being actively colonized by the mycelium in plastic bags, which have grown out for a minimum of 1 week and up to 16 weeks, UV light exposure lights can be placed directly above and below horizontally shaped bags for maximum light exposure. The plastic bags or glass vessels can be selected for allowing these blue light wavelengths to reach the mycelium. The mycelium can undergo a phase-change in response to light stimuli into producing derivative neuroregenerative agents (it is to be expected that during this transitional period, the mycelium may contain varying mixtures of active compounds). This method and derivative improvements can potentiate the production of neuroregenerative molecules, some of which are intermediates during the melanization pathways activated by light exposure at specific wavelengths. This opens possibilities for customizing the output of specific active molecules using precise wavelengths, exposure times and intensities of light for manufacturing and potentiating production from mycelium. Lights can be pulsed and/or sequenced with varying wavelengths for exposing mycelium. The mycelium can also be subsequently agitated to cause new growth spurts, causing differentiation of hyphae with multiple nuclei per cell and hyper-expression of extracellular metabolites. Moreover, active molecules may be emitted differentially over time, allowing for windows of harvesting by washing the mycelium using cold EtOH and H₂O or other solvents and processes known to the art of natural product extraction.

[0025] Serotonin is the fundamental neurotransmitter all animals use. That serotonin and psilocybin co-occur within psilocybin-containing (“psilocybian”) mushrooms, and that psilocybin is a serotonin agonist, substituting for serotonin in the human brain and exciting neurotransmission, underscores the value of exploring these pathways for neurogenic compounds. Utilizing specific wavelengths of light—both blue and red spectra—can induce or suppress expression of these compounds, allowing customization of neurogenic compounds which can be useful medically. Exposure of red light spectra on maturing mycelium of psilocybin active mushroom species—which naturally would generate psilocybin and psilocin in its mycelium—can be used to acquire compounds useful for neurogenesis. Moreover, this unique combination of compounds can be incorporated into other therapies with such combinations providing unique advantages for medically significant advancements in repairing neurons, removing amyloid plaques, improving mental health, cognition, agility, and improving overall the ecology of consciousness. The inventor foresees utilizing such compounds in helping amputees activate their articulable prostheses. Such derivatives can help the improve cyborg technologies, allowing for neurons to grow into and mesh computer interfaces.

[0026] Moreover, the production of active principle ingredients from mycelium can be additionally enhanced by vibrational actions, including but not limited to pulsed sonic vibration—sonification—in combination with active principal ingredients stimulating UV wavelengths. Specific UV spectra and vibrations can be customized for enhancing yields.

[0027] Psilocybin dephosphorylates into psilocin in the liver, which then passes through the blood-brain barrier. Subsequent to enzymatic conversion and liver metabolism, psilocin is further degraded along at least one pathway, one rendition of which is featured below. These derivative compounds have neurogenic potential and are anticipated to be useful in nootropic formulations.



From Wikipedia, the Free Encyclopedia, Psilocybin.

[0028] Moreover, since psilocin and its analogs are neurotransmitters, and substitute for serotonin, acting as an agonist exciting serotonin receptors, their ability to enhance neurotransmission while in combination with nerve growth factors such as erinacines and hericenones, provides a unique opportunity for spurring neurogenesis. When combined with niacin, which causes nerve ending excitement, and additionally combined with mushroom and plant extracts, compounded neurogenic benefits are anticipated by this inventor.

[0029] The inventor claims rights to obvious embodiments of this invention, including using delivery systems, compositions, combinations and solvent extraction methods as outlined in this author's previous patents and patent applications, which are a matter of record at the United States Patent and Trademark Office as well as methods and compositions known to the art of pharmaceutical science and drug discovery.

[0030] It will be apparent to one of ordinary skill in the relevant art that suitable modifications and adaptations to the compositions, formulations, methods, processes, and applications described herein can be made without departing from the scope of any embodiments or aspects thereof. The compositions and methods provided are exemplary and are not intended to limit the scope of any of the specified embodiments. All of the various embodiments, aspects, and options disclosed herein can be combined in any and all variations or iterations. The scope of the compositions, formulations, methods, and processes described herein include all actual or potential combinations of embodiments, aspects, options, examples, and preferences herein described. The exemplary compositions and formulations described herein may omit any component, substitute any component disclosed herein, or include any component disclosed elsewhere herein. The ratios of the mass of any component of any of the compositions or formulations disclosed herein to the mass of any other component in the formulation or to the total mass of the other components in the formulation are hereby disclosed as if they were expressly disclosed. Should the meaning of any terms in any of the patents or publications incorporated by reference conflict with the meaning of the terms used in this disclosure, the meanings of the terms or phrases in this disclosure are controlling. Furthermore, the foregoing discussion discloses and describes merely exemplary embodiments. All patents and publications cited herein are incorporated by reference herein for the specific teachings thereof.

[0031] No limitations with respect to the specific embodiments and examples disclosed herein are intended or should be inferred, as the examples and embodiments are representative only. While examples and preferred embodiments of the present invention have been shown and described, it will be apparent to those skilled in the art, or ascertainable using no more than routine experimentation, that many changes and modifications may be made without departing from the invention in its broader aspects. The appended claims are therefore intended to cover all such changes, modifications and equivalents as fall within the true spirit and scope of the invention.

1. A method for improving neurological health of an animal comprising: administering a therapeutically effective amount of a composition to an animal, wherein the composition comprises one or more of psilocybin, psilocin, baeo-

cystin, norbaeocystin, salts thereof, or combinations thereof, one or more of erinacines, hericenones or combinations thereof, and niacin.

2. The method of claim 1, wherein the animal is a human.

3. The method of claim 1, wherein the composition additionally improves memory and cognition.

4. The method of claim 1, wherein the composition additionally improves motor skills and coordination.

5. The method of claim 1, wherein the composition additionally improves ability to solve complex computer coding challenges.

6. The method of claim 1, wherein the composition additionally improves hearing.

7. The method of claim 1, wherein the composition additionally improves vision.

8. The method of claim 1, wherein the composition additionally improves sensory function.

9. The method of claim 1, wherein the composition additionally improves learning.

10. The method of claim 1, wherein the composition additionally promotes neurogenesis.

11. The method of claim 1, wherein the composition additionally comprises one or more of (*Bacopa monnieri*), Gotu kola (*Centella asiatica*), *Gingko* (*Gingko biloba*), Ginger (*Zingiber officinale*), Holy Basil (*Ocimum sanctum*), Hu Zhang (*Polygonum cuspidatum*), Oregano (*Origanum vulgare*, *Origanum onites*), Rosemary (*Rosmarinus officinalis*, *Rosmarinus eriocalyx*, *Rosmarinus* species), Turmeric (*Curcuma longa*), Green Tea (*Camellia sinensis*), lavender (*Lavandula spica* and *Lavandula* species), skullcap (*Scutellaria lateriflora*), oat straw (*Avena sativa* and *Avena byzantina*), Diviner's Sage (*Salvia divinorum*), ayahuasca (*Banisteriopsis caapi* and *Psychotria* species), *Tabernaemontana iboga*, *Voacanga africana*, *Tabernaemontana undulate*, peyote (*Lophophora williamsii*), morning glory (*Ipomoea tricolor*, *Argyrea nervosa*), *Cannabis sativa*, *Cannabis indica* or *Cannabis ruderalis*, or combinations thereof.

12. The method of claim 1, wherein the composition additionally comprises one or more mycelium of *Antrodia*, *Beauveria*, *Copelandia*, *Cordyceps*, *Ganoderma*, *Grifola*, *Hericium*, *Inonotus*, *Isaria*, *Panaeolus* or *Phellinus* fungi, or combinations thereof; one or more extract of mycelium of *Antrodia*, *Beauveria*, *Copelandia*, *Cordyceps*, *Ganoderma*, *Grifola*, *Hericium*, *Inonotus*, *Isaria* *Panaeolus* or *Phellinus*, or combinations; one or more extract of *Antrodia*, *Beauveria*, *Copelandia*, *Cordyceps*, *Ganoderma*, *Grifola*, *Hericium*, *Inonotus*, *Isaria*, *Panaeolus* or *Phellinus* fruitbodies, or combinations thereof; or combinations thereof.

13. The method of claim 1 wherein the composition comprises one or more of extracted, isolated, synthetic or manufactured active compound, or combinations thereof.

14. A method for improving neurological health comprising: administering a daily dose of a composition for at least one month to a patient, wherein the composition comprises: one or more of about 0.1 to 10 mg of psilocybin, psilocin, baeocystin, norbaeocystin, or salts thereof, one or more of about 0.1 to 1 gram of psilocybin mushrooms, or combinations thereof; about 0.1 to 200 mg of one or more of erinacines, hericenones, or combinations thereof; and about 1 to 200 mg of niacin.

15. The method of claim 14, wherein the composition comprises about 0.6 to 10 mg of one or more of psilocybin, psilocin, baeocystin, norbaeocystin, salts thereof, or combi-

nations thereof, about 20 to 200 mg of one or more of erinacines, hericenones, or combinations thereof, and about 50 to 200 mg of niacin.

16. The method of claim 14, wherein the composition comprises about 0.9 to 10 mg of one or more of psilocybin, psilocin, baeocystin, norbaeocystin, salts thereof, or combinations thereof, about 50 to 200 mg of one or more of erinacines, hericenones, or combinations thereof, and about 50 to 200 mg of niacin.

17. The method of claim 14, wherein the composition additionally comprises one or more of (*Bacopa monnieri*), Gotu kola (*Centella asiatica*), *Gingko* (*Gingko biloba*), Ginger (*Zingiber officinale*), Holy Basil (*Ocimum sanctum*), Hu Zhang (*Polygonum cuspidatum*), Oregano (*Origanum vulgare*, *Origanum onites*), Rosemary (*Rosmarinus officinalis*, *Rosmarinus eriocalyx*, *Rosmarinus* species), Turmeric (*Curcuma longa*), Green Tea (*Camellia sinensis*), lavender (*Lavandula spica* and *Lavandula* species), skullcap (*Scutellaria lateriflora*), oat straw (*Avena sativa* and *Avena byzantina*), Diviner's Sage (*Salvia divinorum*), ayahuasca (*Banisteriopsis caapi* and *Psychotria* species), *Tabernaemontana iboga*, *Voacanga africana*, *Tabernaemontana undulate*, peyote (*Lophophora williamsii*), morning glory (*Ipomoea tricolor*, *Argyria nervosa*), *Cannabis sativa*, *Cannabis indica* or *Cannabis ruderalis*, or combinations thereof.

18. A method for improving neurological health of an animal comprising: administering a therapeutically effective amount of a composition to an animal, wherein the composition comprises: one or more of erinacines, hericenones, or combinations thereof; niacin; and one or more of N,N-dimethyltryptamine, 5-hydroxytryptamine, 5-hydroxytryptophan, 4-acetoxy-N,N-dimethyltryptamine, 4-acetoxy-N-methyl-N-ethyltryptamine, 4-acetoxy-N,N-diethyltryptamine, 4-acetoxy-N-methyl-N-

propyltryptamine, 4-acetoxy-N-methyl-N-isopropyltryptamine, 4-acetoxy-N,N-dipropyltryptamine, 4-acetoxy-N,N-diisopropyltryptamine, 4-hydroxy-N-methyl-N-ethyltryptamine, 4-hydroxy-N-methyl-N-propyltryptamine, 4-hydroxy-N-methyl-N-isopropyltryptamine, 4-hydroxy-N,N-diisopropyltryptamine, 4-hydroxy-N,N-diisopropyltryptamine, 4-hydroxy-N-methyl-N-propyltryptamine, 4-hydroxy-N,N-diethyltryptamine, 4-hydroxy-N,N-diallyltryptamine, N-methyl-N-ethyltryptamine, N,N-diethyltryptamine, N,N-dipropyltryptamine, N,N-diisopropyltryptamine, N-methyl-N-propyltryptamine, N-methyl-N-isopropyltryptamine, a-methyl-tryptamine, N-ethyl-N-isopropyltryptamine, N-methyl-N-butyltryptamine, N,N-dimethyl-5-hydroxytryptamine, 5-methoxy-a-methyltryptamine, 5-methoxy-N,N-dimethyltryptamine, 5-methoxy-N,N-diethyltryptamine, 5-methoxy-N,N-dipropyltryptamine, 5-methoxy-N,N-diisopropyltryptamine, 5-methoxy-N-ethyl-N-isopropyltryptamine, 2,a-dimethyltryptamine, a,N-dimethyltryptamine, a-ethyltryptamine, 2-methyl-N,N-dimethyltryptamine, 2-methyl-N,N-diethyltryptamine, 1-methylpsilocin, ibogaine, 4-hydroxindole-3-acetylaldehyde, 4-hydroxytryptophol, 4-hydroxindole-3-acetic acid, salts thereof, or combinations thereof.

19. The method of claim 17, wherein the animal is a human.

20. The method of claim 17, wherein the composition additionally results in one or more of improved memory and cognition, improved motor skills and coordination, improved ability to solve complex computer coding challenges, improved hearing, improved vision, improved sensory function, improved learning or promotion of neurogenesis, or combinations thereof.

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